Option Survey for Japan to acquire credits from abroad

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Executive Summary

1 Background

Japan is currently facing difficulty in achieving its Kyoto target, because its greenhouse gas (GHG) emissions have increased since 1990 by 7.6 percent as of 2002. This means it has to reduce emissions by about 13.6 percent—corresponding to 168.232 million tonnes of carbon dioxide equivalent (Mt CO_2e) per year—in order to achieve its target of 6 percent below the 1990 level (set out in article 3.1 of the Kyoto Protocol, which was adopted in 1997 and entered into force on February 16, 2005).

In recognition of this situation, the Japanese government decided in its Kyoto Target Achievement Plan to procure certificates corresponding to 1.6 percent of its 6 percent reduction target by utilizing the Kyoto mechanisms, which can be broken down into three distinct options:

1. Purchasing emission reduction units (ERUs) generated by joint implementation (JI) projects in (a) the Central and Eastern European EU member states and EU accession countries, and (b) in other countries

2. Purchasing certified emission reductions (CERs) generated by Clean Development Mechanism (CDM) projects

3. Purchasing assigned amount units (AAUs) according to article 17 of the Kyoto Protocol

Moreover, since adoption of the protocol, the following two novel options for acquiring certificates have been developed:

4. Establishing green investment schemes (GIS)

5. Establishing a domestic emissions trading system in Japan and linking it with other national emissions trading systems, particularly the EU Emissions Trading Scheme (EU ETS)

The report consists of four papers, a conclusion paper and three background papers.

Background Paper 1 analyzes *Current Japanese Climate Policy from the Perspective of Using the Kyoto Mechanisms* Japan's GHG emissions have been increasing since 1990, and this trend will not change drastically under existing measures; therefore, Japan faces difficulty in achieving its Kyoto target. As well, effective policies and measures were not introduced after the review in 2004. Based on the current estimation, even if all the policies and measures are implemented as scheduled, there will still be a 1.6 percent shortfall, which will therefore have to be purchased in the form of credits from abroad. However, the current scheme cannot procure a sufficient amount of certificates to correspond to the envisaged 1.6 percent of its GHG emissions, and the government cannot utilize all the certificates acquired by Japanese entities for national compliance, since it currently has no means of drawing these certificates into its national account. As such, the paper highlights the urgent need to quickly identify and act on the best option for Japan to acquire certificates from abroad and to utilize the certificates for national compliance.

Background Paper 2 analyzes *The EU Linking Directive and its Impact on the Potential for JI Projects in the New EU Member States and EU Accession Countries*. Potential JI projects in the energy and industry sectors now largely overlap with the EU ETS and are thus probably removed from JI. The feasibility of JI projects which are indirectly connected to the EU ETS and thus raise the danger of doubly counting emission reductions, such as renewable energy projects connected to the national grid, is not yet entirely clear. There is still significant potential for projects which are not connected to the EU ETS, such as end-use energy efficiency, small renewable energy and district heating projects. However, these types of projects typically do not reach critical size to be viable for JI. Their establishment will thus depend on developing instruments to bundle projects.

Background Paper 3 analyzes Demand and Supply on the Global Market for Emission Certificates. In theory, supply exceeds demand by far. However, several concerns regarding both supply and demand, such as the effectiveness of domestic policies and measures or whether seller countries will meet the eligibility criteria for participating in the Kyoto mechanisms, remain unresolved. In practice, there remains substantial uncertainty whether supply will be able to cover the total demand that will arise if the buyer countries do not rein in their emissions. These findings reinforce the urgency of devising a sound strategy for meeting Japan's Kyoto commitments.

A conclusion paper examines the pros and cons of each option—based on the analysis conducted in the three background papers of this project—according to five criteria (environmental integrity, cost, size of potential, political acceptability, long-term impact) with the aim of identifying the best option(s) for Japan to acquire and use certificates to achieve its Kyoto target.

2 Options—pros and cons

The result of the analysis of pros and cons can be summarized as follows.

JI is highly rated under most criteria. Negative aspects are transaction costs in the case of track 2, the current lack of clarity about the environmental integrity of track 1, and the long-term prospects of the scheme itself.

The Clean Development Mechanism is also highly evaluated under most criteria. Negative elements are the transaction costs involved and the long-term prospects of the scheme itself. There is also the problem of projects like HFC and methane projects, which reduce emissions but typically do not contribute substantially to sustainable development.

International emissions trading gains the most negative evaluation in terms of political acceptability, while the best in price and transaction cost. It is also negative in terms of the long-term prospects of the scheme itself.

GIS also gains good ratings under most criteria. It is highly evaluated in environmental integrity in the hard greening case, size of potential, and political acceptability. Negative elements are the cost for establishing the scheme and the long-term prospects of the scheme itself. Due to the dependence on a continuation of a Kyoto-like regime and the availability of surpluses in countries with reduction targets, it is expected that GIS will have a short life, although the idea of "hard greening" could be applied in the case of Annex I Parties with lower surpluses and non-Annex I Parties that might adopt commitments in the future, but possibly with a lot of surpluses. This could also be a model for bilateral cooperation for the reduction of GHG emissions even without the existence of a Kyoto-like regime.

The linkage of domestic emissions trading schemes costs the highest upfront for establishing the scheme itself, and it faces the largest opposition from industry. Once the system is established, however, it provides the lowest transaction cost, a very effortless way for the Japanese government to acquire certificates, and the best option in terms of long-term impact, including the fact that it could be a strong and viable instrument for emissions reductions even without a continuation of the Kyoto regime. In contrast to all other options discussed here, the ETS is not only an instrument for purchasing certificates from abroad but also for promoting cost-efficient domestic emission reductions.

Comparing all the available options, JI and the CDM are more promising in the short term, since they are cheaper in terms of price, and the mechanisms have largely already been established. Considering that the prices of all options will probably converge once the market is fully functional, "short term" means the period until the second half of 2007, when the Enforcement Branch of the Compliance Committee makes a decision on the eligibility requirement to use the Kyoto Mechanisms. After that, it will become much clearer which Parties fulfill the eligibility requirement for international emissions trading and JI track 1. Thereafter, international emissions trading and GIS will become viable. However, since GISs still need to be established, work would need to start now if this option is to be pursued. In the longer term, however, the linkage of domestic emissions trading schemes might well be the strategically most promising option, since it would provide easier access to the emissions reduction potential in the new EU member states and accession countries. Moreover, once the scheme has been established, the Japanese government would automatically obtain the foreign certificates acquired by Japanese companies without having to use taxpayers' money. Last but not least, linked ETS between the EU and Japan and possibly further countries could establish a framework for international climate policy independent from the Kyoto Protocol.

3 Proposed best options for Japan to achieve its target

In Section 4.2 of the Conclusion Paper, we propose the best option for Japan to acquire certificates from abroad based on the examination of the pros and cons of each option, considering the issues it faces in achieving its Kyoto target, as explained in background paper 1, i.e., (1) the current scheme cannot procure a sufficient amount of certificates to correspond to the envisaged 1.6 percent of its GHG emissions, and (2) the government cannot utilize all the certificates acquired by Japanese entities for national compliance, since it currently has no means of drawing these certificates into its national account.

As the best option for Japan to acquire certificates from abroad, based on the above analysis, it is recommended that Japan first establishes a national purchasing scheme, then establishes a domestic emissions trading scheme and links it with other emissions trading schemes.

A national purchasing scheme—which would enable Japan to systematically acquire the certificates necessary for compliance with its Kyoto target—should be established as soon as possible in order to purchase ERUs and CERs before the market is fully functional and the prices of all options converge.

It is recommended that investments in JI/CDM projects be made up to the first half of 2007, and then shift to GISs after it becomes clear which Parties fulfill the eligibility requirement. In this regard, it is recommended that in the meantime Japan cooperate with countries that have surpluses to establish GISs. In order to ensure the environmental integrity of GISs, however, they should be limited to the hard greening case. Although soft greening is attractive in terms of flexibility—which is beneficial for both host countries and buyer countries in addressing the issue of eligibility requirements in host countries—there is a risk of distorting the environmental integrity of GISs and undermining their effectiveness in addressing the hot air issue in the normal transaction of AAUs. The institutional and capacity constraints of the seller countries should be addressed by means other than soft greening. One idea might be to conclude framework package agreements with seller countries that encompass capacity building measures on the one hand and hard greening GIS projects on the other. By establishing a national purchasing scheme, the government could also purchase the certificates acquired by Japanese entities.

In the long term, however, establishing a domestic emissions trading scheme and linking it with other emissions trading schemes is highly recommended. First, as a short-term benefit, it would make it easier to acquire certificates from the new EU member states and accession countries, since in this case Japanese entities would be able to utilize EUAs to achieve their targets set in Japan's domestic emissions trading scheme. Therefore, Japanese companies as well as the government can acquire certificates as EUAs—thus bypassing the issues surrounding JI projects—which will be backed by the exchange of AAUs between national schemes. This also applies to the certificates of other countries if they also establish domestic emissions trading schemes. Second, Japanese companies will have obligations to achieve their own targets for which they will utilize certificates acquired from abroad. Therefore, Japan's national account can absorb the certificates that private entities acquire from abroad without using taxpayers' money. In the long term this option could continue even after the first commitment period, once the system is established. The Japanese government could thus effectively install a permanent conduit of foreign certificates. Moreover, this option would support the international climate protection regime and even induce emission reduction efforts regardless of a continuation of a Kyoto-like regime.

Although this option is highly rated under most criteria in section 4.1, it will probably have distributional impacts on industrial stakeholders. In order to address this issue, discussion involving all stakeholders is necessary. Therefore, it will take longer to adopt this option than the others. Even so, it is highly recommended to start implementing it in the near future, considering that it would enable Japan to acquire certificates from Central and Eastern European countries, which are probably the most reliable among the countries with surpluses and inexpensive reduction potential. Besides, the cost to achieve the 6 percent target solely through a national purchasing scheme might be too expensive, and the option to link domestic emission trading schemes has a positive long-term effect regardless of a continuation of the Kyoto or similar regime.

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Comparison of Options Available to Japan for Acquiring Emission Certificates

March 2005

Rie Watanabe, Wolfgang Sterk, and Stefan Lechtenböhmer

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4. **Establishing green investment schemes (GIS)**
5. **Establishing a domestic emissions trading system in Japan and linking it with other national emissions trading systems, particularly the EU Emissions Trading Scheme (EU ETS)**

As the final installment of this project to explore options for acquiring certificates from abroad, this conclusion paper examines the pros and cons of each option—based on the analysis conducted in the three background papers of this project—with the aim of identifying the best option(s) for Japan to acquire and use certificates to achieve its Kyoto target.

1 Current situation in Japan

1.1 Introduction

As shown in figure 1, Japan's GHG emissions had already increased by 7.6 percent since 1990 as of 2002. Therefore, it is necessary to reduce emissions by a total of 13.6 percent on average for the first commitment period (2008–2012) in order to achieve the Kyoto target of reducing its emissions by 6 percent relative to the 1990 level.

As described in Background Paper 1, *Current Japanese Climate Policy from the Perspective of Using the Kyoto Mechanisms*, a review of existing climate policies and measures was conducted in 2004, based on the step-by-step approaches laid out in the New Guideline for the Promotion of Preventive Measures to Address Global Warming, which Japan adopted in 2002 when it ratified the Kyoto Protocol. This was done in order to examine the effects of existing policies and measures and, if necessary, the need to introduce additional policies and measures for the second step from 2005 onwards.

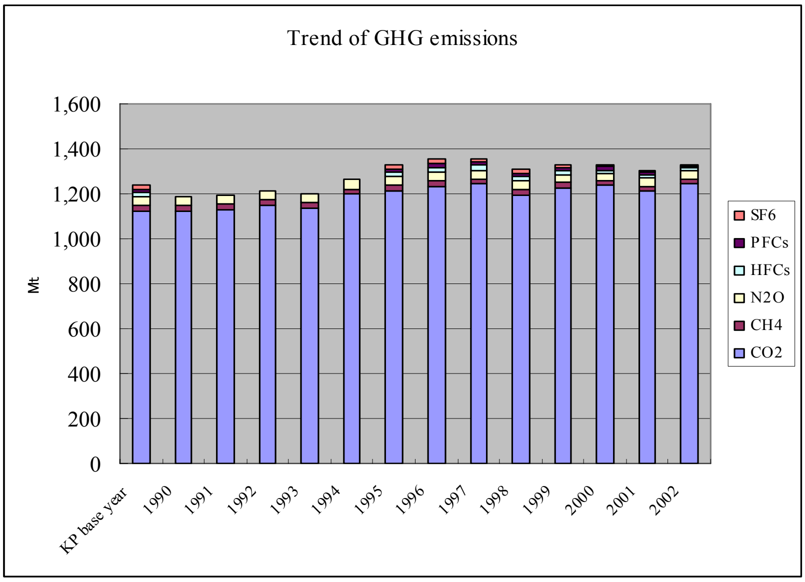

Figure 1: Japan's GHG emissions trend (1990–2002)

Note: SF_6 = sulphur hexafluoride; PFCs = perfluorocarbons; HFCs = hydrofluorocarbons; N_2O = nitrous oxide; CH_4 = methane; CO_2 = carbon dioxide

The 2004 review revealed that Japan's emissions, at the current rate, will be at least 6 percent above the 1990 level in 2010. Therefore, an average reduction of at least 12 percent will be necessary for achieving Japan's emissions reduction commitment for the first commitment period. In consideration of this, the draft of Japan's Kyoto Target Achievement Plan (KTAP) clearly states that out of 12 percent, 6.5 percent will be reduced by domestic policies and measures, 3.9 percent through the full utilization of sinks, and 1.6 percent—which corresponds to a reduction of 19.79 Mt CO_2e per year (or a total of 98.96 Mt CO_2e) for the first commitment period—by using the Kyoto mechanisms (METI 2005; MoE 2005b). Both the government and Japanese stakeholders recognize the urgent need to rapidly prepare to utilize the Kyoto mechanisms, because there is concern that the easiest "low-hanging fruits" will be picked first by other industrialized countries that have ratified the protocol, especially Western European countries. First, member states of the European Union can utilize CERs and ERUs surrendered by energy-intensive companies covered by the EU ETS for complying with their targets set in the scheme. Second, some EU member states have launched national purchasing schemes to procure ERUs and CERs. Besides the above, the lead time of CDM/JI projects is usually three to five years, and only three years remain until the start of the Kyoto Protocol's first commitment period in 2008. This means that any project which is supposed to generate certificates during the first commitment period should already be on the drawing board.

Based on the recognition of this situation, the Japanese government and stakeholders have begun preparations to start utilizing the Kyoto mechanisms.

First of all, the Japanese government secured 5.7 billion yen (US$54 million) as the budget for CDM/JI assistance projects.[1] The MoE allocated 2 billion yen in 2005, a more than threefold increase from the 0.6 billion yen allocated in 2004 (MoE 2005a), and METI allocated 3.7 billion in 2005, a more than 1.5 times increase from the 2.4 billion yen allocated in 2004 (METI 2005; Yamagata 2005). Second, it is planned to use these funds to make upfront payments, instead of payment on delivery, in order to encourage companies to undertake CDM/JI projects. According to the budget plans, certificates equal to 8.45 Mt CO_2e will be acquired,[2] which is, however, far less than the required 19.79 Mt CO_2e/year (total of 98.96 Mt CO_2e) needed for the first commitment period.[3] Therefore, CDM/JI assistance projects will not provide a sufficient amount of certificates to correspond to the 1.6 percent portion. Private companies also created the Japan Greenhouse Reduction Fund (JGRF), which was established in December 2004 with 14.8 billion yen ($141.5 million) in funding. The JGRF will be operated until 2014 with the aim of acquiring certificates to be issued in 2012, the last year of the first commitment period. It plans to acquire 10 to 20 Mt CO_2e worth of certificates during the whole period, depending on the price. Using a calculation of 5 euros per tonne, it will acquire around 22 Mt CO_2e worth of certificates for the whole period, or an average of 4.4 Mt CO_2e/year.

The above analysis reveals that the currently planned measures to utilize the Kyoto mechanisms are not sufficient to provide certificates corresponding to 1.6 percent of Japan's 1990 GHG emissions. It is also uncertain whether it is possible to achieve a 6.5 percent reduction in 2010 through domestic policies and measures, considering that GHG emissions have been increasing so far and that no drastic policies or measures have been introduced. Furthermore, sinks will probably only deliver an amount equal to 3.1 percent according to the current estimation; therefore, the full utilization of 3.9 percent through sinks will be difficult. Moreover, it is unclear how all of the certificates acquired by the JCF will be transferred into Japan's national account to be utilized for compliance with the Kyoto Protocol. Under the current regulation there is no scheme to have the certificates that private companies acquire from abroad transferred into Japan's national account; only certificates corresponding to the CDM/JI project assistance budget (8.45 MtCO_2e for the whole period) are slated to be transferred into the national account.

1. 1 US dollar = 105 yen
2. 1 CER/5 euros; 1 euro = 135 yen
3. 1.6% of base year emissions (1,237 Mt) = 19.79 Mt

The analysis of Japan’s current climate policies and measures clearly illustrates the urgent need to quickly identify and act on the best option for Japan to acquire certificates from abroad (Watanabe 2005a). The pros and cons of potential options are analyzed in section 3, and then in section 4 is an examination of the best ones for Japan to use to acquire certificates and utilize them for compliance with the Kyoto Protocol.

2 Options—pros and cons

2.1 The Kyoto mechanisms

2.1.1 Joint implementation

2.1.1.1 Joint implementation in Central and Eastern European EU member states and EU accession countries

As pointed out in Background Paper 2, *the EU Linking Directive and its Impact on the Potential for JI Projects in the New EU Member States and EU Accession Countries*, the potential for reducing GHG emissions in Central and Eastern European countries is substantial (Sterk et al. 2005). Our analysis shows that the largest and most cost-effective emission reductions can be found in the waste and power sectors. Further large potential is found in district heating systems, renovation of dwellings, and expansion of renewable energy use.

However, the interplay of the introduction of the EU ETS in the countries that have acceded to the EU, or will do so in the near future, and the baseline and double-counting provisions of the EU’s Linking Directive significantly reduce the potential for JI.[4]

Regarding the baseline issue, the Linking Directive states that the baselines of JI projects must be based on the *acquis communautaire* (the total existing body of EU legislation). This provision has significant impacts on JI projects, since in many areas EU environmental legislation is much more demanding than the regulations which had previously applied in the new EU member states and accession countries. Therefore, many activities which could previously have been counted as “additional” to business as usual are now required by law and thus no longer eligible for JI. The actual impact depends on the legislation relevant to the respective project. One example is the EU Landfill Directive, which renders most of the reduction potential at landfills to the baseline, since it requires the collection of landfill gas at all landfills in operation from 2009 onwards. Moreover, the collected gas has to be flared as a minimum. Additionality is thus limited to the following:

- Crediting in 2008
- Projects at closed landfills

4. The European Union in 2004 adopted the so-called Linking Directive to provide for the integration of CDM and JI into the EU ETS. It is the first large-scale incentive for private companies to participate in CDM projects.

- Projects at landfills in operation that utilize the collected gas for energy production instead of flaring it off

The so-called double-counting issue arises because, without regulation, a CDM or JI project affecting an installation covered by the EU ETS would result in (a) the issuance of CERs/ERUs and (b) the freeing up of EU emission allowances (EUAs) for trading. In other words, the reduction would be rewarded twice. In order to systematically address the double-counting problem, three different types of JI projects in EU member states must be distinguished, as listed in table 1.

Type	Description	Regulation (New article 11[b] Emissions Trading Directive)
1	*JI projects with direct links to the EU ETS.* These are project activities undertaken at installations covered by the EU ETS, e.g., refurbishing or fuel switching in a power plant (above 20 megawatts).	ERUs may be issued if the operator of the respective installation cancels an equal number of EUAs.
2	*JI projects with indirect links to the EU ETS.* These are project activities that have no direct link to installations covered by the EU ETS but indirectly lead to emission reductions at such installations, e.g., the development of a wind park leading to the displacement of electricity from a power plant within the EU ETS, or the improvement of energy end-use efficiency leading to a decreased withdrawal of electricity from a power plant within the EU ETS.	ERUs may be issued if an equal number of EUAsare cancelled from the national registry of the respective member state.
3	*JI projects without links to the EU ETS.* These are, for example, project activities that reduce emissions at sources not connected to the EU ETS. For example, renewable energy projects that are not connected to the national grid or projects in the agriculture or transport sectors.	These do not pose a problem and are therefore not regulated by the Linking Directive. ERUs may be issued without restriction.

Table 1: Types of linkages between JI and the EU ETS and their regulation according to the Linking Directive

Note: Table by Sterk.

The impact on JI is difficult to evaluate, since now there is essentially competition between financing emission reductions via JI and via the EU ETS. An installation operator has the following options:

1. Reduce emissions at the installation by itself, resulting in no need to buy additional EU allowances or even having a surplus of allowances which it can sell.
2. Agree to have emissions reduced by an external company and transfer the corresponding amount of allowances to this company. This might be an attractive option if it cannot raise the necessary capital itself or if the external company can reduce emissions at a lower cost than the installation operator can.
3. Agree to have emissions reduced by an external company, as in option 2, but by means of a JI project.

Regarding the third option, as pointed out in Paper 2, the Czech Republic and Slovakia have already indicated that they are not in favor of allowing JI projects with direct linkage. Even if they are allowed, dealing with the double-counting problem raises transaction costs. One can therefore probably assume that the potential in the sectors covered by the EU ETS has now largely been removed from JI (*nega-*

tive impact on JI potential due to EU accession). A different option for non-EU countries to access this potential is to establish their own domestic emissions trading scheme and link it with the EU ETS (this option will be examined later).

Of the reduction potentials that are in principle suitable for JI and have been quantified in the literature surveyed, about 60 Mt CO_2e per year do not seem to be affected by EU accession. This chiefly relates to renovating buildings, district heating systems, and afforestation projects. Adding measures that feature indirect linkage with the EU ETS, mainly renewable energy projects, raises the potential to about 130 Mt CO_2e per year. However, the exact treatment of projects with indirect linkage is still unclear.

It is important to note that the figures in the literature surveyed usually only refer to technical potentials, where it is not clear which part of them could feasibly be implemented. This is especially the case for renewable energy projects. At the same time, many possible reduction measures were not quantified at all. The above figures have therefore only limited value.

Another issue with joint implementation is that of its first track vs. second track:

- Countries which fulfill all the eligibility criteria laid down in the Marrakesh Accords qualify for the first track, which essentially leaves the whole project procedure to the discretion of the host country, although they can also choose to use the second track.
- Countries which fulfill only the minimum criteria for being able to participate in JI can only use the second track. This will entail an international procedure similar to the CDM under the yet to be established JI Supervisory Committee, and will thus be more cumbersome than the first track.[5]

It is not yet clear if the Central and Eastern European countries will qualify for the JI first track, Moreover, since the details for both tracks are still to be worked out, it is not possible at the moment to estimate the transaction costs that JI will entail in either case.

2.1.1.2 Potential joint implementation projects in the Ukraine and Russia

JI potential in the Ukraine and Russia is even more substantial than in Central and Eastern Europe. Here, as well, there is great uncertainty as to the concrete figures, but JI in those two countries could easily generate several hundred Mt CO_2e per year (in theory).

It should be noted, however, that both countries are generally not considered to be the best venues for direct foreign investments. Critics cite barriers such as a weak judiciary, a relatively extensive black market, corruption, and a poorly developed capital market. Furthermore, both countries have so far taken only limited steps to put in place the national infrastructure necessary for the implementation of JI projects. Evidently, the uncertainty regarding which JI track will be used applies here as well, and probably even more so than for the EU member countries. As pointed out in Paper 3, *Demand and Supply on the Global Market for Emission Certificates*, due to the poor general investment climate and JI-specific institutional shortcomings, the combined JI supply from both countries might not exceed 30 Mt CO_2e per year (Sterk et al. 2005).

5. Annex of Decision 16/CP:7: Guidelines for the Implementation of Article 6 of the Kyoto Protocol.

2.1.2 Clean Development Mechanism

Paper 3 puts the total theoretical CDM potential at 423.85 Mt CO_2e per year. However, the CDM process has so far been very slow, which raises the question of whether or not it would actually be able to handle this amount. If one assumed that the average project would deliver 200,000 tonnes of CO_2e per year, then more than 2,000 projects would be necessary to deliver this potential. At the time of writing, however, only four projects have been officially registered. The CDM Executive Board is one obvious bottleneck, and the current severe lack of funding will further delay the process if not resolved (the Executive Board's April 2005 meeting even had to be cancelled due to insufficient funding) (*delay of process*). Many host and investor countries are also far from establishing the necessary infrastructure for the implementation of projects (*capacity issue*). The CDM will therefore need substantial efforts by all relevant actors, especially governments, if a significant part of the theoretical emissions reduction potential is to be realized.

Another issue is that the CDM seems to be in danger of failing to fulfill its mandate to promote sustainable development in the host countries. There is currently a marked shift in the project portfolio towards projects reducing emissions of GHGs with high global warming potential, such as methane or hydrofluorocarbons (HFCs). These projects provide cost-effective emission reductions, but they are end-of-pipe fixes that provide few, if any, development benefits. HFC projects alone are estimated to have a potential of 100 Mt CO_2e per year, with abatement costs of about $0.50 per tonne. There is therefore a risk that these projects could drive down the price for CERs to such an extent that projects such as renewable energy or energy-efficiency projects, which usually entail significant development benefits but also entail higher abatement costs, will no longer be viable (Ellis et al. 2004).

2.1.3 International emissions trading (article 17)

As outlined in Paper 3, although reliable data concerning projections for GHG emissions in 2010 were not available for all countries, it seems safe to say that all new EU member states and EU accession countries, except for Hungary and Slovenia, will not only meet their Kyoto commitments but will indeed be below, in some cases far below, their GHG emission reduction targets.

According to their national communications under the United Nations Framework Convention on Climate Change (UNFCCC), the accumulated surpluses of these countries are estimated to be 151.6 Mt CO_2e annually in the "with measures" scenario, but one has to note that only nine of the ten EU accession countries are included. In the "with additional measures" scenario the surplus amounts to 227.5 Mt CO_2e, but only information from eight countries is included.[6]

Projected surpluses for Russia and the Ukraine are even more substantial, although estimates vary widely. For the Ukraine, they range from 168 to 300 Mt CO_2e annually. An estimate of the Russian surplus for 2008–2012 is only available for carbon dioxide, and it is expected to be 524.3 Mt CO_2 annually in the "positive scenario" and 725.4 Mt CO_2 annually in the "unfavorable scenario" defined in Russia's third national communication.

However, there are at least three caveats connected to these figures.

6. The national communications under the UNFCCC usually contain three emission scenarios: "without measures," "with measures," and "with additional measures." The "with measures" scenario usually reflects the impacts of already implemented or currently planned policies and measures, and can thus be regarded as the baseline, whereas the "with additional measures" scenario includes policies and measures that have been suggested but have not yet been introduced into the domestic political process. The "without measures" scenario is usually only a hypothetical benchmark to measure against the impacts of measures.

First, it is not clear if these countries will be able to deliver their surpluses to the market. Eligibility to participate in any of the Kyoto mechanisms is "dependent on its compliance with methodological and reporting requirements under Article 5, paragraph 1 and 2, and Article 7, paragraphs 1 and 4, of the Kyoto Protocol."[7] Moreover, the modalities, rules, and guidelines for emissions trading under article 17 list further eligibility requirements to transfer and/or acquire Kyoto units. These relate especially to putting in place a national system for the estimation of anthropogenic emissions by sources and removals of GHGs by sinks, submitting an annual inventory of GHGs, and supplying additional information on the assigned amounts.[8] Especially in the cases of the Ukraine and Russia, it is not clear how far they will be able to meet these requirements (*eligibility requirement*) (table 2).

Second, even if they are able to participate in international emissions trading under article 17, they will not necessarily make all of their surpluses available. As pointed out in Paper 3, Russia might limit sales to 2 to 3 percent of its surplus and the Ukraine to 30 percent. Given the estimates outlined above, this might mean an annual supply of only about 100 Mt CO_2e (*market control*).

Third, buying the Central and Eastern European countries' surpluses would inevitably raise the "hot air" issue (*hot air*). This term was coined to denote the fact that these surpluses are not the result of active climate policy but due to the fact that business-as-usual emissions in these countries are already below the targets adopted under the Kyoto Protocol. Trading hot air would not violate the integrity of the protocol in a formal sense, but critics argue that this would violate its underlying aim of climate protection. The emission reductions underlying the hot air have already taken place "by themselves," and if there were no trading (and all countries met their Kyoto targets), then global emissions would be even lower than agreed under the protocol. Conversely, if hot air is purchased instead of reducing emissions domestically, then overall global emissions will be higher than if there were no emissions trading. The emission targets in the Kyoto Protocol are being criticized as being much too weak anyway, and using this option therefore raises the risk of bringing the instrument of emissions trading, if not the whole protocol, into disrepute.

7. Paragraph 5 of Draft Decision -/CMP.1 (Mechanisms): Principles, nature, and scope of the mechanisms pursuant to articles 6, 12, and 17 of the Kyoto Protocol.
8. Paragraph 2 of the annex to Decision 18/CP.7: Modalities, rules, and guidelines for emissions trading under article 17 of the Kyoto Protocol.

	International emissions trading (article 17)		JI track 1		JI track 2		CDM
	Acquire	Transfer	Acquire	Transfer	Acquire	Transfer	Use for compliance
Party of the Kyoto Protocol	○	○	○	○	○	○	○
Calculate and record assigned amount units pursuant to article 3, paragraphs7 and 8	○	○	○	○	○	○	○
Establishment of a national system for the estimation of anthropogenic emissions by sources and anthropogenic removals by sinks of all GHGs not controlled by the Montreal Protocol, in accordance with article 5.1 and the requirements in the guidelines decided thereunder.	○	○	○	○	○		○
Establishment of a national registry, in accordance with article 7.4 and the requirements in the guidelines decided thereunder.	○	○	○	○	○	○	○
Submission of the most recent required inventory, in accordance with article 5.2 and article 7.1 and the requirements in the guidelines decided thereunder, including the national inventory report and the common reporting format.	○	○	○	○	○		○
Submission of the supplementary information on the assigned amount, pursuant to articles 3.7 and 8, including for the activities under articles 3.3 and 4, in accordance with article 7.4, and the requirements in the guidelines decided thereunder.	○	○	○	○	○		○

Table 2: Eligibility requirement for the Kyoto mechanisms

Source: Watanabe 2005b.

2.1.4 Evaluating the Kyoto mechanisms

As mentioned above, room still remains to conduct JI projects in Central and Eastern European countries, despite the accession of these countries to the European Union and the application of the *acquis communautaire*, including emissions trading and the linking directives in these countries. But in practice, as pointed out above, it is difficult to conduct JI projects that are directly or indirectly linked to the EU ETS. The JI potential is much higher in the Ukraine and Russia than in Central and Eastern Europe. However, the two countries are not exactly the best for direct foreign investments. Although the theoretical CDM potential is quite large, it is dubious whether all the potential can be realized, mainly due to the slow approval process of the CDM Executive Board and the lack of capacity in many countries, especially the host countries.

Finally, trading AAUs under article 17 of the Kyoto Protocol raises at least three issues, namely, the eligibility requirement, market control, and hot air.

Due to these problems connected with all of the Kyoto mechanisms, it seems worthwhile to further explore the novel mechanisms that have been developed more recently, i.e., GISs and the linkage of domestic emissions trading schemes.

2.2 Novel instruments

2.2.1 Greening AAUs/green investment schemes

The concepts of the green investment scheme (GIS) and the green assigned amount unit (AAU) have been developed in order to address the issues connected with article 17 emissions trading, as outlined above. Greening AAUs is used as a term covering all transactions of AAUs with a condition that the money transferred be utilized for GHG reductions, including GIS. A GIS is a more systematic AAU transaction scheme to earmark funds generated from the sale of AAUs for use in mitigation projects or the effective implementation of certain pre-defined activities, such as implementation of demand-side management programs, dismantling of energy subsidies, or capacity-building activities related to climate change. The World Bank defines the former as “hard” greening and the latter as “soft” greening (World Bank 2004). Some use a wider definition, which includes all environment-related projects not contributing to the mitigation of GHG emissions. The GIS would be set up by the seller countries and would operate as a domestic scheme within their respective climate policy frameworks, with operational details to be agreed on a bilateral basis between buyer and seller nations.

Below, we will summarize the merits and demerits of green investment schemes with reference to findings in the existing literature.

One of the biggest benefits of the GIS concept is that AAUs generated from hard greening GIS projects are backed by actual emission reductions, similar to JI. Therefore, it is effective in addressing the negative perceptions that surround the trading of surplus AAUs and provides an acceptable political basis for the buyer, while increasing demand for AAUs and providing additional liquidity to the market (*hot air issue*) (Blyth and Baron 2003; World Bank 2004).

Flexibility is another merit of the GIS concept. With GISs there is no limit on the time period during which the emission reductions are credited, which is different from JI. Therefore, emission reductions taking place before 2008 can also be rewarded with AAUs (World Bank 2004). Under the World Bank Prototype Carbon Fund and the Dutch ERUPT program, a contract is concluded with seller countries to acquire so-called “early JI credits,” under which seller countries transfer AAUs corresponding to their emission reductions before 2008.[9] Under a GIS it is also possible to transfer AAUs against emission reductions realized after 2012 if several conditions are fulfilled (World Bank 2004), including

9. ERUPT stands for emission reduction unit procurement tender.

effective emission reductions to be measured up to 2012, the project in operation at that date, and a high probability of continuing to generate emission reductions in the future (*flexibility of timeframe*). Due to the flexibility of timeframe explained above, GISs may also contribute to inducing investments in projects with emission reductions even after the first commitment period (*mid- and long-term impact*).

In the soft greening case, a GIS under article 17 of the Kyoto Protocol allows full flexibility on the side of the seller to channel funds to greening activities (Blyth and Baron 2003; World Bank 2004). This could provide funds for preparing institutions fundamental to addressing the climate change issue through activities that would otherwise have difficulty getting funds, such as capacity building and the establishment of a registry and inventory. This is particularly effective for addressing the first issue of the transfer of AAUs (*eligibility requirement*). Since most Central and Eastern European countries are behind in planning and short in funds to establish proper institutions for implementing environmental regulations—especially with issues of monitoring, reporting, and human capacities—GISs could contribute to providing funds for these countries to fulfill the eligibility requirement.[10] While GIS provides the aforementioned merits, the following issues still need to be addressed:

The World Bank raises the issues of payment and resource risk (delay in receiving payment), price risk (volatile AAU price), counter-party risk (project sponsors fail to implement the project/generate emission reductions), risk related to the financial manager of the GIS (failure to deliver projects/emission reductions), and the financial risk of the government (financial risk of the host country government). All these, however, are not particular to GISs but will also be issues for JI as well as for "traditional" article 17 emissions trading. The eligibility requirement to utilize article 17 is one of the biggest issues identified in the JI and AAU sections of this paper (*eligibility requirement*). Another issue is monitoring and verification of emission reductions in the case of soft greening (*proper monitoring, reporting, and verification*). As already mentioned, acquiring the funding for the soft greening case or environment-friendly projects that do not directly generate emission reductions is one of the largest benefits of GISs compared to JI. It could be a problem at the same time, however, because in the case of soft greening or environment-friendly projects that do not reduce emissions there is no clear basis for determining the amount of AAUs that should be allocated to projects. There is also a substantial risk that the funds will be used for non-environmental purposes. Considering the above, GISs must be limited to the hard greening case, unless the governments involved elaborate clear criteria for this allocation and find a way to avoid the "green" investment scheme turning to an easy justification of the normal transaction of AAUs.

Since GISs are agreed bilaterally between the seller and buyer countries, the design of each will ultimately differ. In order to maximize the aforementioned merits and to minimize potential issues, however, a common standard for monitoring and verification of the credits to be allocated to projects should be established. In responding to our interviews, officials in the Czecz Republic, Hungary, and Romania also pointed out the necessity to develop a common standard for operationalizing GISs in these countries (Chmelik 2004; Feiler 2004; Trusca 2004). A common standard would contribute not

10. The Environmental Action Programme Task Force in Central and Eastern European Countries rates projects two out of five (best to ambient monitoring system and human resources and facilities supporting project execution in both Russia and the Ukraine). For the ambient monitoring system, two means that a well-documented ambient monitoring system exists; while five means that monitoring results are reliable and are fully used in decision-making. For human resources and facilities supporting execution, two means that there is awareness of the necessary expertise, facilities, and operational costs for the short and long term, while five means that a predictable and sustainable mechanism exists for fully satisfying the needs in human resources and facilities (OECD 2005).

only to developing the opportunities for buyer countries to leverage the involvement of their private sector companies in resulting projects but also to addressing the second issue of the transfer of AAUs (*market control*), since a standardized scheme will limit the room for negotiation between buyer and seller countries. Box 1 details a project between Japan and Slovakia in the transaction of green AAUs.

> Slovakia is a country that has long prioritized emissions trading other than JI, because it did not see JI as promising for the future due to the cost of verifying the additionality requirement and getting approved by the Article 6 Committee if track 2 is applied. The Slovakian government considered that it did not have the necessary human resources to undertake such complicated procedures and that its surplus is not large enough to bear additional costs.
>
> In one early experience, in 2002, a Slovakian company called Menerek Engineering concluded a contract on transferring AAUs with the Sumitomo trading company in Japan. About 30 companies conduct emissions reduction projects at their installations, and Menerek collects the reduction amounts and transfers them to Sumitomo. Slovakia's government guaranteed the transfer of AAUs under the following conditions: establishment of a registry in Slovakia, Kyoto's entry into force, and allocation of AAUs to Slovakia (Fischerova 2004; Mojeek 2004).
>
> Slovakia encourages the transfer of AAUs, especially the GIS type of transaction, for the reasons explained above. Its recent accession to the European Union and the application of the *aquis communitare* are further pushing the Slovakian government in this direction. It is currently considering the establishment of emissions trading at medium and small installations not covered by the EU ETS, in order to allocate AAUs to them directly, and converting EU emissions allowances (EUAs) into AAUs through trading between installations covered by the EU ETS and those to whom AAUs are directly allocated (Fischerova 2004; Mojeek 2004).

Box 1: A contract to transfer green AAUs between an engineering company in Slovakia and Japanese trading companies

Note: Box 1 by Watanabe.

The concepts of green AAUs and GISs were originally developed with the aim of greening Russian surpluses (Tangen et al. 2002), but they can be applied to all other countries that have emission surpluses. Blyth and Baron (2003) also concluded that GISs have the largest potential in Russia and the Ukraine and also in countries that did not participate in the first wave of joining the European Union, namely, Bulgaria and Romania. Moreover, interviews conducted in Central and Eastern European countries revealed that the new EU member states are also interested in GISs, not only due to the aforementioned merits but also due to the difficulties with implementing JI projects caused by their accession to the EU and resulting application of the *acquis communautaire*, including the IPPC Directive, Large Combustion Plant Directive, Landfill Directive, the Emissions Trading Directive, and the Linking Directive (Chmelik 2004; Feiler 2004; Fischerova 2004; Jaworski et al. 2004; Kozakiewicz 2004).

2.2.2 Linking domestic emissions trading schemes

Another way to acquire certificates from abroad is to establish a domestic emissions trading scheme and link it with other markets. For this option, it would be necessary for Japan to establish its own emissions trading scheme and link it with the EU ETS or other markets. The participants of the Japanese scheme would then be able to purchase certificates from the other schemes, or via CDM and JI projects, and use them for complying with their domestic obligations.

Linking domestic emissions trading schemes is an attractive option for acquiring certificates from abroad in so far as it would make it easier to acquire certificates from the new EU member states and accession countries in the form of EUAs—thus bypassing the issues surrounding JI projects—which will be backed by the exchange of AAUs. This also applies to the certificates of other countries like Canada if they also establish domestic emissions trading schemes. Moreover, by using this option the Japanese national account can absorb the certificates that private entities acquire from abroad without having to use taxpayers' money.

Linking two or more emissions trading schemes is generally supposed to improve the efficiency of the overall emissions trading market due to enhanced market liquidity. It is also supposed to lead to economic benefits at the macro level by providing the participants a broader range of emission reduction opportunities and lowering the overall cost of compliance (*cost efficiency*) (Blyth and Bosi 2004; Stowell 2005). It could also contribute to making more ambitious targets acceptable to participants by providing lower-cost options, although the linkage itself is regarded as environmentally neutral (*environmental integrity*) (Blyth and Bosi 2004). Also, industries should be less concerned about the competitiveness issue if the ETS is linked with those of other major industrialized countries (*political acceptability*). Furthermore, in Japan's case, it would provide an additional option to acquire certificates from Central and Eastern European countries, since transfers of EUAs will be backed by the corresponding amount of AAUs. Linking domestic cap-and-trade emissions trading schemes entails high upfront costs for establishing the schemes and negotiating the linkages. Once the market has been established, however, costs would be relatively low, since in principle no regulatory intervention is needed in the market itself.[11] This is in contrast to baseline-and-credit systems like the CDM and JI, where every transaction needs to be certified and approved individually (US EPA: 2-7–2-9).

Despite the above merits, the linkage of different emissions trading schemes could have a negative impact on market function if not carefully designed. This is exactly why the European Union established the EU-wide scheme rather than trying to coordinate different national schemes. Based on a survey of existing literature, we identified the following potential issues to be considered when linking schemes.

- **Compliance regime and penalties.** With regards to compliance regime and penalties, three basic types of regimes can be distinguished: (1) schemes with a sufficient penalty for non-compliance, (2) price cap or safety valve-type regimes,[12] and (3) voluntary schemes. If the linked schemes set penalties at the same level, then there is no problem for linkages in terms of the compliance regime and penalties. Even if the levels of penalties are different, it should not be a problem as long as they are sufficient to ensure overall compliance. However, linking between a scheme with penalties and a voluntary scheme would be a problem, since a voluntary scheme would by definition not entail penalties. Linking the fixed-penalty type of compliance regime with a price cap type of regime or safety valve type of regime would face problems too, since additional allowances issued at a certain price fixed in advance in a price-cap type of regime may also be available to installations operating in the fixed-penalty rate scheme, which undermines the compliance regime in the fixed-penalty rate scheme (Blyth and Bosi 2004; Philibert and Reinaud 2004; Meadows 2004).
- **Monitoring, reporting, and verification.** Transparent and robust monitoring, reporting, and verification (MRV) are fundamental to achieving a credible GHG trading system and the underpinning

11. However, there exists no experience with carbon markets yet, so reality still has to prove if they really work. Nevertheless, a huge international market (e.g., of the EU and Japan) is generally expected to have enough liquidity and prevent players from dominating the market.
12. A safety valve type regime means that the system sets the highest price in advance and the government provides certificates at that price if the market price exceeds the highest price, in order to avoid the compliance cost becoming too expensive.

value of the traded units. Therefore, the establishment of standardized MRV is desirable. Even if MRV systems between two schemes are different, this should not cause a problem in linking as long as both systems are sufficiently transparent and robust. However, if the MRV system of one country is not sufficiently robust, then the installations located in the country could sell unqualified allowances resulting from an inaccurate MRV system, which would damage the efficient operation and environmental integrity of the combined trading system (Blyth and Bosi 2004; Philibert and Reinaud 2004; Meadows 2004).

- **Definition and recognition of trading units.** The units to be utilized to achieve the targets in each scheme must be agreed upon. For example, the EU ETS does not allow the use of AAUs or CERs from land use, land-use change, and forestry (LULUCF) for achieving the target. However, if the EU ETS is linked with the scheme under which these certificates are eligible then certificates could be indirectly used for the EU ETS installations. Due to the rule of supply and demand, certificates not allowed in the EU ETS are likely to be cheaper than certificates allowed in all systems that have been linked. Installations in the non-EU countries would therefore have an incentive to fill their accounts with non-EU ETS-eligible certificates and sell the corresponding amount of EU ETS-eligible certificates into the EU ETS. The non-eligible certificates would therefore still have an impact on the EU ETS, even though the European Union has banned them. This would undermine its political decision to restrict the units eligible for compliance in its scheme. The EU will therefore probably insist on a common definition of which units are eligible (Blyth and Bosi 2004; Meadows 2004).

- **Stringency of environmental targets.** As long as the targets in both schemes are stringent (beyond business as usual), there should not be any technical problems in linking schemes with different levels of stringency. If stringency is lower than required under business as usual in one scheme, however, then linking could undermine the environmental effectiveness in the combined scheme, especially the scheme with more stringent targets (Blyth and Bosi 2004; Meadows 2004).

Apart from the issues discussed above, coverage of gases and sectors, absolute versus relative targets, allocation method, compliance period, and banking have been identified as other potential issues to address (Blyth and Bosi 2004; Philibert and Reinaud 2004; Meadows 2004; Hasselknippe 2003; Storell 2005).

As box 2 shows, some industrialised countries that have ratified the Kyoto Protocol have started to establish domestic emissions trading schemes following the lead of the European Union. Discussions on the linkages of different emissions trading schemes, however, have just started. The question of how much the differences between schemes are an obstacle to linking requires more in-depth study based on the accumulation of actual experiences.

The European Commission expressed their willingness to link the EU ETS with other emissions trading schemes with the aim of promoting market liquidity and to make the EU scheme a kind of de facto standard for international emissions trading through bottom-up linkages (*Point Carbon*, June 18, 2004 [http://www.pointcarbon.com]). Point Carbon also reported that discussions with Norway, Canada, Switzerland, Russia, Australia, and the United States are ongoing.

Among them, it was already decided to establish a linkage between the EU ETS and the Norwegian scheme. Norway designed its scheme in view of linking with the EU scheme in order to establish access to a larger market and to promote market liquidity (ibid.). Therefore, the two schemes are very similar and should not experience a problem in linking.

Canada, another country that ratified the Kyoto Protocol, declared it would launch its domestic emissions trading scheme from 2008. Although Canada is of the opinion that the linkages of different emissions trading schemes is possible as long as the requirements stipulated in Marrakesh Accords are fulfilled (Storell 2005, pp. 215), it would be difficult to link the proposed Canadian scheme and the EU ETS due to the differences between the two schemes in the aforementioned points.

	EU ETS	Canada	Norway
Compliance regime and penalty	40 euros in the period 2005–07 and 100 euros in the period 2008–12	To be decided, but should be higher than $15 CDN	40 euros
Monitoring, reporting, and verification	Monitoring guidelines by the EU Commission	Mandatory monitoring system	*
Definition and recognition of trading units	• EUAs, CERs, and ERUs • No AAUs • No CERs from sink projects	AAUs, CERs, and ERUs	*
Stringency of allocation	Not stringent for the phase from 2005 to 2007	Not stringent	Not stringent for the phase from 2005 to 2007
GHG coverage	CO_2, but may include more gases from 2008	CO_2	CO_2, but may include more gases from 2008
Sector coverage	Covers energy-related activities of more than 12,000 installations, which includes combustion installations with a rated thermal input exceeding 20 megawatts and other high-energy industrial installations, including metal ore roasting or sintering and the production of steel, pig iron, cement clinker, glass, ceramic products by firing, paper and board, and pulp from timber or other fibrous material.	Covers approximately 650 firms in industries classified as large final emitters (LFEs), i.e., thermal electricity, oil and gas, and mining and manufacturing.	Part of energy- and emissions-intensive industries exempted from the tax
Target	Absolute	Relative	Absolute
Possibility for banking	No for the period 2005–07. Yes for the period 2008–12	Yes	*
Allocation method	• Grandfathering • Auction is allowed for up to 5% in the period 2005–07 and up to 10% in the period 2008–12	Grandfathering	Partially grandfathering, partially auctioning
Others		Price assurance: $15 CDN**	

*Information not available.

**The price assurance functions as a price cap. If the price of allowances on the market goes above $15 CDN, the Canadian government is responsible for the additional costs/or for providing allowances at the price cap level.

Box 2: Comparison of emissions trading schemes in the European Union, Norway, and Canada

Source: Box 2 by Watanabe, based on information in Hasselknippe 2003; Stowell; 2005; and Convey et al. 2005.

3 Conclusion—Comparative evaluation of options

This paper examined the pros and cons of different options available to Japan for acquiring emission certificates. Here, we compare and assess the options in order to propose the best way for Japan to achieve its Kyoto target, based on the following criteria (see table 3):

- **Environmental integrity.** Each certificate bought from abroad means that one less tonne of GHG emissions will be reduced in the buyer country. To maintain the environmental integrity of the system it is therefore vital to ensure, through proper monitoring and verification procedures, that each certificate is backed up by the corresponding emissions reduction elsewhere.
- **Cost.** One of the biggest concerns raised by the countries that have ratified the Kyoto Protocol is the fear of a negative impact on their competitiveness vis-à-vis developing countries and industrialized countries that have not ratified the protocol. Even in the case that industries do not have any obligation to contribute to achieving the national target, if (for example) a tax is utilized to achieve the target, then it could ultimately affect the economic prosperity of the country. Therefore, in general, the option that brings the same amount of certificates with less cost is the most desirable. Cost is divided into certificate price and transaction cost (administrative cost of the transaction). Transaction cost is further divided into the administrative cost for negotiating the transaction of certificates and for establishing the scheme. When evaluating the cost for establishing the scheme, the duration of the system should also be considered. If the system is designed for a long duration, it may be worthwhile to establish the scheme even if the initial cost is high, while a smaller cost may still be too high if the lifespan of the system is expected to be short.
- **Size of potential.** As indicated in section 1, certificates corresponding to a reduction of at least 19.79 Mt CO_2e per year (or a total of 98.96 Mt CO_2e) for the first commitment period (2008–2012) need to be procured by using the Kyoto mechanisms. In order to acquire certificates effectively, the size of potential that could be delivered by each option is also an important factor in the selection.
- **Political acceptability.** This should be taken into account to select the option(s) most likely to meet with the highest degree of cooperation from stakeholders and can thus be introduced smoothly and implemented most effectively. These depend on the environmental integrity and distributional impact of options, since selecting option(s) ultimately relates to burden sharing among stakeholders, especially between the industry/energy sector and the other sectors (transportation and households).
- **Long-term impact (beyond the Kyoto period [BKP]).** Addressing climate change requires a long-term strategy for giving the right signals for investments. Since the Kyoto Protocol sets out emission reduction targets for the first commitment period only, and difficulties are observed in reaching agreement on the future regime which would strengthen the targets, then the best option is one that contributes to bringing about reductions in GHG emissions regardless of the existence of a Kyoto Protocol-like international climate regime after 2012. Therefore, long-term impacts should be analyzed with regard to the long-term prospects of the respective scheme as such and the emission reductions achieved.

3.1 Assessment of options using selected criteria

3.1.1 Joint implementation

Environmental integrity. This depends on the stringency of modalities in the case of JI track 2. In the case of JI track 1, seller countries can decide on the amount of ERUs to be transferred to buyers. Because of this, there is a danger that environmental integrity could be undermined by seller countries allocating more certificates than actually reduced. However, the details of JI track 1 still need to be worked out. Moreover, the seller and the buyer countries usually conclude a memorandum of understanding establishing the general framework for their cooperation. As a result, the Japanese government (and other buyer governments) can still work to safeguard the environmental integrity of the mechanism.

Price. As the market is still in its infancy, it is very difficult to estimate and compare the prices of the different options. The price of ERUs is generally expected to remain lower than the price of EUAs and higher than the prices of CERs and AAUs. This is borne out by the current developments in the EU market, where EUAs are more expensive than ERUs and CERs.[13] Comparison of ERU and GIS/AAU prices is difficult. AAUs are theoretically considered to be the cheapest option, but no actual trades have taken place so far. The price could be more expensive than other standardized options, however, since it is negotiated between buyers and sellers. The officials we interviewed in Central and Eastern European countries also estimated that EUAs will be the most expensive, but they expected that the EU ETS could develop into the "lead market" that determines all prices and the price of all options will probably converge in the future.

Transaction cost. JI track 2 will probably be the second most expensive option after the CDM. JI track 1 reduces the administrative cost in the case of Russia and the Ukraine. It also contributes to reducing the administrative burden of projects in the new EU member states and accession countries, but in these countries there will also be additional costs related to avoiding the double-counting issues. Moreover, finalizing the rules for JI projects—much of which could be based on the rules for CDM projects—requires a substantial effort. The Japanese government will also need to invest in efforts to negotiate memoranda of understanding with the host countries which require their conclusion a precondition for approving projects.

Size of potential. Despite the adoption of the *acquis communautaire*, the technical potential in the new EU member states and accession countries is still large. The actual potential will depend on the policies of these states and on the possibility of bundling small projects not covered by the EU ETS. In Russia and the Ukraine the potential is very large, in theory, but the realization of this potential depends on capacity and institution building and improving market conditions.

Political acceptability. JI is regarded to be at least not negative because (1) JI projects generate actual emission reductions in other Annex I countries, and (2) it is neutral in terms of distributional impact.

13. The current price of one EUA was around 16 euros, as of March 2005, while that of one CER was 5 euros. Nevertheless, the CER price is an estimation of average price. The CDM Executive Board had approved 19 projects as of September 2005; however, no CERs have been issued yet. Once CDM projects start generating CERs, the price of CERs, ERUs, and EUAs will probably converge.

Long-term impacts. The achievement of emission reductions for the long term depends on the type of project. Under the framework of JI, projects that will generate emission reductions even after the first commitment period could be conducted. Whether such projects secure investments depends highly on a continuation of the Kyoto regime. If it is sure that the Kyoto regime does not continue after the first commitment period, buyer countries and investors would be more interested in projects that generate as many emission reductions as possible during the first commitment period. It is also questionable if projects that are implemented will continue operating after 2012 if their emission reductions will no longer have value. Therefore, the long-term prospect of JI as a scheme and of the potential long-term emission reductions depends on the continuation of a Kyoto Protocol-like regime.

3.1.2 The Clean Development Mechanism

Environmental integrity. Depends on each project.

Price. As explained above, the price of CERs is generally expected to remain lower than prices of EUAs and ERUs, and higher than the price of AAUs, although the price of all options will probably converge in the future.

Transaction cost. The CDM is probably going to be the most expensive option due to costs for validation, approval, registration, verification, and certification. Since the CDM is already fully operational, there will be no further costs for establishing the scheme. What remains is for the Japanese government to conclude memoranda of understanding with host countries.

Political acceptability. The CDM is basically regarded in a positive way, since it is designed to contribute to sustainable development for non-Annex I Parties while reducing compliance costs for Annex I Parties. If the project is not beneficial to sustainable development (such as in case of HFC or methane projects), however, political acceptability may be negative. The CDM is also neutral in terms of distributional impact.

Size of potential. Large in theory. The actual realization of potential, however, depends on the removal of current bottlenecks.

Long term-impact. Same as in the case of JI.

3.1.3 International emissions trading

Environmental integrity. The transaction of AAUs is neutral in terms of environmental integrity, as defined above.

Price. As explained above, AAUs are theoretically considered the cheapest; however, the price could be more expensive than other standardized options since it is negotiated between buyers and sellers. Especially when Russia attempts to maximize its profits by pursuing an active market strategy, which includes buying as well as selling and holding back the larger part of its surplus (as *Point Carbon* indicated), then the normal transaction of AAUs might not be a cheaper option. Our interviewees also expressed concern about the strong influence of Russia and the Ukraine on the AAU market (Chmelik 2004; Feiler 2004; Mojeek 2004). The sellers could to a large extent dictate the terms and prices, especially if there is a "last-minute scramble" for AAUs as the last remaining opportunity for buyer countries to come into compliance. The same could apply to GISs. In this sense, the prices of ERUs, CERs, and EUAs are much more transparent.

Transaction cost. The transaction of AAUs is theoretically the cheapest option.

Size of potential. There is a large potential of AAUs in theory, but the realization of this potential depends on institution building and the policies of EIT countries, especially Russia and the Ukraine.

Political acceptability. The normal transaction of AAUs (hot air) would probably not be supported by the general public due to the perception that money is expended without achieving additional emission reductions. However, it is neutral in terms of distributional impact.

Long-term impact. It is unclear what the revenue coming from the sales of AAUs will be utilized for. Therefore, the transaction of AAUs has possibly the least long-term impact among the options. In terms of the long-term prospects of the scheme itself, it is dependent on not only a continuation of the Kyoto Protocol but also on the stringency of target in the future commitment periods, i.e., the existence of surpluses in countries with emission targets.

3.1.4 Green investment schemes

Environmental Integrity. Hard greening could achieve direct and verifiable emission reductions. In the case of soft greening and other environment-friendly projects, however, GISs either do not generate direct emission reductions or it is at least very difficult to measure them. In the case of soft greening there is also a serious risk that the monetary flows will be used for non-environmental purposes.

Price. Certificates from GISs will probably be cheaper than project-based certificates and might be more expensive than normal AAUs. As already mentioned, however, the price of all options will probably converge in the future.

Transaction cost. There would be costs involved in setting up the GIS system; therefore, in terms of cost for establishing the system, GISs are more expensive than other Kyoto-based options, although not more than the linking of different emissions trading schemes. Nevertheless, it would be effective to standardize the transaction and lower transaction costs compared to normal AAU trading once the system is established. The life expectancy of the system is probably only very short, however, since it depends on the EIT countries having surpluses, which may be the case only during the first commitment period.

Size of potential. There is a large potential in theory, but the realization of it depends on institution building and the policies of the EIT countries.

Political acceptability. Political acceptability of GIS is basically positive in the case of hard greening, since it achieves actual emission reductions and has no distributional impact. In the case of soft greening and other environment-friendly projects, political acceptability might be as negative as that of normal AAU trading due to the ambiguity of the actual contribution to emission reductions.

Long-term impact. The hard greening case is positive in terms of long-term impact, since projects would generate emission reductions even after the first commitment period. The soft greening case is also positive if projects contribute to establishing institutions fundamental to addressing climate change issues, such as the preparation of MRV and capacity building. In terms of the long-term prospects of the scheme itself, it is dependent on not only a continuation of the Kyoto Protocol but also on the stringency of targets in future commitment periods, i.e., the existence of surpluses in countries with emission targets.

3.1.5 Linkage of domestic emissions trading schemes

Environmental integrity. The environmental integrity of this option depends on the modalities for MRVs and on the compliance regime.

Price. The linkage of emissions trading schemes currently appears to be the most expensive option, as the price of EUAs indicates. However, the EU ETS market does not yet seem mature enough to allow a final conclusion. Moreover, the EU ETS could become the "lead market" determining the prices of all certificates, in which case the price advantage of the other options would largely disappear.

Transaction cost. The linkage of domestic emissions trading schemes first requires establishing a domestic emissions trading scheme in Japan and then linking it with other emissions trading schemes, particularly the EU ETS. Establishing domestic emissions trading will require comprehensive discussions in the country to ensure the full understanding of stakeholders. In order to link up with different emissions trading schemes, all the technical issues examined and detailed in this report need to be resolved. Therefore, this will be the most expensive option in terms of initial transaction cost. Once the scheme is established, however, the transaction costs of running would be relatively low. Moreover, by exercising this option the Japanese government would automatically obtain the foreign certificates acquired by Japanese companies.

Political acceptability. This option would possibly face the largest opposition from industrial stakeholders, while it could be supported by the general public since it would reduce the burdens of the household and transportation sectors (where the general public has to participate in taking responsibility), and also reduce the amount of taxation necessary to purchase certificates from abroad.

Long-term impact. Emission reductions for the long term depend on the scheme and the stringency of targets. As for the long-term prospect of the scheme itself, however, this option is probably the most positive, since once the system is established the market itself functions to keep it running. This could continue all by itself even after the first commitment period, which would support the international climate protection regime, rather than depending directly on the continuation of a Kyoto-like regime as the other options do.

Criteria	Joint implementation (JI)	Clean Development Mechanism (CDM)	International emissions trading (AAUs, hot air)	Green AAUs	Linkage of emissions trading schemes
Environmental integrity (emissions reduction)	Depends on the modalities and on the actual project. If track 1 is applied, it could be negative.	Depends on the project.	The transaction of AAUs itself is neutral in terms of environmental integrity.	Depends on the scheme design. Positive in the hard greening case. The soft greening case or other environment-friendly project cases is dubious, unless the MRV to precisely measure the reduction effects are established.	Depends on stringency of the MRV.
Price	Cheap[14]	Cheap	Theoretically the cheapest. However, it could be the most expensive since the price is bilaterally negotiated, especially if there is a "last-minute scramble."	More expensive than AAUs.	Currently most expensive, with EUA prices at 16 euros/tonne (as of March 2005). However, the EU ETS does not yet seem mature enough to allow a final conclusion. Moreover, the EU ETS could become the "lead market" determining prices of all certificates.
Transaction cost (administrative burden)	High. If track 1 is applied, it would be lower.	High	Depends on the negotiation cost.	There is an upfront cost to establish a scheme. Transaction cost depends on the scheme. If the scheme were standardized, the cost would be low. Nevertheless, it's considered lower than JI.	High upfront cost to establish a domestic emissions trading scheme and to solve all the technical issues resulting from the linkage, but low cost to run the scheme once established.

Table 3: Comparative assessment of options for Japan

14. Cheaper than EUAs if comparing the current EUA price and the current prices of ERUs or CERs. Nevertheless, the price of ERUs or CERs is an estimation of average prices. The CDM Executive Board had approved four projects as of March 2005; however, no CERs have been issued yet. Once CDM projects start generating CERs, the price of CERs, ERUs, and EUAs will probably converge.

Table 3 continued

Criteria	Joint implementation (JI)	Clean Development Mechanism (CDM)	International emissions trading (AAUs, hot air)	Green AAUs	Linkage of emissions trading schemes
Size of potential	• Central and Eastern Europe: technical potential still large. Actual potential depends on the policies of Central and Eastern European (CEE) EU states and on the possibility of bundling small projects. • Russia and the Ukraine: very large in theory, but it depends on capacity and institution building and market conditions.	Large in theory. Realization depends on removal of current bottlenecks.	Large in theory, but it depends on institution building and the policies of Russia and the Ukraine.	Large in theory, but it depends on institution building and the policies of CEEs, Russia, and the Ukraine.	Central and Eastern Europe: Potential is large. It's easier to tap the certificates through the linkage of emissions trading schemes than JI. Independent of policies of individual states.
Political acceptability					
Environmental integrity	Depends on the project.	Depends on the project; however, if the project is not beneficial to sustainable development, then might be negative.	Negative in terms of environmental integrity since the usage of money transferred is uncertain.	Positive in the hard greening case. In other projects, the ambiguity remains.	Depends on the scheme.
Distributional impact	No distributional impact.	No distributional impact.	No distributional impact.		• Industry is negative to the introduction of the cap-and-trade scheme. • The general public might be positive because it would reduce the burdens for the household and transportation sectors.

Table 3 continued

Criteria	Joint implementation (JI)	Clean Development Mechanism (CDM)	International emissions trading (AAUs, hot air)	Green AAUs	Linkage of emissions trading schemes
Long-term impact (BKP)	Depending on a continuation of the Kyoto regime, it could achieve emission reductions even after the first commitment period.	Depending on a continuation of the Kyoto regime, it could achieve emission reductions even after the first commitment period.	The least possibility to generate reductions for the long-term.	Depending on a continuation of the Kyoto regime, it could bring emission reductions even after the first commitment period.	Depends on the scheme.
Emission reductions					
Long-term prospect of the scheme itself	Depends on continuation of the Kyoto regime	Depends on continuation of the Kyoto regime	Depends on continuation of the Kyoto regime	Depends on continuation of the Kyoto regime	Independent of continuation of the Kyoto regime.

Note: Table by Watanabe, Sterk, and Lechtenböhmer.

The following conclusions can be drawn based on the above comparison:

JI is highly rated under most criteria. Negative aspects are transaction costs in the case of track 2, the current lack of clarity about the environmental integrity of track 1, and the long-term prospects of the scheme itself.

The Clean Development Mechanism is also highly evaluated under most criteria. Negative elements are the transaction costs involved and the long-term prospects of the scheme itself. There is also the problem of projects like HFC and methane projects, which reduce emissions but typically do not contribute substantially to sustainable development.

International emissions trading gains the most negative evaluation in terms of political acceptability, while the best in price and transaction cost. It is also negative in terms of the long-term prospects of the scheme itself.

GIS also gains good ratings under most criteria. It is highly evaluated in environmental integrity in the hard greening case, size of potential, and political acceptability. Negative elements are the cost for establishing the scheme and the long-term prospects of the scheme itself. Due to the dependence on a continuation of a Kyoto-like regime and the availability of surpluses in countries with reduction targets, it is expected that GIS will have a short life, although the idea of "hard greening" could be applied in the case of Annex I Parties with lower surpluses and non-Annex I Parties that might adopt commitments in the future, but possibly with a lot of surpluses. This could also be a model for bilateral cooperation for the reduction of GHG emissions even without the existence of a Kyoto-like regime.

The linkage of domestic emissions trading schemes costs the highest upfront for establishing the scheme itself, and it faces the largest opposition from industry. Once the system is established, however, it provides the lowest transaction cost, a very effortless way for the Japanese government to acquire certificates, and the best option in terms of long-term impact, including the fact that it could be a strong and viable instrument for emissions reductions even without a continuation of the Kyoto regime. In contrast to all other options discussed here, the ETS is not only an instrument for purchasing certificates from abroad but also for promoting cost-efficient domestic emission reductions.

Comparing all the available options, JI and the CDM are more promising in the short term, since they are cheaper in terms of price, and the mechanisms have largely already been established. Considering that the prices of all options will probably converge once the market is fully functional, "short term" means the period until the second half of 2007, when the Enforcement Branch of the Compliance Committee makes a decision on the eligibility requirement to use the Kyoto Mechanisms[15] (Watanabe 2005b). After that, it will become much clearer which Parties fulfill the eligibility requirement for international emissions trading and JI track 1. Thereafter, international emissions trading and GIS will become viable. However, since GISs still need to be established, work would need to start now if this option is to be pursued. In the longer term, however, linkage of domestic emissions trading schemes would also be a good option, since it would provide easier access to the emissions reduction potential in the new EU member states and accession countries. Moreover, once the scheme has been established, the Japanese government would automatically obtain the foreign certificates acquired by Japanese companies without having to use taxpayers' money.

[15] Paragraph 5 of Draft decision-/CMP.1: (Mechanisms), principles, nature, and scope of the mechanisms pursuant to articles 6, 12, and 17 of the Kyoto Protocol, paragraph 22 of ANNEX of Draft decision-/CMP.1 (Article 6) , paragraph 3 of ANNEX of Draft decision-/CMP.1(Article 17)

3.2 Proposed best options for Japan to achieve its target

The comparison and assessment conducted in section 4.1 examined the pros and cons of each option. In this section we propose the best option for Japan to acquire certificates from abroad, considering the issues it faces in achieving its Kyoto target, as explained in section 1, i.e., (1) the current scheme cannot procure a sufficient amount of certificates to correspond to the envisaged 1.6 percent of its GHG emissions, and (2) the government cannot utilize all the certificates acquired by Japanese entities for national compliance, since it currently has no means of drawing these certificates into its national account (figure 2).

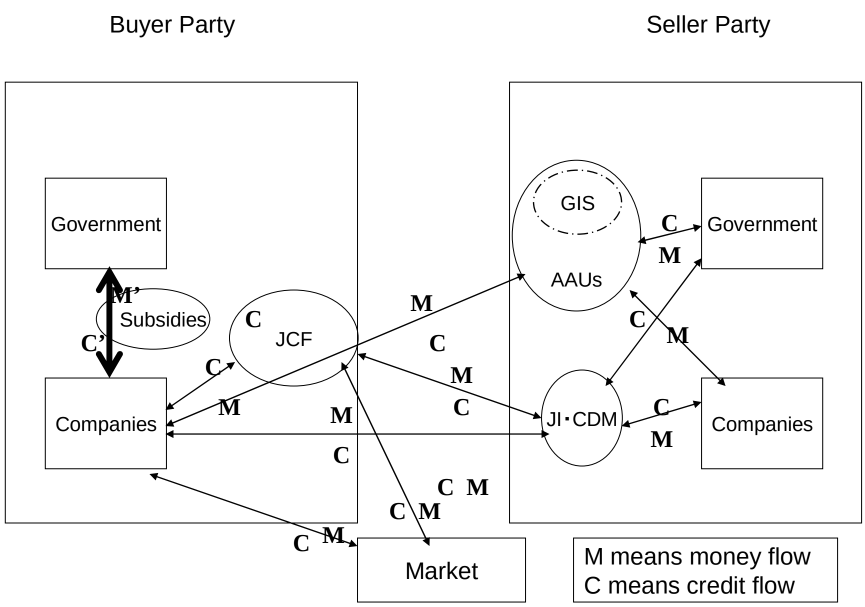

Figure 2: Current money and credit flows in the Japanese case

Note: M = money flow, C = credit flow

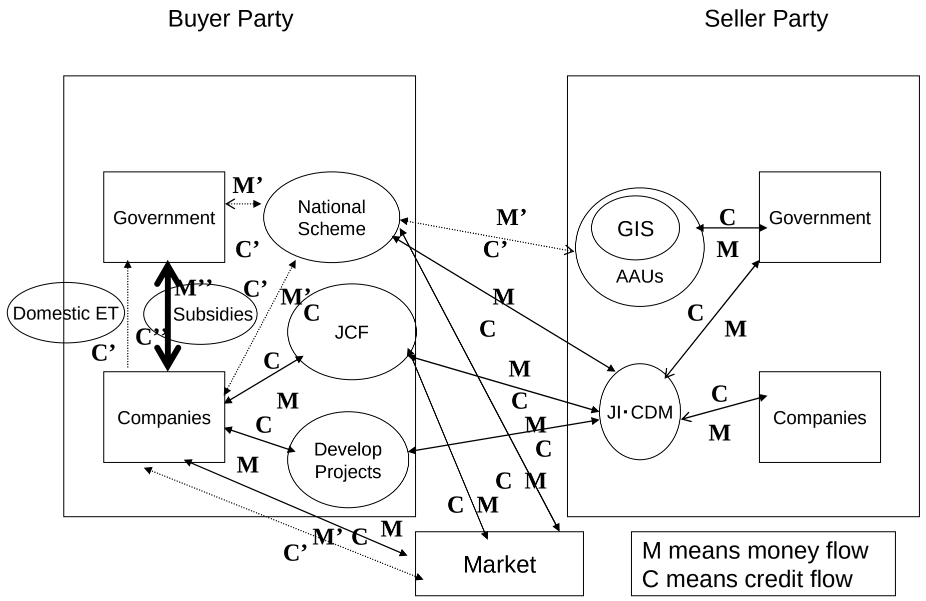

Figure 3: *The credit and money flows created by establishing a national credit-purchasing scheme*

Note: M = money flow, C = credit flow

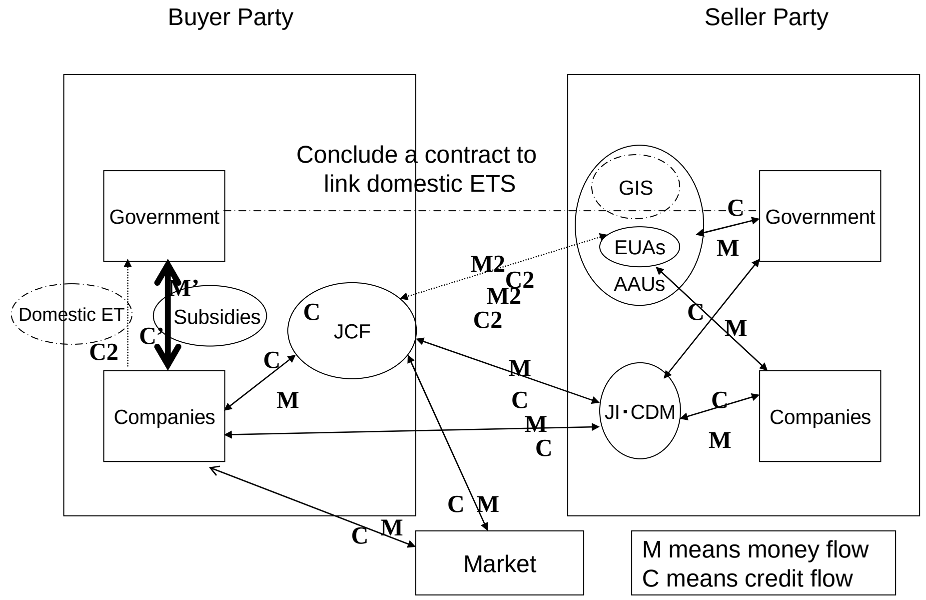

Figure 4: *The credit and money flows created by establishing a domestic emissions trading scheme and linking it with other markets*

Note: M = money flow, C = credit flow

As the best option for Japan to acquire certificates from abroad, based on the above analysis, it is recommended that Japan first establishes a national purchasing scheme, then establishes a domestic emissions trading scheme and links it with other emissions trading schemes.

A national purchasing scheme—which would enable Japan to systematically acquire the certificates necessary for compliance with its Kyoto target—should be established as soon as possible in order to purchase ERUs and CERs before the market is fully functional and the prices of all options converge. It is recommended that investments in JI/CDM projects be made up to the first half of 2007, and then shift to GISs after it becomes clear which Parties fulfill the eligibility requirement (Watanabe 2005b). In this regard, it is recommended that in the meantime Japan cooperate with countries that have surpluses to establish GISs. In order to ensure the environmental integrity of GISs, however, they should be limited to the hard greening case. Although soft greening is attractive in terms of flexibility—which is beneficial for both host countries and buyer countries in addressing the issue of eligibility requirements in host countries—there is a risk of distorting the environmental integrity of GISs and undermining their effectiveness in addressing the hot air issue in the normal transaction of AAUs. The institutional and capacity constraints of the seller countries should be addressed by means other than soft greening. One idea might be to conclude framework package agreements with seller countries that encompass capacity building measures on the one hand and hard greening GIS projects on the other. By establishing a national purchasing scheme, the government could also purchase the certificates acquired by Japanese entities, as shown in figure 3 (M1 and C1).

In the long term, however, establishing a domestic emissions trading scheme and linking it with other emissions trading schemes is highly recommended. First, as a short-term benefit, it would make it easier to acquire certificates from the new EU member states and accession countries, since in this case Japanese entities would be able to utilize EUAs to achieve their targets set in Japan's domestic emissions trading scheme. Therefore, Japanese companies as well as the government can acquire certificates as EUAs—thus bypassing the issues surrounding JI projects—which will be backed by the exchange of AAUs between national schemes. This also applies to the certificates of other countries if they also establish domestic emissions trading schemes. Second, Japanese companies will have obligations to achieve their own targets for which they will utilize certificates acquired from abroad. Therefore, Japan's national account can absorb the certificates that private entities acquire from abroad without using taxpayers' money. In the long term this option could continue even after the first commitment period, once the system is established. The Japanese government could thus effectively install a permanent conduit of foreign certificates. Moreover, this option would support the international climate protection regime and even induce emission reduction efforts regardless of a continuation of a Kyoto-like regime.

Although this option is highly rated under most criteria in section 4.1, it will probably have distributional impacts on industrial stakeholders. In order to address this issue, discussion involving all stakeholders is necessary. Therefore, it will take longer to adopt this option than the others. Even so, it is highly recommended to start implementing it in the near future, considering that it would enable Japan to acquire certificates from Central and Eastern European countries, which are probably the most reliable among the countries with surpluses and inexpensive reduction potential. Besides, the cost to achieve the 6 percent target solely through a national purchasing scheme might be too expensive,[16] and

16. Using the calculation of 5 euros/tonne, it will cost 100 million euros (13 billion yen) per year to procure certificates corresponding to 1.6%. Considering that the prices of all certificates will converge, the actual cost may be higher.

the option to link domestic emission trading systems has a positive long-term effect regardless of a continuation of the Kyoto or similar regime.

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Background Paper 1

March 2005

Current Japanese Climate Policy from the Perspective of Using the Kyoto Mechanisms

Rie Watanabe

Japan is currently facing difficulty with achieving the emission reduction target for greenhouse gases (GHG) that it committed to under the 1997 Kyoto Protocol. By 2002, its emissions had already increased by 7.6 percent since 1990. Therefore, it has to reduce its emissions by at least 13.6 percent in order to achieve the 6 percent reduction target set in article 3.1 of the protocol.

This paper first examined the Japanese climate policy development process and the result of review of current policies and measures conducted in 2004.

The 2004 review revealed that Japan's emissions in 2010 are estimated to be at least 6 percent higher compared to the 1990 level, which will require a reduction of at least 12 percent to achieve its 6 percent reduction target. Based on the current estimation, even if all the policies and measures are implemented as scheduled, there will still be a 1.6 percent shortfall, which will therefore have to be purchased in the form of credits from abroad.

The paper will then proceed to examining preparations in Japan to utilize Kyoto mechanisms. It revealed that the current scheme cannot procure a sufficient amount of certificates to correspond to the envisaged 1.6 percent of its GHG emissions, and the government cannot utilize all the certificates acquired by Japanese entities for national compliance, since it currently has no means of drawing these certificates into its national account. As such, the paper highlights the urgent need to quickly identify and act on the best option for Japan to acquire certificates from abroad and to utilize the certificates for national compliance.

This is the first paper in a series of four papers commissioned by the Ministry of the Environment of Japan.

1 Introduction

Japan is currently facing difficulty with achieving the emission reduction target for greenhouse gases (GHG) that it committed to under the 1997 Kyoto Protocol. By 2002, its emissions had already increased by 7.6 percent since 1990. Therefore, it has to reduce its emissions by at least 13.6 percent in order to achieve the 6 percent reduction target set in article 3.1 of the protocol.

In light of this situation, it is highly likely that Japan will have to purchase emission reduction certificates from abroad in order to comply with its target. Therefore, it is crucial for Japan to examine and implement its best options to acquire credits by utilizing the Kyoto mechanisms at the earliest possible date.

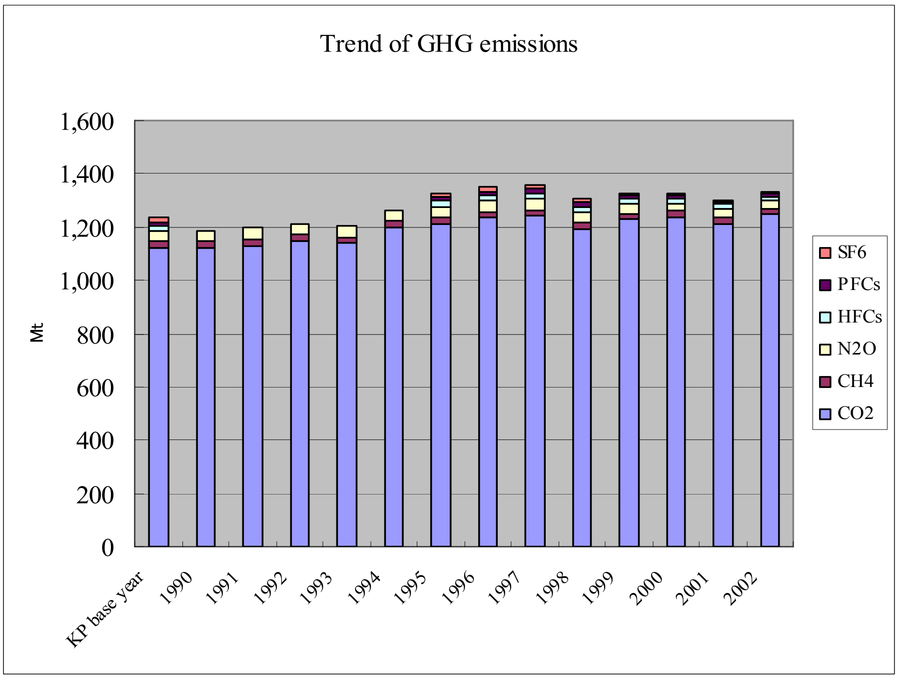

Figure 1: Japan's GHG emissions trend (1990–2002)

Note: SF_6 = sulphur hexafluoride; PFCs = perfluorocarbons; HFCs = hydrofluorocarbons; N_2O = nitrous oxide; CH_4 = methane; CO_2 = carbon dioxide

This paper examines Japan's current policies and measures to mitigate its GHG emissions in order to highlight the difficulties mentioned above and the necessity to prepare for acquiring credits from abroad.

2 Climate policy development in Japan

2.1 Pre-Kyoto

2.1.1 Conference of the Parties to the UNFCCC (up to 1992)

Global warming became a political issue in the late 1980s in the wake of international efforts to address stratospheric ozone depletion. In response to the first World Conference on the Changing Atmosphere, held in Toronto, Canada, in June 1988, the Dutch government convened an international ministerial conference on climate change in Noordwijk, Netherlands, in November 1989. At the conference, the Dutch government proposed that industrialized countries agree to stabilize carbon dioxide (CO_2) emissions at the latest by the year 2000 as a first step to combating global climate change.

Before the Dutch conference, on May 12, 1989, the Japanese government established the Ministerial Council on Global Environmental Protection in order to facilitate inter-ministerial coordination of internationally negotiated environmental policies. According to the Ministry of Environment's *White Paper on the Environment,* 1989 was the year that Japan and the world made a big first step towards protecting the global environment (MoE 1990). Despite this, Japan initially sided with the United States, which said that it recognized the CO_2 problem but believed that further study was necessary before binding controls could be proposed (Schreurs 2002). The director-general of Japan's Environment Agency, Mr. Setsu Shiga, announced that he agreed in principle to stabilization of GHG emissions but that setting concrete targets should wait until the Intergovernmental Panel on Climate Change (IPCC) made its report in the fall of 1990 (Schreurs 2002; Shiga 1991).

On October 23, 1990, Japan's Ministerial Council adopted the Action Plan to Arrest Global Warming in order to identify a basic position for Japan to contribute to discussions on an international framework for the prevention of global warming. The plan included the government's announcement that it would stabilize CO_2 emissions at the 1990 level by 2000 on a per capita basis. Then, in the midst of pervasive skepticism on taking action to address global warming, formal international negotiations on a climate change convention were launched in February 1991.

In June 1992, Japan signed the United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994. Article 4-2(a) of the convention states that each of the Parties "shall adopt national policies and take corresponding measures on the mitigation of climate change…These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification." After adoption of the UNFCCC, Japan reconfirmed its pledge in 1990 to stabilize its CO_2 emissions on a per capita basis at the 1990 level by 2000.[17]

17. Article 4.2 of the UNFCCC said that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the convention, recognizing that to stabilize their absolute GHG emissions at the 1990 level by 2000

Before signing the UNFCCC, Japan's government had already discussed the introduction of a carbon tax in the framework of the revision of its Basic Law for Environmental Protection Control. The Environmental Agency issued a report in May 1992 titled *An Appraisal of Instruments to Prevent Global Warming*. The report argued that it would be necessary to introduce a carbon tax in order to achieve the target of stabilizing CO_2 emissions at the 1990 level by 2000. Due to huge opposition from the Ministry of Industry, Transport and Import (MITI) and industries, however, the revision was watered down and the carbon tax was dropped (Schreurs 2002).

2.1.2 From Berlin to Kyoto (1992–1997)

In March 1995, the Parties to the UNFCCC agreed on adoption of the Berlin Mandate, which required them to negotiate a protocol or other legal instrument that would set quantified limitation and reduction objectives for the Annex 1 (developed) countries within specified time frames (2005, 2010, and 2020) for their anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol, in order to be ready for agreement at the third Conference of the Parties (COP 3) in Kyoto (UNFCCC 1995). Against this background, the Environmental Agency and MITI, along with the Ministry of Foreign Affairs, started inter-ministerial discussions to formulate a Japanese position on a quantitative target and to examine the reduction potential and measures for providing a basis to form the position.

MITI examined potential domestic mitigation measures at its Industrial Structure Council (from April 1996 to March 1997) and at its General Energy Study Council (from September 1996 to November 1997), while the Environmental Agency examined them at its Central Environmental Council. The Industrial Structure Council made proposals on amending the Law Concerning Rational Use of Energy and submitted a proposal of the Law Concerning Special Measures for Promotion of New Energy Use (New Energy Law) to the Diet (parliament).[18] The law was enacted in April 1997 with the aim of accelerating the advancement of the introduction of new energy use and achieving Japan's target by 2010. While clarifying the role of each area for the overall advancement of new energy usage, the law also provides financial support measures for utilities that use new energy. Apart from the above, both ministries decided to consider other measures after COP 3.

MITI also requested industries to set voluntary emission reduction targets. In order to show a positive attitude towards climate protection and to avoid the introduction of drastic measures, Nippon Keidanren—the Japan Business Federation—unveiled its Voluntary Action Plan in June 1997 and announced that it would see to stabilization of its members' CO_2 emissions at the 1990 level by 2010 (Sawa and Kikukawa 2003).

would contribute to such modification, while Japan's target was to stabilize its CO_2 emissions on a per capita basis at the 1990 level by 2000.

18. According to the Law Concerning Special Measures for Promotion of the Use of New Energy, new energy and the use of new energy are stipulated as (1) an oil alternative energy for either manufacture, generation, or use; (2) there is no development of broadening economic restrictions; and (3) it particularly contributes to the promotion of an oil alternative energy for which necessary support measures aimed at promoting positive implementation are positioned (http://www.enecho.meti.go.jp/english/policy/new_energy/ definition.html#top#top). The target resources for the "Use of New Energy, etc.," as specified in the government ordinance of the New Energy Law includes photovoltaic power generation, wind power generation, solar thermal utilization, the use of temperature difference energy, waste power generation, thermal utilization of waste, waste fuel manufacturing, biomass power generation, thermal utilization of biomass, biomass fuel manufacturing, cool energy use for supply side and clean-energy motor vehicles, and natural gas co-generation and fuel cells for the demand side. Biomass power generation, thermal utilization of biomass, biomass fuel manufacturing, and cool energy use were included in the ordinance revision on January 25, 2002.

In the summer of 1997, the Joint Meeting of Relevant Councils was also established by an initiative taken by Prime Minister Ryutaro Hashimoto in order to coordinate the examination of policies implemented by different ministries from various perspectives.

2.2 After Kyoto (December 1997–June 1998)

In December 1997, the Parties to the UNFCCC agreed to adopt the Kyoto Protocol, which set differentiated quantitative emission reduction targets for the industrialized countries.

On December 19, 1997, immediately after the Kyoto conference, the Global Warming Prevention Headquarters (GWPH) was established under an initiative by Prime Minister Hashimoto and staff of the Cabinet Office, with the Joint Meeting of Relevant Councils as its advisory body (Hattori 1999).

In January 1998, the headquarters made an announcement titled "About Future Programs of Measures to Cope with Global Warming" and called for the development of comprehensive measures to do so, taking into account the result of the Kyoto conference (GWPH 1998a). Based on the headquarters' decision, relevant ministries submitted high-priority measures to be introduced to the joint meeting.

The headquarters adopted the Fundamental Guideline to Promote Measures to Cope with Global Warming on June 19, 1998 (GWPH 1998b), which set emission reduction targets for sources (table 1) and stated that the following measures should be taken:

- Comprehensive promotion of coping with global warming based on the Climate Change Policy Law
- Promotion of mitigation of CO_2 emissions, while taking the demand and supply of energy into account. This includes the Amended Law Concerning the Rational Use of Energy (ALRUE) (see below) and the Keidanren's Voluntary Action Plan.
- Promotion of controlling other GHG emissions
- Promotion of carbon sinks
- Research and development of innovative environment and energy technology
- Reinforcement of the global monitoring system
- Promotion of international cooperation
- Changes of the Japanese lifestyle

Source	Reduction target (%)
Energy source CO_2	0[a]
Non-energy source CO_2, methane, and carbon monoxide	–0.5
Further efforts of the general public/innovative technology development	–2.0
Alternatives to fluorine gas (HFCs, PHCs, and SF_6)	+2.0
Forestry sinks	–3.9
Others (Kyoto mechanisms)	–1.6
Total	–6.0

Table 1: Emission reduction targets for sources set by the Global Warming Prevention Headquarters

Source: GWPH 1998b.

[a]This figure is based on the targets set in a report of the Joint Meeting of Relevant Councils just before COP 3 (–7% for the industry sector, +17% for the transportation sector, and 0% for the household sector). However, these sector targets were not explicitly described in the guideline, since this is contrary to the voluntary target declared by the Keidanren, which is the stabilization of emissions at the 1990 level.

Based on its competence in energy policy, MITI proposed measures to cover the industry and energy sectors, including an amendment of the ALRUE to introduce a top-runner program (box 1), as well as intensifying energy-efficiency measures at factories. The Environmental Agency (EIA) drafted a new regulation, the Climate Change Policy Law (CCPL), and tried to include the obligation of companies to submit a plan to control their GHG emissions, based on its competence in environmental policy.

The top-runner scheme was introduced in the ALRUE, which was passed at the Diet in May 1998 and went into effect in April 1999.

The law was originally enacted in 1979 to promote energy efficiency in order to address the oil crisis at the time. It has been amended several times since then. The 1993 amendment introduced energy-efficiency standards as absolute targets for vehicles and certain types of electrical equipment. If manufacturers and equipment importers failed to comply with the standards, they were subject to recommendations by MITI.

In 1999, after the Kyoto Protocol was adopted, the law was amended with the aim of addressing the climate change issue, and the top-runner program was introduced to replace the energy-efficiency standards.

While the energy-efficiency standards had been set at a level slightly above the average energy efficiency of each product, under the top-runner program the best performing items in their category in the market set the minimum standard for a target year. The program originally covered 11 items, including cars, refrigerators, air conditioners, etc., and has since been extended to 18 items. If a company cannot achieve the target by a target year, then its name as well as the product name is made public, and it has to pay a fine. However, compliance is evaluated not based on each product but on products in the same category.

	Base year (fiscal year)	Target year (fiscal year)	Approximate improvement in efficiency (%)
Air-conditioners	1997	2004 for blower/wall type items <4kW 2007 for others	63 (for most types)
Space heaters	2000	2006	1.4 (gas) 3.8 (oil)
Refrigerators and freezers	1998	2004	30
Fluorescent lamps	1997	2005	17
Televisions	1997	2003	16
Video players	1997	2003	59
Magnetic disk devices	1997	2005	78
Copy machines	1997	2006	30
Computers	1997	2005	83
Gas cooking appliances	2000	2006	14
Water heaters	2000	2006	4.1 3.5
Electric toilet seats	2000	2006	10
Vending machines	2000	2005	34
Transformers	2000	2006 (oil-filled) 2007 (mold)	30
Passenger vehicles, gasoline	1995	2010	23
Passenger vehicles, diesel	1995	2005	15
Freight vehicles, gasoline	1995	2010	13
Freight vehicles, diesel	1995	2005	7

Box 1: Top-Runner Program

Source: Top Runner Program, Energy Conservation Center, Japan (http://www.eccj.or.jp/toprunner/pamph/04/).

The ALRUE was passed by the Diet on May 15, 1998. Then it passed the CCPL on October 6, 1998, in which, however, the EIA failed to have the obligation of companies included, due to huge opposition from industries who argued that it would cause double regulation in relation to the ALRUE. As a result, the CCPL became just a framework law.[19]

Based on the ALRUE, MITI developed policies and measures for the industry and energy sectors, set a top-runner standard for electric appliances and cars at its General Energy Study Council and conducted a review of the Voluntary Action Plan declared by the Keidanren at its Industrial structure Council.

Apart from the above, MITI as well as the EIA recognized that it was premature to introduce drastic measures immediately, since it was first necessary to agree on the operational details of the Kyoto Protocol at the international level in order to implement it, and international society aimed at having the protocol enter into force around the time of the World Summit on Sustainable Development in August/September 2002 in Johannesburg, South Africa. Both ministries, especially the EIA, who had failed to have the obligation of companies to submit a plan to control their GHG emissions included in the CCPL, had conducted detailed evaluations of the pros and cons of different policy instruments in preparation for strengthening policies and measures after the adoption of the operational details of the protocol at the international level.

2.3 Towards ratification of the Kyoto Protocol (up to June 2002)

Against the background of the core elements of the operational details of the Kyoto Protocol being adopted at COP 6, Part 2, held in Bonn in July 2001, the new Ministry of Environment (MoE)—which was elevated from the Environmental Agency during administrative restructuring in January 2001—started consultations at its Central Environmental Council in September 2001 to prepare for ratification of the protocol after COP 7.

In January 2002, the council issued “A Report Regarding a Domestic Scheme towards the Ratification of the Kyoto Protocol.” The report said that Japan had implemented emissions reduction measures after the adoption of the Kyoto Protocol in 1997 but that it expected that, with existing policies and measures, GHG emissions in 2010 would have increased by around 8 percent relative to the 1990 level. Therefore, additional reduction efforts would be necessary (MoE 2002). As a domestic plan towards ratification of the protocol, it recommended the introduction of a review scheme, the use of the so-called step-by-step approach, and the introduction of policies and measures, such as an environmental tax, to ensure the achievement of the target set in the protocol.

Just before this, the Ministry of Economy, Trade and Industry (METI), formerly named the Ministry of International Trade and Industry, also presented an interim report by its Industrial Structure Council on December 28, 2001. This report provided the following three basic principles regarding measures: (1) they should avoid excessive burden on the economy, (2) maintain a balance of burden among sectors, and (3) use flexible measures which ensure a maximum climate protecting effect with minimum cost through the innovation of mitigation technologies (METI 2001). Based on these principles, it

19. Here “framework law” means that the law sets a framework for climate policymaking but does not include any concrete obligations for companies and the general public.

emphasized the importance of employing the step-by-step approach, the best mix between existing measures and new measures, and preparation for utilizing the Kyoto mechanisms. The step-by-step approach means that policies and measures will be implemented step by step, based on reviews of existing policies and measures conducted in 2004 and 2007. For the near future, it recommended the following:

1. Existing measures should be strengthened and energy and technology policies should be prioritized.
2. Measures for the industry sector should be based on voluntary approaches.
3. The effectiveness of voluntary approaches should be enhanced through improving and strengthening transparency and credibility.

Based on the reports of both ministries, the GWPH issued the "Future Guidance for the Ratification of the Kyoto Protocol," under the initiative of Prime Minister Junichiro Koizumi on February 13, 2002, which recommended that Japan ratify the protocol. Regarding the ratification schedule, it also recommended that the existing Guideline to Promote the Prevention of Global Warming be revised and a new one should be developed, and that the necessary domestic laws be passed at the regular meeting of the Diet in view of the fact that the protocol would likely enter into force at the World Summit on Sustainable Development in the fall of 2002 (GWPH 2002a).

On March 19, 2002, based on the above guidance, the headquarters issued the New Guideline to Promote the Prevention of Global Warming (GWPH 2002b).

The new guideline set out four basic principles: (1) recognition of the co-existence of the environment and economy, (2) use of the step-by-step approach, (3) the promotion of participation of all stakeholders in implementing measures, and (4) international cooperation on global warming measures.

It included the same targets for sources as set in the old guideline, but it clearly described the targets for each sector and listed 115 policies and measures to assure achievement of the Kyoto target.

Burden sharing among sectors was one of the main discussion points at the time. The target was divided up into minus 7 percent for the industry sector, plus 17 percent for the transportation sector, and minus 2 percent for the household sector, as described in table 2.[20] However, industry was opposed to including the minus 7 percent target in the new guideline, because it was contrary to the target declared in the Keidanren's Voluntary Action Plan to stabilize CO_2 emissions at the 1990 level. In the end, the targets for each sector were included in the new guideline with a compromise that the target for industry would not be changed, but that the minus 7 percent target would be reached by measures taken by small- and medium-sized enterprises (SMEs) and by switching fuel from coal to nuclear and new energy (*Mainichi Shimbun*, March 20, 2002; GWPH 2002b).[21]

20. The stabilization target for energy-related CO_2 emissions that was set in the old guideline was based on the targets set in a report of the Joint Meeting of Relevant Councils published before COP 3. The target was divided up into minus 7% for the industry sector, plus 17% for the transportation sector, and 0% for the household sector.

21. The estimated figure of construction of new nuclear power plants was also contentious. The MoE argued for the use of a realistic estimation, considering the difficulty of finding new sites for nuclear power plants, while METI aimed to utilize the estimation reported in *About Future Energy Policy*, published by the General Energy Council (METI 2002). In the end, the MoE agreed on using the council's estimation, which meant an increase of the amount of energy from nuclear power plants by three times more than presently produced. The report estimated that the construction of 10 to 13 new nuclear power plants would be needed, which would result in an increase in production capacity of 13.63 to 17.52 million kilowatts.

Emission savings	Industry	Households	Transportation
Emission reduction target	462 million tonnes (–7%)	260 million tonnes (–2%)	250 million tonnes (+17%)
Energy conservation: 22 million tonnes	• Solid implementation and follow-up of voluntary action plans by industry (emissions in 2010: below 0% compared to the 1990 level) • Research and development (R&D) of high-efficiency boilers and lasers • Promotion of high-efficiency industrial furnaces	• Application of energy management systems in large commercial buildings, etc., based on the amendment of the Energy Efficiency Law • Scope expansion of top-runner programs in appliance manufacturing • Promotion of high-efficiency water heating • Promotion of home energy management systems (HEMS) and building energy management systems (BEMS)	• Accelerated introduction of vehicles achieving top-runner programs • Acceleration of R&D and dissemination of low-emission vehicles, including clean energy vehicles • Traffic flow management by promotion of intelligent transport systems (ITS), etc. • Promotion of efficient logistics systems, including shift of transport modes from trucking to shipping • Promotion of public transport utilization
New energy: 34 million tonnes	• Add biomass and snow and ice cryogenics to energy, which is promoted by the Law Concerning Promotion of the Use of New Energy • Proposal of the Bill Concerning the Use of New Energy by Electric Utilities • Subsidies to promote the introduction of photovoltaic power, solar thermal, wind power, waste power, biomass energy, etc. • Strengthen R&D and conduct demonstration testing on fuel cells, photovoltaic power, biomass energy, etc.		
Fuel switching: 18 million tonnes	• Assist a switch of fuel use from coal to natural gas for old power generators • Assist with fuel switching of industrial boilers • Develop safety standards on natural gas pipelines		
Nuclear energy promotion	• Promotion of nuclear power under assurance of safety • Assist economic development of municipalities hosting the nuclear fuel cycle		

Table 2: Emission reduction targets (in CO_2 equivalent) and measures for each sector

It must be noted that the new guideline also said that examination of the Kyoto mechanisms should be conducted by considering their supplementarity.

On March 29, 2002, the ministers agreed on submitting a draft amendment of the CCPL and a draft of ratification of the Kyoto Protocol, after getting the approval of the political parties in power at the time, namely, the Liberal Democratic Party (LDP, or *Jiyu-minshu to*); the New Conservative Party (NCP, or *Hoshu-shin-to*), which separated from the LDP in 1993 and then merged with the LDP in 2003; the Democratic Party of Japan; and the Club of Independents (DPJ, or *Minshu-to*). The NCP, in particular, whose main supporter is industry, agreed to adopt the decision on condition that the international regime would be reconsidered if it was difficult to get the United States to participate, that legally binding penalties would be opposed, and that the Keidanren's Voluntary Action Plan would continue to be used as a main instrument to control emissions from the industry and energy sector. The party also requested the ministers of the ministries of environment (MoE); economy, trade, and industry (METI); land, infrastructure, and transportation (MLIT); agriculture, fisheries, and forest (MAFF); and foreign affairs (MOFA) to promise in writing to take initiatives with the above conditions. The Cabinet office, however, was against this. In the end, a head of the Cabinet office from the DPJ succeeded in persuading a head of the NCP to agree to withdraw the request (*Yomiuri Shimbun*, March 30, 2002).

On May 31, 2002, the amendments to the CCPL were passed by the Diet (see table 3 for a comparison of the CCPL versions). Key elements of the revised law are the Kyoto Target Achievement Plan, developed by the GWPH and adopted by Cabinet after the Kyoto Protocol's entry into force (article 8), and Follow-ups and Revision of the Plan (article 9). The plan stipulates emission reduction targets for sectors, the measures to achieve the targets, and central and local governments' policies to promote or enhance the above measures. It was to be comprehensively reviewed in 2004 and 2007 using the step-by-step approach, upon which the government would base revisions of the plan, where necessary, in order to ensure the achievement of Japan's 6 percent emissions reduction commitment.

The CCPL also gave legal status to the Global Warming Prevention Headquarters, which was made responsible for developing the plan (article 10).

Backed by the above domestic laws and others, including the Renewables Portfolio Standard Law (RPS Law), which was enacted June 7, 2002, the Diet ratified the Kyoto Protocol with unanimity in June 2002, six months after adoption of the operational details for the Kyoto Protocol/Marrakesh Accords at COP 7. Looking at the substantial policies and measures, however, most of them already existed.

	The first Law Concerning the Promotion to Prevent Global Warming (adopted October 1998)	The Revised Law Concerning the Promotion to Prevent Global Warming (adopted June 2002)
Status of the headquarters	Cabinet decision	Article 10 of the new law
Tasks of the headquarters		• Make a draft of the Kyoto Protocol Target Achievement Plan • Enhance its implementation (article 11)
Organization in charge of the above tasks	Cabinet office, MoE, and METI	Cabinet office (article 17)
Plan developed under the law	Fundamental guideline	Kyoto Protocol Target Achievement Plan
Organization in charge of development	Ministry of the Environment	Prime Minister

Table 3: Comparison on the differences between the first CCPL and the revised CCPL

Source: Table by Watanabe, based on the Law Concerning the Promotion to Prevent Global Warming and the Revised Law Concerning the Promotion to Prevent Global Warming.

As such, the government decided not to include any drastic measures to achieve its Kyoto target at the time of ratification. Considering the necessity to introduce drastic measures after the first review in 2004, however, the MoE published an interim report of an expert committee on environmental taxation under the Central Environmental Council on June 6, 2002, which said that an environmental tax should be introduced at the earliest possible date after 2005. Against this background, METI started discussions on reforming the existing energy tax system in the summer of 2002, with the objectives of removing distortions in inter-fuel competition between coal and other fuels and taking environmental considerations into account as one of the determinants for levying a tax. (The various energy taxes are shown in table 4.)

The tax on electricity is called the Electric Power Development Promotion Tax. Revenues from it are put into the Special Account on Electricity for use as subsidies to local governments to facilitate site approvals for power plants and to promote diversification away from oil use by encouraging the use of new energy and nuclear energy.

However, the demand for subsidies to facilitate site approvals for power plants has been gradually decreasing, due to the difficulty of finding appropriate sites for nuclear power plants. Considering this situation, METI proposed to gradually increase the tax rates on fossil fuels and place a levy on coal (Special Account on Oil), while reducing taxes on electricity (Special Account on Electricity) and therefore making the tax revision revenue-neutral. METI also proposed that the increased tax revenues in the Special Account on Oil would be divided between itself and the MoE, which could use the revenues for climate change mitigation projects.

Tax item	Fuel	Tax rate (yen)	Tax revenue (100 million yen)	Type of tax	Use of tax revenue
Crude Oil Tax	Imported oil	215/kl[a]	527	Custom tax	Encourage use of domestic coal
Oil Tax	• Crude oil • Imported oil products • Gas carbon hydro	2,040/kl 720/kl 670/kl	4,880	National tax	Oil and energy demand-side management
Liquefied Petroleum Tax	Gasoline	48,600/kl	28,365	National tax	Road construction by the national government
Local Road Tax	Gasoline	5,200/kl	3,035	National tax	Road construction by local governments
Oil-Gas Tax	Liquefied petroleum gas (LPG) for vehicles	17,500/kl	280	National tax	Road construction by the national and local governments
Light Oil Transaction Tax	Light oil	32,100/kl	12,472	Local tax	Road construction by local governments
Kerosene Tax	Jet fuel	26,000/kl	1,064	National tax	Airport construction/ noise reduction, etc.
Electric Power Development Promotion Tax	Electricity	445/1,000 kWh[b]	3,799	National tax	Promotion of electric power development

Table 4: Existing energy taxes in Japan (as of March 2005)

Note: Table by Watanabe, based on MoE 2001.
[a]kiloliters
[b]kilowatt-hours

The MoE was concerned about METI's intention to block the introduction of an environmental tax by offering to share authority over the Special Account on Oil. In the end, Minister of Economy, Trade and Industry Takeo Hiranuma and Minister of Environment Shunichi Suzuki concluded a written agreement on November 15, 2002, stating that the tax revision was not considered as the introduction of an environmental tax and that such a tax would be considered in the 2004 review in the framework of employing the step-by-step approach. Table 5 shows the change in rates of existing energy-related tax.

Tax	Energy source	Tax rate (in yen)			
		Current	October 2003	April 2005	April 2007
Oil and coal tax	Oil	2,400/kl	Same		
	LPG	670/t	800/t	940/t	1,080/t
	LNG	720/t	840/t	960/t	1,080/t
	Coal	No tax	230/t	460/t	700/t
Electric Power Development Promotion Tax (yen/1,000 kWh)	Electricity	445	425	400	375

Table 5: The change of tax rates in existing energy-related taxes (as of March 2005)

Note: Table by Watanabe, based on the law concerning oil and coal (sekiyu-sekitan hou).

3 Japan’s current climate policy

As described above, Japan did not introduce drastic policies and measures along with its ratification of the Kyoto Protocol. As a result, it has so far failed to reduce its GHG emissions in line with reaching its Kyoto target, as shown in figure 1.

In the framework of the step-by-step approach, Japan conducted a review in 2004 of policies and measures to achieve its Kyoto target, with the aim of introducing additional measures from 2005 if the existing ones in the revised guideline are not sufficient to achieve the target. In the meantime, Russia ratified the Kyoto Protocol and it entered into force on February 16, 2005. This means that, according to article 8 of the Climate Change Policy Law (CCPL), the review will end not with a revision of the guideline but with drafting a Kyoto target achievement plan.

The review of all policies and measures was mainly conducted by the MoE’s Central Environmental Council and METI’s Industrial Structure Council. Both ministries launched discussions in January 2004.

Tables 6 and 7 describe the results of the review of current policies and measures, as published by METI’s Industrial Structure Council and the MoE’s Central Environmental Council.

Emission sources	Sector	Reduction target	Measure	Results and estimates from the 2004 review
Energy-related CO_2	Energy supply	—	New energy	• In the new guideline to promote measures to cope with global warming, adopted in 2002, the CO_2 emissions reduction goal by 2010 is about 34 million tonnes (Mt) through the introduction of 19.1 million kl of new energy. • As for the power generation sector, it is expected that the target will be achieved by the smooth implementation of the Renewables Portfolio Standard Law (RPS Law), which came into effect in April 2003, acceleration of technological development such as solar power generation technologies, and enhancement as well as reinforcement of the systematic networking of wind power generation and site regulation. • As for the heating sector, the target of 2.5 million kl will probably not be achieved without additional measures. • Estimation of the introduction of these new energies, power generation, and heat is 16.50 million kl. • Therefore, the introduction target of 19.1 million kl cannot be achieved by a shortfall of 2.5 million kl, and additional measures will be necessary to achieve the target.
			Nuclear power	• It will be difficult to achieve the target of increasing nuclear power generation by about 30% compared to FY2000, especially due to expected delays in construction of new nuclear plants. • As for CO_2 emissions intensity in the electric power sector, the target described in the Voluntary Action Plan by electricity enterprises is to decrease end-user CO_2 emissions intensity by about 20% in 2010 compared to FY1990. • Estimating the CO_2 emissions intensity in 2010 by taking into account the operation of an additional three nuclear plants under construction and the installation of facilities and operation plan by electric power companies, CO_2 emissions intensity will be improved by 0.36 kilograms of CO_2 per kWh, corresponding to 15% relative to the 1990 level.
	Industry sector	–7%	Keidanren's Voluntary Action Plan	Energy consumption per industrial activity in 2010 will be improved by 5.9% under the Keidanren Voluntary Action Plan compared to the case without measures.
			Promotion of the introduction of energy-efficient facilities and of the diffusion of energy-efficient technologies.	Energy consumption per industrial activity in 2010 will be improved by 0.5% due to promotion of the introduction of energy-efficient facilities and the diffusion of energy-efficient technology.

Table 6: Summary of the 2004 review of current policies and measures by METI's Industrial Structure Council

Table 6—Continued

Emission sources	Sector	Reduction target	Measure	Results and estimates from the 2004 review
Energy-related CO_2	Transportation	+17%	Accelerated introduction of vehicles achieving the standard set in top-runner programs	Energy consumption per transport volume in FY2010 will improve by 6.8% through the top-runner standard.
			Acceleration of R&D and dissemination of low-emission vehicles, including clean energy vehicles	Energy consumption per transport volume will be improved by 0.5% due to the diffusion of clean energy cars.
			Traffic flow management by promotion of ITS, etc.	Energy consumption per transport volume will be improved by 6.7% through the improvement of traffic systems.
	Services, etc.	–2%	Improvement of the efficiency of devices through the top-runner standard	Energy consumption per floor space of the commercial sector in FY2010 will be improved by 2.8% through the top-runner standard.
			Improvement of the energy efficiency and conservation performance of buildings based on the amendment of the Energy Efficiency Law	Energy consumption per floor space in 2010 will be improved by 7.2% through improvement of the thermal insulation efficiency of buildings compared to the case without current measures.
			Diffusion of high-efficiency water heaters	Energy consumption per floor space in the commercial sector in 2010 will be improved by 0.01% due to the diffusion of high-efficiency water heaters.

Table 6—Continued

Emission sources	Sector	Reduction target	Measure	Results and estimates from the 2004 review
Energy-related CO_2	Services, etc.	–2%	Diffusion of high-efficiency lights	Energy consumption per floor space in the commercial sector in 2010 will be improved by 0.5% due to the diffusion of high-efficiency lights.
			Diffusion of BEMS	Energy consumption per floor space in the business sector in 2010 will be improved by 2.3% due to the diffusion of BEMS.
	Households	–2%	Improvement of the efficiency of devices through application of the top-runner standard	Energy consumption per household in FY2010 will be improved by 3.5% through the top-runner standard compared to the case without measures.
			Application of energy management systems in new houses, etc., based on the amendment of the Energy Efficiency Law	Energy consumption per square meter in new houses will be improved by 4.3% through improvement of energy efficiency.
			Reduction of standby mode power consumption in devices	Energy consumption per household by 2010 will be improved by 0.6% through the reduction of power consumption of electric devices during the standby mode.
			Improvement of the efficiency of thermal insulation of houses	Energy consumption per household by 2010 will be improved by 4.3% through improvement of the thermal insulation efficiency of houses.
			Promotion of high-efficiency water heating	Energy consumption per household by 2010 will be improved by 1.7% due to the diffusion of high-efficiency water heating.

Table 6—Continued

Emission sources	Sector	Reduction target	Measure	Results and estimates from the 2004 review
Energy-related CO_2	Households	–2%	Diffusion of high-efficiency lights	Energy consumption per household by 2010 will be improved by 0.3% due to the diffusion of high-efficiency lights.
			Promotion of HEMS	Energy consumption per household in 2010 will be improved by 0.8% due to the diffusion of HEMS.
Non-energy-related CO_2			Diffusion of the use of mixed cement for cement production processes	It is estimated that CO_2 emissions from cement production can be reduced by about 4%, considering the past increasing ratio of the use of mixed cement.
			Installation of an N_2O decomposer in the adipic acid manufacturing process	Decomposers have been installed voluntarily by enterprises and are in operation, which has resulted in a substantial amount of emissions reduction compared to the base year. It is expected that more than 90% of N_2O emissions from the adipic acid production process can be reduced.
Promotion of R&D on environment and energy				• In the industry sector, reduction of 4.7 million tonnes of CO_2 equivalent per year ($MtCO_2e$/year) is expected through the promotion of 18 technologies, including efficiency improvement of the combustion process in steel production. • In the household sector, a CO_2 reduction of 0.93 $MtCO_2e$/year is expected through the promotion of four technologies. • In the commercial sector, a CO_2 reduction of 0.76 $MtCO_2e$/year is expected through the promotion of five technologies. • In the transport sector, a CO_2 reduction of 0.83 $MtCO_2e$/year is expected through the promotion of four technologies.
HFCs, PFCs, and SF_6				It is expected that emission intensity in 2010 compared to 1995 level will be improved substantially if current measures continue to be implemented.
Sinks				Not addressed
Kyoto mechanisms				Not addressed

Note: Table by Watanabe, based on METI 2005.

Emission source	Sector	Reduction target	Measure	Estimated results and recommendations
Energy-related CO_2	Energy supply	• The New Guideline to Promote Measures to Cope with Global Warming adopted in 2002 did not decide on the burden for energy suppliers and energy consumers. • Achieving the target seems difficult (see column to the far right).	New energy	The RPS law set a target to generate 1.13 kl/year from new energy sources; however, there is a gap between the target in the new guideline and actual production in terms of solar energy and wind energy. As for photovoltaics and waste heat utilization, it is difficult to reach the target set in the guideline. Therefore, the possibility of achieving the target for new energy is low.
			Fuel switching	Due to the liberalization of the electricity market, it is expected that coal combustion power plants will amount to over 50% of capacity; therefore, fuel switching is not progressing as planned in the guideline.
			Nuclear power	Construction of new nuclear power plants has been delayed from the schedule of the guideline. If the projected electricity demand is the same as it described, then an additional 20–30 Mt of CO_2 will be discharged. However, the energy supply plan was revised with the electricity demand reduced, therefore CO_2 emissions in 2010 will be almost the same.
			Keidanren Voluntary Action Plan	The power sector pledged to reduce its relative CO_2 emissions by 20% in its voluntary action plan.
	Industry sector	–7% A gap between the current situation and the target is small compared to other sectors.	Keidanren Voluntary Action Plan	Reductions based on the Keidanren Voluntary Action Plan are progressing well. In order to achieve the target as a whole it is necessary that each sector makes efforts to achieve its own target.
			Promotion of the introduction of energy-efficient facilities	Progressing and will continue to progress well.
			Promotion of the diffusion of energy-efficient technologies	Efficient boilers will be diffused. It will be difficult to achieve the target for the diffusion of more efficient lasers.
	Transportation	+17% (same growth rate as 1995)	Accelerated introduction of vehicles achieving the standard set in top-runner programs	More than 90% will achieve the target for 2010 in 2005.
			Acceleration of R&D and dissemination of low-emission vehicles, including clean energy vehicles	To achieve the target described in the plan, the diffusion of clean energy vehicles should be accelerated. Therefore, achievement of the target is presently uncertain.

Table 7: Summary of the 2004 review of current policies and measures by the MoE's Central Environmental Council

Table 7—Continued

Emission source	Sector	Reduction target	Measure	Estimated results and recommendations
Energy-related CO_2	Transportation	+17% (same growth rate as 1995)	Traffic flow management by promotion of ITS, etc.	It is difficult to evaluate the effect of each measure due to the lack of data. Additional measures, including the improvement of data collection, are necessary.
			Promotion of efficiency logistics systems, including shift of transport modes from trucking to shipping	Due to the improvement of efficiency in the transportation sector, GHG emissions are stable/declining despite the increase in distance. Nevertheless, there is a possibility that CO_2 emissions from car transportation will increase due to an economic upturn.
			Promotion of public transport utilization	The infrastructure is being established; however, the data available to evaluate the shift from cars to public transportation is insufficient. Therefore, it is impossible to evaluate the effect. Additional measures, including the improvement of data collection, are necessary.
	Services, etc.	–2% Emissions from the service sector have mostly increased; therefore, it will be difficult to achieve the target.	Improvement of efficiency of devices by the top-runner standard	It is expected that the target will be achieved regarding energy consumption per floor space through the top-runner standard.
			Improvement of energy efficiency and conservation performance of buildings	There is a lack of data available to evaluate the effect of measures; however, certain progress is observed.
			Diffusion of high-efficiency lights	High-efficiency lights will be diffused in a couple of years; therefore, a certain amount of reduction is expected.
			Diffusion of BEMS	The diffusion rate is increasing in new, large buildings; therefore, the potential for reduction is high. However, it is necessary to accelerate diffusion, including the ESCO (Energy Service Companies), in order to achieve the target set in the guideline.
	Households	–2% Emissions from the household sector are the second most increased; therefore, it will be difficult to achieve the target.	Application of energy management systems in large commercial buildings, etc., based on the amendment of the Energy Efficiency Law	It is expected that the target will be achieved by the target year.
			Promotion of high-efficiency water heaters	Sales of efficient water heaters are increasing; however, diffusion should be accelerated in order to achieve the program target.

Table 7—Continued

Emission source	Sector	Reduction target	Measure	Estimated results and recommendations
			Promotion of HEMS and BEMS	The uncertainty of achieving the target is large, since HEMS are still under development.
Non-energy-related CO_2, methane, and carbon monoxide (CO)		–0.5% The measures whose effects are uncertain are included; however, it is almost certain that the –0.5% target will be achieved, reflecting the fact that activities have been decreasing more than ex-pected.	Non-energy-related CO_2	Although emissions from waste incineration have increased, emissions from industrial processes have decreased. Therefore, it is highly expected that the target will be achieved.
			Methane	Methane emissions have been decreasing. It is highly likely that the target will be achieved.
			N_2O	N_2O emissions have been decreasing. It is highly likely that the target will be achieved.
HFCs, PFCs, and SF_6		+2.0%		It is highly likely that the targets set in the guideline will be achieved.
Sinks			Measures are being taken with the aim of utilizing the 3.9% of total emis-sions in 1990 allowed in the Bonn Agreement.	• The 3.9% is utilized when all the planted forests and a part of natural forests are counted to fulfill the requirement of forest management; however, the actual effect of forest management in the past five years is that only 70% of planted forest will fulfill the forest management requirement. Therefore, it is expected that sinks will be utilized for only 3.1%. • The budget for FY2004 is smaller than that in the past. If the budget is not increased, then the utilization of sinks is expected to be around 2.6%.
Kyoto mechanisms			Not explicitly described in the program.	The Japanese government has approved 16 CDM projects; however, the CDM Executive Board has not yet approved any of them as of March 2005, and it has not been decided how credits from the above project will be entered into the national account.

Note: Table by Watanabe, based on MoE 2005a, 2005b.

Although both ministries acknowledge the increase of GHG emissions and the necessity to enhance the use of the Kyoto mechanisms to achieve the Kyoto target, their opinions are divided in terms of domestic policies and measures. The main points of discussion are summarized as follows:

1. What amount of reductions is necessary to achieve the target?
2. What kind of additional policies and measures need to be introduced in order to achieve the reductions?

Regarding the amount of reductions, Japan's emissions had increased by 7.6 percent compared to the 1990 level as of 2002; therefore, a 13.6 percent reduction is necessary to achieve its Kyoto target. At the beginning, the MoE's Central Environmental Council estimated that the trend would not change. Therefore, a 7.6 to 8.1 percent reduction will be necessary in the first commitment period (2008–2012) (MoE 2004b). On the other hand, METI's Industrial Structure Council estimated that Japan's emissions will decrease from the current level to 3.7 to 5.5 percent higher than the 1990 level in 2010 without introducing additional policies and measures (table 8). The main reason for this difference was the different estimation of energy-related CO_2 emissions (table 9). In December 2004, the MoE revisited the estimation of emissions in 2010 after revising the rate of operation of nuclear power plants and the method used to estimate energy consumption in the industrial sector and the CO_2 emission rate for utilities. According to the revised estimation, energy-related CO_2 emissions will decrease from 7.1 to 5.4 percent higher than the 1990 level. As a result the total GHG emissions will decrease to 5.9 to 6.4 percent higher than the 1990 level. As such, the gap between the estimates of both ministries has shrunk, but nevertheless still remains (table 9). At the end, both ministries adjusted their estimations when METI's Industrial Structure Council and the MoE's Central Environmental Council submitted proposals for developing and implementing climate policies and measures in the second step (of the step-by-step approach) from 2005 to 2007 (table 10), in order for the headquarters to draft and adopt the Kyoto Target Achievement Plan (MoE 2005a, 2005b; METI 2005; GWPH 2005).

	Kyoto target	Existing measures
Domestic measures	–0.5	3.7 to 5.5
Energy related CO_2	–2.0	+2.2 to 4.0
HFCs, PFCs, and SF_6	+2.0	+1.9
Non-energy CO_2, methane, N_2O	–0.5	–0.5
Forest and sinks	–3.9	–3.1*
Kyoto mechanisms	–1.6	—
Total	–6.0	0.6 to 2.4

Table 8: METI's estimates on measures and reductions (%)

Source: METI 2004b.
*This figure is based on the estimate in the MoE's report "*Chikyu Ondanka Taisaku Suishin Taiko no hyoka/minaoshi ni kansuru chukan torimatom*" (MoE 2004b). It was revised to 2.6% in *Onshitsu koka gasu no shorai suikei* (MoE 2004c).

Emissions	Target set in the 2002 guideline	METI (2004.8)	MoE (2004.8)	MoE (2004.11)	MoE (2004.12)
Total GHG emissions	–0.5	+3.7 to 5.5	—	+7.6 to 8.1	+5.9 to 6.4
Energy-related CO_2	–2.0	+2.2 to 4.0	+7.1	+7.1	+5.4
HFCs, PFCs, and SF_6	–2.0	+1.9	Under examination	+1.4	+1.4
Non-energy-related CO_2, methane, N_2O	–0.5	–0.5	–0.9 to 0.4	–0.9 to 0.4	–0.9 to 0.4

Table 9: Comparison of estimates of Japan's GHG emissions in 2010 with current policies and measures (%)

Note: Table by Watanabe, based on GWPH 2002; METI 2004a; MoE 2004b; and MoE 2004c.

Emissions	Target set in the 2002 guideline	METI (2005.3)	MoE (2005.2)	MoE (2005.3)	GWPH (2005.3)
Total GHG emissions	–0.5	+6.0	+6.0	+6.0	+6.0
Energy-related CO_2	–2.0	+5.4	+5.4	+5.4	+5.4
HFCs, PFCs, and SF_6	–2.0	1.4	1.4	1.4	1.4
Non-energy-related CO_2, methane, N_2O	–0.5	–0.8	–0.8	–0.8	–0.8

Table 10: Estimates of Japan's energy-related CO2 emissions in 2010 with current policies and measures (%)

Note: Table by Watanabe, based on METI 2005; MoE 2005a; MoE 2005b; and GWPH 2005.

Regarding the question of what kind of additional policies and measures are necessary to be introduced to achieve the required reductions, the joint meeting of METI's two councils recommended that 5 percent should be reduced by using domestic policies and measures and that the ALRUE should be revised, along with the slogan "Compliance without a Tax Increase." They also recommended that 2 percent should be reduced from additional reductions in the use of HFCs, PFCs, and SF_6, and 1.6 percent through the Kyoto mechanisms.

Based on these recommendations, METI submitted a proposal to revise the ALRUE, along with a new law concerning promotion of more efficient logistics. Regarding the ALRUE, METI proposed to raise the standards of the top-runner scheme after 2010 for 11 out of 18 items currently regulated, considering that the current standards will have been achieved by 2010. The proposal expanded the scope of factories and sectors covered by the law. METI also recommended enhancing the transparency and credibility of the Keidanren Voluntary Action Plan. At the same time, it proposed a scheme to utilize the Kyoto mechanisms to achieve the targets set in the plan and the establishment of basic infrastructure to utilize the mechanisms. In terms of using them, METI proposed an increase of the government budget to be allocated to climate policies, which included the establishment of the Japan Global Warming Reduction Fund in 2004 with about 100 million US dollars (discussed later in this paper) (METI 2004a).

Contrary to METI, the MoE's Central Environmental Council's interim report on the evaluation and review of the Guideline to Promote the Prevention of Global Warming recommended the introduction of additional policies and measures to achieve the Kyoto target, including an environmental tax, the obligation of companies to report their GHG emissions, a voluntary emissions trading scheme, and utilization of the Kyoto mechanisms. Apart from the Kyoto mechanisms, all of the measures, especially the environmental tax, were opposed by METI and industries (MoE 2004b).

3.1 Environmental tax

The introduction of an environmental tax, which had been discussed since the beginning of the 1990s in the framework of revising the Environmental Basic Law, generated the most controversy among stakeholders.

In the preparation process to ratify the Kyoto Protocol, the Central Environmental Council set up the Expert Committee on a Tax System to Combat Climate Change, in October 2001, as part of a series of studies on how to combat climate change. In December 2001, the committee published the *Study of a Tax System for Combating Climate Change in Japan* as a summary of the main points of debate regarding anti-climate change taxes. Then, in June 2002, the committee published *A Tax System for Combating Climate Change in Japan*, in response to the adoption of a new climate change policy program in March 2002.

As such, the MoE examined the introduction of an environmental tax with the aim of introducing it upon ratification of the Kyoto Protocol; however, it did not lead a consensus among stakeholders to submit a draft to the Diet.

As mentioned earlier, the existing energy taxes were "greened" at the beginning of 2003 by gradually increasing tax rates on fossil fuels and placing a levy on coal, while reducing taxes on electricity; nevertheless, the MoE and METI agreed that this revision was not considered the introduction of an environmental tax. In February 2003, Environmental Minister Suzuki sent the Expert Committee a request to publish a report by around the summer of that year. He did this in order to show the political will of the ministry to introduce the tax upon the revision of the New Guideline to Promote Measures to Cope with Global Warming and to allow enough time for sufficient debate before the 2004 review. The committee published its report, titled "Draft of a Climate Change Tax Proposal for a National Dialog Report," on August 29, 2003, saying that it is necessary to introduce a tax of 3,400 yen/CO in order to achieve Japan's 6 percent reduction target based on the modeling calculation (MoE 2003).

After the report was published, huge opposition was mounted by industries and METI. In the review in 2004, with the view that additional measures would be necessary to achieve the Kyoto target, the MoE put top priority on introducing the environmental tax. Reflecting the opposition expressed by industries, in the draft of the environmental tax that the MoE made public in November 2004, the tax rate was reduced by 20 to 50 percent for energy-intensive industries, including steel, in order to avoid a negative impact on the international competitiveness of these sectors. As a result, the revenue was estimated at 49 billion yen, half of what was originally expected (MoE 2004a).

The MoE proposed to use 34 billion of the 49 billion yen for measures to mitigate emissions and 15 million for social insurance deductions. According to its estimation, the environmental tax is expected to bring about a reduction of 52 million tonnes of CO_2e, which corresponds to a 4 percent reduction compared to the 1990 level.

While discussions continued at the Central Environmental Council, the MoE decided to send the revised proposal to the basic environmental issue study group of the Democratic Party at the beginning of November, in order to have the proposal passed at the Diet in FY2004. Although some members supported the idea, most did not. Most said that it was too early to submit the proposal to the Democratic Party and that it still needed to be examined, including conducting a cost-benefit analysis comparing the environmental tax to the case of utilizing the Clean Development Mechanism (CDM). Several members also said that the introduction of the environmental tax should be discussed after a detailed examination of the existing 1,258 billion yen in expenditures for climate measures (*Denki Shimbun*, November 8, 2004; *Nihon Keizai Shimbun*, November 24, 2004).

Finally, the study group decided to submit the plan to the government's Tax Issue Study Committee, an advisory body to the prime minister. Reflecting the conflicts between opponents and proponents, the committee decided not to introduce the tax that fiscal year and to continue the discussion, considering the necessity to introduce additional measures to achieve the Kyoto target. As such, the introduction of the environmental tax was again postponed.

At the beginning of 2005, when the government started drafting the Kyoto Target Achievement Plan, which is based on the review, the environmental tax issue was again put on the agenda. The MoE's Central Environmental Council published an estimate at the beginning of March that revenues of 400 to 700 billion yen from the environmental tax are necessary to achieve the Kyoto target. Based on this estimate, the MoE tried to include the ongoing consideration of the environmental tax in the plan, while METI, reflecting the concern of industries, was again opposed to it. In the end, negotiations focused on the wording in the plan. The MoE tried to include the phrase "introduce as soon as possible," which METI opposed. In the end, they compromised on the wording and ended up with "examine the introduction of an environmental tax seriously and comprehensively," which could be interpreted several ways.

As such, the introduction of an environmental tax was set to be discussed in the framework of the revision of the whole tax system in the autumn of 2005.

3.2 Voluntary emissions trading scheme

Japanese industries argued that the Keidanren's Voluntary Action Plan is sufficient to achieve the target of stabilizing CO_2 emissions from the industry sector at the 1990 level and that additional measures are not necessary. In March 2000, however, the United Kingdom's Emissions Trading Group (ETG) presented a full set of proposals on emissions trading, and the EU Commission submitted a Green Paper on establishing a GHG emissions trading scheme within the European Community. Influenced by these countries and the EU region, awareness of emissions trading has continued to increase among Japanese industries.

Reflecting the growing awareness of stakeholders, the MoE conducted an examination of the design of emissions trading in a study group. In January 2003, the MoE undertook a simulation of emissions trading with Mie Prefecture with the following objectives: examine the scheme (which properly evaluates environmentally benign activities by industries); examine the possibility of giving credits for CO_2 absorbed by forest management activities and reduced by refuse-derived fuel (RDF) power generation; and propose a domestic emissions trading scheme based on the actual situation of industry (see box 2).

Thirty-five companies, along with one non-profit organization, located in the prefecture participated in the simulation.

Also in 2003, the MoE went on to operate the Prototype Project for Voluntary Domestic Emissions Trading. Its main objectives were to provide private companies with opportunities to build experience and technical skills regarding emissions trading procedures, demonstrate that a cross-sectoral emissions trading scheme is feasible in Japan, encourage participants to be aware of the importance of improved emissions management, and establish the infrastructure for domestic emissions trading. Sixty-three parties that participated in the project, including 13 observers, voluntarily set their corporate-wide GHG reduction targets for fiscal year 2003 at their discretion and tried to achieve their own targets.[22]

A simulation of emissions trading in Mie Prefecture was undertaken, focusing on CO_2 from 2005 to 2012, with the following five options:

1. An absolute target of a 7.9 percent reduction in total is set, no credits are given for reductions by RDF power-producing projects, and CO_2 absorptions from forest management can be used.
2. An absolute target of a 14 percent reduction is set, credits are given for reductions by RDF power-producing projects, and CO_2 absorptions from forest management can be used.
3. Based on the Keidanren's Voluntary Action Plan, the target is set as either an absolute target of a 14 percent reduction in total or a relative target, no credits for reductions in RDF power-producing projects are given, and CO_2 absorptions from forest management can be used
4. An absolute target is set with half by grandfathering and half by auction, credits are given for reductions by RDF power-producing projects, and CO_2 absorptions from forest management can be used.
5. An absolute target of a 19.9 percent reduction relative to 2001 is set, and credits for reductions by RDF power-producing projects and absorptions from forest management can be used.

The penalty for non-compliance was set at 100,000 yen. All options were effective in terms of achieving the targets; however, it revealed that there is a possibility that the target set in option 3 is not strict compared to the others. In terms of costs, options 1 and 5 cost more for penalties, and option 4 costs more for managing auctions, while options 2 and 3 cost less. As a result, issues identified for further consideration in establishing an emissions trading scheme were the level of target, the way to set it, capacity building in companies to reduce emissions, the way to treat credits reduced outside of a company, credits from forest management, credits from RDF projects, the expansion of participants, and the monitoring, verification, and registration of emissions.

Box 2: The simulation of emissions trading in Mie Prefecture

METI also conducted a pilot project to trade and transact credits. Within the framework of pilot projects, 29 projects were conducted. Credits coming from them were treated as certified emissions reduction credits (CERs), which companies can trade and transact. Originally, it aimed at conducting a pilot

22. Participants chose their reduction targets from the choices of absolute target, relative target, or absolute reduction target. An *absolute target* means that participants set absolute emission targets for FY2003. Participants received allowances matching their emissions cap from the start. They were free to sell their allowances if they wished, but they needed to ensure that they held enough to cover their actual verified emissions by the end of the reconciliation period (cap and trade). *Relative target* means that participants set an emissions target per unit of output (production or total floor space). Credits were issued to participants when they reduced their emissions below their targets (baseline and credit). *Absolute reduction target* means that participants declared a targeted reduction that would be realized by their emissions reduction efforts. Credits were issued to participants when they reduced emissions below their targets (baseline and credit). During the project, participants had four periods of trading to buy or sell their allowances or credits, with each period of trading lasting three days. In April and May, all participants calculated their emissions in 2003 and had their emissions verified by the project verifiers. After the final trading period in June, 27 participants had succeeded in meeting their voluntary targets, with 16 out of the 27 participants meeting their targets by purchasing allowances and credits from other participants. The total amount of allowances transacted was 2.4 $MtCO_2$.

project in which companies set voluntary targets based on the Keidanren's Voluntary Action Plan, with an incentive to subsidize half of the investments for the projects that would achieve their targets in advance or overachieve them. The Keidanren and industries opposed the idea, however, because they were concerned that the pilot project would be followed by a mandatory trading scheme.

Considering the concern expressed by industries, METI explained that the pilot project aimed at establishing infrastructure and had no relevance to establishing a domestic emissions trading scheme.

Apart from the initiatives taken by the central and local governments, several companies—including Hitachi, Konica, Matsushita, and Cosmo—developed their own internal emissions trading schemes (box 3).

Cosmo

Cosmo's initiative was different from emissions trading. It conducted a campaign called "CO_2 Green Gasoline" in December 2002 and 2003. Customers paid more than the regular gasoline price to purchase credits from an afforestation project in Australia, conducted by Cosmo, to make up for the equivalent amount of CO_2 emissions produced by burning gasoline in their vehicles. Cosmo also retailed CO_2 credits from the project and issued a CO_2 sink certificate. The idea behind this activity was to absorb CO_2 emissions from its gasoline by afforestation and to balance total CO_2 emissions.

Matsushita Group

Matsushita launched group-wide emissions trading among 125 of its companies in July 2003, with the aim of achieving a 7 percent reduction target from 1990 to 2010—equivalent to 1.26 million tonnes of CO_2—set in its Green Plan published in 2001. This system sets the targets based on an energy-saving ratio instead of putting caps on each company. Using this method, the system does not prevent companies from expanding their business.

Konica

From April 2003, Konica started a cap-and-trade emissions trading system among four of its manufacturing divisions, with the aim of reducing the group-wide GHG emissions level by 6 percent from 1990 to 2010. The price of CO_2 was set at 10,000 yen per tonne; however, there was no money transacted in order to avoid paying taxes.

Box 3: Examples of initiatives by Japanese companies

Despite the experience gained by the government and private sector through the above activities, most companies still opposed the introduction of emissions trading with absolute caps. Nevertheless, they and other stakeholders recognized that domestic emissions trading schemes are/will be used as the main instrument to reduce industry sector emissions in other industrialized countries, such as the European Union, Norway, Switzerland, and Canada. Recognizing the importance of emissions trading as an instrument to control emissions from the industry and energy sector, the MoE decided to launch a voluntary emissions trading scheme in 2005, mainly based on its prototype project. The scheme is a combination of emissions trading with subsidies.

Private companies were invited to commit to their CO_2 emissions reduction targets in return for receiving subsidies to cover one-third of their costs spent on emissions reduction projects conducted during FY2005 to a maximum of 200 million yen. The MoE has budgeted 3 billion yen annually for subsidies. After it screened participants on the basis of "cost-efficiency" optimization, 34 companies were selected as participants with targets in return for the subsidy of 2.6 billion yen to conduct projects in FY2005.

Participants are to report their emissions from 2002 to 2004—which must be verified by organizations appointed by the MoE—and register the estimated emissions reduction amount for 2006. The companies will get allowances corresponding to the difference between the average emissions from 2002 to 2004 and the estimated CO_2 emissions reduction in April 2006, and then trade allowances freely throughout FY2006. They are required to surrender the allowances of CERs corresponding to the actual emissions in FY2006, which will be verified in April/May 2007.

In the case of non-compliance, the subsidy must be returned to the MoE and the names of companies in non-compliance will be published.

3.3 GHG emissions reporting scheme

The MoE also tried to include an obligation in the CCPL for companies to monitor, report, and publish their GHG emissions. Up to that time, CO_2 emissions were to be calculated based on energy consumption data collected under the ALRUE. In order to effectively draft, implement, and review mitigation policies, it is critical to know the actual amount of CO_2 emissions as well as those of the other five GHGs as soon as possible.[23] Therefore, the MoE intended to include the obligation for installations that produce emissions above a certain level to report their emissions of all six GHGs.

Industries opposed the introduction of the scheme, while the government almost agreed to it. However, the MoE and METI again fought over authority. METI as well as industries argued that the reporting scheme must be established within the framework of the ALRUE, which would make it possible to utilize the existing process to collect information on energy consumption. Industries also claimed that establishing a new scheme to collect information on CO_2 emissions would cause double regulation (MoE 2004b, 2004d).

On the other hand, the MoE argued that at least the other gases that the ALRUE has not regulated can/should be regulated under the CCPL.

In the end, both ministries agreed to include the reporting scheme in the revised Climate Change Policy Law (article 21.1), which includes the provision that reporting under the ALRUE is regarded as fulfilling the reporting obligation under the revised CCPL (article 21.10), and that the ministers of environment, economic affairs, and ministers who have competencies to guide the sectors share the competence on the CCPL (article 31.2).

23. The other five GHGs under discussion are methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

3.4 Draft elements of the Kyoto Target Achievement Plan by the MoE and METI

Sector	Measures	Reduction targets (thousands of tonnes)
Industry	Keidanren's Voluntary Action Plan	4,240
	R&D on fuel switching of high-efficiency boilers and lasers	200
	Promotion of high-efficiency industrial furnaces	130
	Energy management as set out in the revised ALRUE	170
Households	Diffusion of efficient air conditioners for commercial buildings	60
	Improvement of energy efficiency at home	850
	Promotion to replace old electric appliances with more efficient ones	560
	Promotion of high-efficiency water heating	340
	Promotion of HEMS and BEMS	1,120
Transportation	Accelerated introduction of vehicles achieving top-runner programs	2,100
	Acceleration of R&D and dissemination of low-emission vehicles, including clean energy vehicles	300
	Promotion of efficiency logistics systems, including shift of transport modes from trucking to shipping	120
	Introduction of sulphur-free fuel and vehicles to use such a fuel	760
Energy supply	New energy	1,700
	Fuel switching and nuclear power	4,690

Table 11: The Kyoto Target Achievement Plan's measures for sectors and reduction targets (draft)

Source: GWPH 2005.

4 Dependence on the Kyoto mechanisms

As the above examination reveals, Japan has conducted discussions and reviewed climate policies and measures with the aim of introducing additional policies and measures from 2005, if the existing ones are not sufficient to achieve the 6 percent reduction target committed to in the Kyoto Protocol.

The review revealed that Japan's emissions in 2010 are estimated to be at least 6 percent higher compared to the 1990 level, which will require a reduction of at least 12 percent to achieve its 6 percent reduction target. Based on the current estimation, even if all the policies and measures are implemented as scheduled, there will still be a 1.6 percent shortfall, which will therefore have to be purchased in the form of credits from abroad (METI 2004; MoE 2005; GWPH 2005). Both ministries and the stakeholders share the view that there is an urgent need to prepare for the utilization of the Kyoto mechanisms for the following reasons: (1) the "low-hanging fruits" will be quickly picked by countries that have already established national purchasing schemes as well as emissions trading schemes linked with the Kyoto mechanisms; and (2) it will take three to five years to acquire the credits resulting from CDM/joint implementation (JI) projects, and only three years remain before the start of the first commitment period of the Kyoto Protocol in 2008.

An examination of preparations in Japan to utilize the CDM/JI is provided in the following section.

4.1 Preparations in Japan to utilize the CDM/JI

The Liaison Committee for Utilization of the Kyoto Mechanisms was established as an organization to issue national approval to CDM/JI projects in 2002, and it had already approved 12 projects as of March 2005—most of them CDM projects (table 12).

Approval date	JI/CDM	Applicant	Host country	Expected emissions reduction[a]
2002.12.12	JI	New Energy and Industrial Technology Development Organization (NEDO)	Kazakhstan	62,000
2002.12.12	CDM	Toyota Trading Co.	Brazil	1,130
2003.5.22	CDM	Dengen Kaihatsu Power Co.	Thailand	60
2003.7.15	CDM	Iones Chemical	Korea	1,400
2003.7.29	CDM	Kansai Electric Power Co.	Bhutan	0.5
2003.12.3	CDM	Japan-Vietnam Petroleum Co.	Vietnam	680
2004.5.19	CDM	Sumitomo Trading Co.	India	3,380
2004.6.29	CDM	Chubu Electric Power Co.	Thailand	84
2004.7.22	CDM	Dengen Kaihatsu Power Co.	Chile	14
2004.10.1	CDM	Tokyo Electric Power Co.	Chile	79
2004.10.1	CDM	Tokyo Electric Power Co.	Chile	84
2004.10.1	CDM	Tokyo Electric Power Co.	Chile	249

Table 12: Projects approved by the Liaison Committee for Utilization of the Kyoto Mechanisms

[a]In tonnes of CO_2 per year.

The reasons that most of the approved projects are under the CDM are assumed to be as follows:

- While CERs could be issued from 2000 (Decision 17/CP7 of the Marrakesh Accords), emission reduction units (ERUs) will be issued from 2008.
- As demonstrated in the intervention by the Japanese government on linking directive discussions in November 2003, both the government and companies believe that the European Union Emission Trading Scheme (EU ETS) will absorb most JI potential in new EU member states (METI 2003). Some also argue that it is difficult to compete with the EU 15 in acquiring credits from Central and Eastern European countries, due to the existing geographical and political relationships between the EU 15 and those countries.
- Although Russia and the Ukraine have large potential for JI projects as well as international emissions trading, it is not yet clear whether or not they will fulfill the eligibility requirement to utilize the Kyoto mechanisms.[24]

Both METI and the MoE have conducted CDM/JI assistance projects. In 2005, they collectively secured 5.7 billion yen for the projects—the MoE with 2.0 billion yen (0.6 billion yen in 2004) and METI with 3.7 billion yen (2.4 billion yen in 2004). Nevertheless, CDM/JI assistance projects will have a limited contribution to acquiring credits for Japanese compliance with the Kyoto Protocol, especially considering that credits corresponding to 20 $MtCO_2$/year have to be acquired from abroad in order to achieve the 1.6 percent target by utilizing the Kyoto mechanisms and that the amount pro-

24. Paragraph 5 of Draft decision-/CMP.1: (Mechanisms), principles, nature, and scope of the mechanisms pursuant to articles 6, 12, and 17 of the Kyoto Protocol, paragraph 22 of ANNEX of Draft decision-/CMP.1 (Article 6) , paragraph 3 of ANNEX of Draft decision-/CMP.1(Article 17)

vided by CDM/JI assistance projects will only be 8.3 $MtCO_2$/year, even if the whole 5.7 billion yen is utilized.[25] In order to enhance project development, the MoE and METI decided to use part of their budgets for upfront payment instead of paying on delivery.

4.2 The Japan GHG Reduction Fund

In recognition of the necessity to establish a fund to systematically purchase carbon credits from abroad, the Japanese government, especially METI and the Ministry of Foreign Affairs (MOFA), requested the Japan Bank for International Commerce (JBIC) and the Development Bank of Japan (DBJ) to take the initiative to establish a carbon fund with other private companies, following the lead of the World Bank's Prototype Carbon Fund (PCF). The Ministry of Finance (MOF) also supported the idea in order to avoid having to find a source to purchase credits from abroad to comply with the Kyoto target.

On December 1, 2004, 31 private Japanese companies, the JBIC, and the DBJ established the Japan GHG Reduction Fund (JGRF) with 14.8 billion yen ($141.5 million)[26] (table 13).

The way the fund functions, the Japan Carbon Finance Co. (JCF) first purchases credits from the market or invest in CDM/JI projects at a certain price (figure 2). Then the JGRF calls on member companies to deliver money, with the amount based on their investment ratio. Then it transfers the money to the JCF and the JCF transfers money to project developers or credit sellers. The JCF will transfer credits to the JGRF, and then the JGRF distributes the acquired credits to member companies based on their investment ratio. The incentives for participation in the fund are avoiding complicated administrative procedures and shortening the number of years needed to acquire credits. It is reported that some companies are considering using the acquired credits to achieve the target set within the framework of the Keidanren Voluntary Action Plan and implicitly prepare for the case that an emissions cap will be introduced (*Nihon Keizai Shinbun*, Nov. 26, 2004).

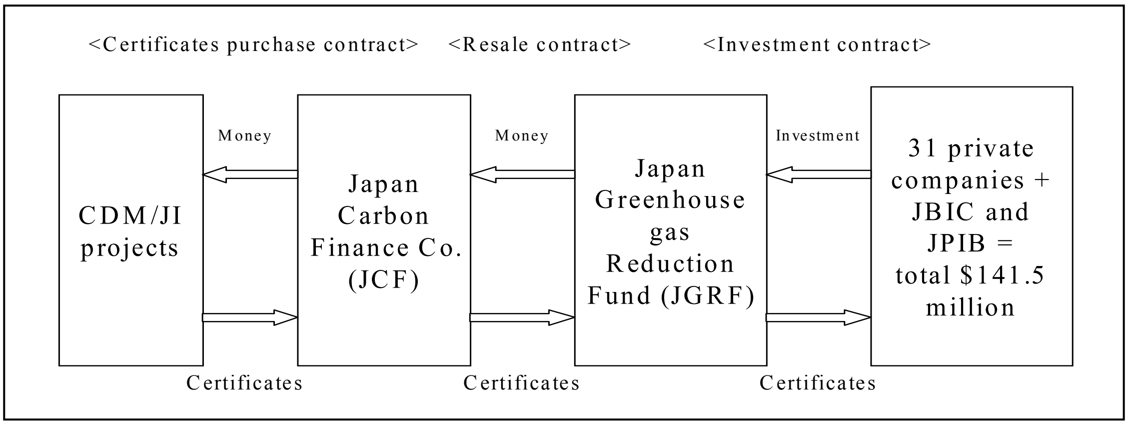

Figure 2: The mechanism of the Japan Carbon Finance Co.

Note: JPIB = Japan Policy Investment Bank.

25. For example, only one CDM/JI assistance project under the MoE budget has been approved, which would bring only 20,000 tonnes of CO_2e into the national account.
26. 1 US dollar = 105 yen.

Sector	Companies		Total contribution (millions of dollars)
Electricity/ gas/heat/water	• Chubu Electric Power Co. • Tokyo Electric Power Co. • Tohoku Electric Power Co. • Kansai Electric Power Co. • Kyushu Electric Power Co. • Shikoku Electric Power Co.	• Dengen Kaihatsu Power Co. • Hokuriku Electric Power Co. • Hokkaido Electric Power Co. • Okinawa Electric Power Co. • Tokyo Gas Co.	55
Manufacturing	• Shin Nippon (oil producing co.) • Idemitsu • Kyushu Oil • Japan Energy • Sony • Toshiba	• Sharp • Fuji Xerox • Japan Steel Federation • Pacific Cement • Toyota • Terumo	33.5
Wholesales/retail	• Mitsui Trading Co. • Mitsubishi Trading Co. • Sumitomo Trading Co.	• Itochu Trading Co. • Marubeni • Sounichi	32
Construction	Nikki		1
Public	JBIC Japan Policy Investment Bank		20

Table 13: Companies investing in the Japan Carbon Finance Co.

The fund will be operated until 2014 with the aim of acquiring the credits that will be issued in 2012, the last year of the protocol's first commitment period. It aims to acquire 10 to 20 million tonnes worth of credits during the whole period.

Companies will acquire credits from abroad under this scheme; however, there is no scheme to get the credits acquired by Japanese entities transferred into the national account. Therefore, credits from this scheme will not be used for Japan's compliance with the protocol.

After the protocol entered into force in February 2005, the government recognized the need to establish a scheme to acquire credits from abroad with a view to use them for national compliance, and they are currently considering establishing a national purchasing scheme to purchase credits from abroad after 2007.

5 Conclusion

As discussed in this paper, Japan's GHG emissions have been increasing since 1990, and this trend will not change drastically under existing measures; therefore, Japan faces difficulty in achieving its Kyoto target. As well, effective policies and measures were not introduced after the review in 2004. Therefore, employing the Kyoto mechanisms is crucial to achieving Japan's Kyoto target, not just the 1.6 percent target, if the difficulties in reducing 5.6 percent through domestic policies and measures and fully utilizing the 3.9 percent from sinks are considered. Stakeholders also realize this and have started investing in CDM/JI projects by themselves as well as establishing the JCF to purchase credits from abroad.

So far, activities have been focused on the CDM, apart from some initiatives conducted by companies, but interest in acquiring ERUs as well as assigned amount units (AAUs) has been increasing. Interest in acquiring credits from Central and Eastern European countries, especially, is increasing for the following reasons:

- The CDM Executive Board's slow process of approving CDM methodologies is recognized as a risk to conducting CDM projects.[27] Considering that only four projects had been approved by the board as of March 2005, governmental as well as industry stakeholders recognize the necessity to diversify options. In addition, the associated costs for CDM projects are expensive.
- As described above, it is not yet clear whether or not Russia and the Ukraine can fulfill the eligibility requirements for utilizing the Kyoto mechanisms. Even when this becomes clear, it is still risky to rely on credits solely from these countries, since they can easily control prices in such a case. Therefore, diversification of trading partners is necessary. Also, it is not desirable from the perspective of reducing global emissions and stabilizing GHG concentrations in the atmosphere to purchase a huge amount of "hot air," which is not backed by actual reductions of GHG emissions.
- The associated costs for JI projects are expected to be the same as the CDM and will reduce the appetite for JI. If projects can be developed under the so-called JI track 1, however, then trading partners can decide for themselves which modalities to apply to transfer reduction units. This reduces regulatory risks and transaction costs.

It is also true, however, that there is skepticism about the possibility of acquiring credits from Central and Eastern European countries, due to the impact of these countries becoming EU member states in May 2004 and the application of *acquis communitaire* (the whole body of EU law)—which includes EU environmental regulations, the EU Emissions Trading Directive, and the Linking Directive—as well as the political and economic relations between these countries and Western European countries.

Despite recognition of the necessity to acquire credits from Central and Eastern European countries and the prevailing skepticism about the acquisition, detailed examination of the actual impacts of emissions trading and linking directives has not yet been conducted.

In order to consider options for acquiring credits from abroad in the future for Japan to achieve its Kyoto target, especially from Central and Eastern European countries, we will conduct a detailed examination of the impacts of emissions trading and linking directive in paper 2 (*The EU Linking Directive and its Impact on the Potential for JI Projects in the EU Accession Countries*) and potentials of credits in paper 3 (*Demand and Supply on the Global Market for Emission Certificates*). Based on these three papers, we will propose options to acquire credits from abroad in the conclusion paper 4 (*Comparison of Options Available to Japan for Acquiring Emission Reduction Certificates*).

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27. Point Carbon reported that the process of approving CDM methodologies by the board is turning out to be a real risk. For example, the Netherlands announced last year that it had selected projects for 16 million CERs, but due to a different interpretation of additionality by the board this was reduced to about 8 million—and still not one of their carefully selected projects has been registered.

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Background Paper 2

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The EU Linking Directive and its Impact on the Potential for JI Projects in the New EU Member States and EU Accession Countries

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In the Kyoto Protocol Japan committed to reducing her greenhouse gas (GHG) emissions by 6% in relation to 1990. However, her GHG emissions have actually been increasing by around 8%. Japan will therefore either have to reduce its GHG emission by about 14%, or she will have to purchase emission certificates from abroad to cover emissions going beyond its target. One of the sources to be considered are the Central and Eastern European countries since they are held to have a very substantial potential for emission reductions. The therefore deserve further study, especially in the light of recent policy developments:

In September 2004 the EU adopted a directive linking the Kyoto Protocol's project-based mechanism to the upcoming EU emission trading system. This so-called "Linking Directive" is going to have a profound impact on the CDM/JI market, both on the demand and on the supply side. On the demand side, it creates a new segment by allowing installation operators covered by EU emissions trading to use certificates from CDM and JI for their compliance. However, at the same time it operationalises the Kyoto Protocol's supplementarity principle for the EU Member States and thus restricts their ability to use CDM and JI for complying with their Kyoto targets. As for the supply side, the Linking Directive contains various provisions which are going to restrict the potential for carrying out CDM and JI projects in EU Member States.

This paper will first outline the general climate policy background in the EU and then examine the directive's negotiating history in order to provide the foundation for the analysis of the directive's contents. This examination will not cover the whole of the negotiations but only those issues which have a direct impact on the international market for CDM and JI. These issues are the supplementarity principle, the question of setting the baselines for CDM and JI projects within the EU and the double counting problem. The paper will then proceed to examining the impact which the Linking Directive's latter provisions are going to have for JI in the new EU Member States Czech Republic, Hungary, Poland and Slovakia and in the EU Accession Countries Bulgaria and Romania. These countries were selected because they appear to provide the most substantial volumes of emission reduction potential. The analysis is based on a survey of previous studies on the JI potential in these countries.

This is the second paper in a series of four papers commissioned by the Ministry of the Environment of Japan and elaborated jointly with the Institute for Global Environmental Strategies.

1 EU Climate Policy and Emissions Trading

1.1 Climate Policy in the EU

Right from the start of international climate policy in the late 1980s the EU has been one of its foremost actors. Climate policy is an area of “mixed competence”, and thus not only its individual Member States but also the EU as such is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Moreover, the 15 “old” EU Member States (EU-15) have redistributed their greenhouse gas limitation and reduction commitments of minus 8% in such a way that the economically stronger states have undertaken to achieve even steeper cuts, whereas the economically weaker states will be allowed to increase their emissions (Burden-Sharing Agreement). The EU has also put in place a monitoring system by which the Member States report and the EU Commission evaluates their progress in achieving their international commitments (Decision 280/2004/EC). EU climate policy is thus a system of complex multi-level governance combining national as well as supranational components.

Right from the start, the EU Commission has also attempted to introduce meaningful policies and measures at the EU level. Hitherto, the most prominent of these attempts has arguably been the design to establish an EU carbon/energy tax. However, this scheme failed repeatedly in the Council of Ministers, not least because fiscal matters require unanimity to be passed. After more than ten years of discussion a much watered-down version was finally adopted in 2003 (Zito 2002; Luhmann 2003).

1.2 From Sceptic to Frontrunner

In contrast to this generally proactive stance, the EU’s attitude towards emissions trading was for a long time rather hesitant. This concept was almost completely new to EU environmental policy and not least for this reason the EU was very sceptical towards the inclusion of the so-called flexible mechanisms – International Emissions Trading (IET), the Clean Development Mechanism (CDM) and Joint Implementation (JI) – in the Kyoto Protocol. She was also afraid that emissions trading would offer countries unwilling to reduce their emissions a cheap exit and therefore held that domestic action should constitute the main part of the effort to achieve the Kyoto target, while the use of the flexible mechanisms should be capped (Oberthür / Ott 1999: 188-191; Zapfel / Vainio 2002: 5f).

However, once the flexible mechanisms had been included in the Kyoto Protocol, the EU quickly took steps to familiarise herself with the new instrument. Then Environmental Commissioner Ritt Bjerregard stated that it was imperative for the EU to actively take part in the discussions about the concrete design of emissions trading since otherwise the rules would be set without her. Moreover, among the Commission officials occupied with emissions trading there was a significant number who had already taken part in the earlier confrontations about the carbon/energy tax. Disappointed about the failure of this and other policy instruments, they seized on emissions trading as a new opportunity to finally establish meaningful policies and measures (Christiansen / Wettestad 2003: 5-7). There was also a sense that there was no more potential in traditional instruments for realising cost-effective emissions reductions (Christiansen 2004: 33).

It bears noticing that in the early stages the discussion was international, with the aim of establishing a global entity-level emissions trading system on the basis of Art. 17 of the Kyoto Protocol, as also reflected in the EU Commission's 98 communication on a post-Kyoto EU strategy (EU Commission 1998: 17). However, these discussions turned out to be very protracted and so a number of bottom-up initiatives considering the viability of national domestic trading schemes came to the fore. These included the establishment of the UK Emissions Trading Group in June 1999, the formation of parliamentary commissions in Norway in October 1998 and in Sweden in the summer of 1999 and the work on Danish energy sector reform, with first draft legislation formulated in May 1998. Of major importance was also the announcement of Sir John Browne, the CEO of the British Petroleum, in September 1998 to establish a company-level emissions trading scheme (Zapfel / Vainio 2002: 7f).

However, this plethora of initiatives gave rise to the question of linking schemes and potential compatibility problems, especially since a number of EU countries came to the conclusion that the trading volumes would be too small if they established domestic systems. Moreover, there was concern that a patchwork of domestic systems might run counter to the functioning of the EU internal market, especially as regards state aid and competition issues (Christiansen / Wettestad 2003: 7; Zapfel / Vainio 2002: 10). Finally, the worrying trends in most Member States' GHG emissions led the Commission to heavily emphasise the necessity of adopting meaningful policy instruments at the EU level (EU Commission 1999: 3-5).

In March 2000, the EU Commission issued a Green Paper on "Greenhouse gas emissions trading within the European Union", a stakeholder consultation paper setting out the issues to be resolved and calling for input. The Green Paper as well as the Commission's Communication which the paper was a part of unambiguously stated that "Most Member States find it increasingly difficult to control their greenhouse gas emissions" and that this was to a large extent due to the failure or weakening of earlier policy proposals like the carbon/energy tax and others. The EU therefore had to take concrete steps sooner rather than later and emissions trading would be "an integral and major part of the Community's implementation strategy" (EU Commission 2000a: 3f; EU Commission 2000b: 4). The Commission also launched the European Climate Change Programme (ECCP), a stakeholder dialogue process designed to identify ways and means for the EU to achieve its Kyoto target. In May 2001 the ECCP's working group on the flexible mechanisms concluded with the clear recommendation that an emissions trading system should be established "as soon as practicable" (ECCP 2001: 12). Finally, on 23 October 2001 the Commission submitted her "Proposal for a Directive of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC" (ET Proposal).

The negotiations turned out to be difficult, but for most actors the issue was how to implement the scheme rather than if it should be implemented at all. Moreover, the discussions received added momentum by the crisis in the UNFCCC negotiations, highlighted by the abortive Conference of the Parties in The Hague in November 2000 and the announcement by then newly elected US President Bush in March 2001 that the US would withdraw from the negotiations and that he would not submit the Protocol for ratification to the US Senate. This crisis strengthened the resolve of the EU to save the Kyoto Protocol by showing leadership in the UNFCCC negotiations as well as by implementing meaningful policies and measures at the "domestic" level (Zapfel / Vainio 2002: 12).

The emissions trading directive (ET Directive) was finally agreed on 13 October 2003. It establishes EU emissions trading as a cap-and-trade system. Each installation covered will be given an initial quota of EU Allowances which is stipulated in the EU Member States' national allocation plans (NAPs). Each year, companies will have to surrender Allowances equal to their installations' actual amount of CO_2 emissions in the preceeding year. Companies that do not need all the Allowances they have been allocated will be able to sell them, whereas those whose emissions exceed their assigned quota will need to buy additional Allowances - or certificates from CDM/JI projects.

2 Linking the EU ETS with CDM/JI – Negotiation History and Final Outcome

2.1 Proponents and Opponents

The issue of linking the EU emissions trading scheme (EU ETS) with the project-based Kyoto mechanisms had been on the agenda very early and the ECCP working group on the flexible mechanisms concluded that such a link would lower compliance costs and promote the development of clean energies (ECCP 2001: 17). But still it was not included in the directive. Christiansen and Wettestad (2003: 11f) consider that this was due to scepticism concerning the environmental integrity of these mechanisms, the rules and procedures of which were in fact under negotiation at the United Nations until December 2003. Moreover, the list of sensitive issues was already very long, so that it was feared that the inclusion of CDM and JI could complicate the negotiations to such a degree that the start of the EU ETS in 2005 might become endangered. Still, it was understood that following the adoption of the ET Directive the Commission would propose an amending directive specifying the rules for integrating CDM and JI into the EU ETS.

The "Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms" (Linking Proposal) was submitted by the Commission on 23 July 2003. The Commission's Explanatory Memorandum put forward several reasons in favour of linking CDM and JI with the EU ETS. These included boosting investment in CDM/JI and thus promoting technology transfer and supporting the host countries in achieving sustainable development, improving the liquidity of the EU ETS and increasing the number and diversity of compliance options both for Member States as well as for companies within the EU ETS (Linking Proposal: 4f). As regards the latter, the Comission's Extended Impact Assessment estimated that annual compliance costs for the participants of the EU ETS would amount to 2.9 billion Euros without linking, with Allowance prices at about 26 EUR. Allowing the use of an amount of CDM and JI certificates of up to 6% of the amount of Allowances allocated would lead to an influx of about 100 million additional certificates into the emissions trading system, which would bring compliance costs down to 2.2-2.4 billion, with Allowance prices at about 14 EUR (EU Commission 2003b: 29f).

For these reasons business was vigorously in favour of linking CDM/JI with the EU ETS and the EU Member States were also very much in favour. The only political actors who opposed the Linking

Directive were the environmental NGOs. They argued that effective climate policy must focus on domestic action and that EU emissions trading had been designed as a means to this end. Moreover, achieving significant domestic emission reductions was a prerequisite for maintaining the EU's international credibility and would also promote other benefits such as the security of energy supply and the reduction of air pollution. Linking the EU ETS with CDM/JI would, however, decrease the pressure to implement effective domestic action. Moreover, the environmental organisations considered CDM/JI to be untested mechanisms whose environmental integrity could not yet be determined (Langrock / Sterk 2004: 8f). The European Parliament was also a bit apprehensive. In the negotiations about the ET Directive the Parliament had agreed on an amendment stipulating that the project-based mechanisms would only be linked to the EU ETS from 2008 onwards, so as to make sure that reductions also take place within the EU (EU Parliament 2002: 25). The amendment was rejected by the Council. However, due to the general climate in favour of linking the NGOs were reduced to trying to achieve certain limitations, especially as regards the amount of certificates to be allowed into the EU ETS (the supplementarity issue, see below) and restrictions on the use of certificates from sink and large hydro projects.

The Linking Directive was finalised on 27 October 2004. The following section will provide a detailed analysis of the provisions which are relevant to the implementation of JI projects in the new EU Member States and EU Accession Countries.

2.2 The Flow of CERs/ERUs in the EU ETS

According to the Linking Directive, the flow of Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) will be as follows:

- The CDM/JI project developer receives CERs/ERUs after the project has successfully undergone the required project cycle for CDM/JI projects respectively.
- He then sells these CERs/ERUs to an operator (i.e. a company that operates an installation covered by the EU ETS).
- The operator can then request the conversion of the CERs/ERUs into the corresponding amount of Allowances. These Allowances will then be used in order to achieve compliance with the obligation to surrender Allowances equal to the total emissions of the installation in each calendar year.
- After the conversion the Member State has the CERs/ERUs in her account and can use them for compliance with obligations under the Kyoto Protocol.

In effect, this does not only mean that companies can use CERs/ERUs for complying with the EU ETS. It also means that in addition to directly acquiring CERs/ERUs for their compliance with the Kyoto Protocol, the EU Member States have now created themselves a second channel, as illustrated in figure 1. Therefore, the question of supplementarity immediately became an issue in the negotiations.

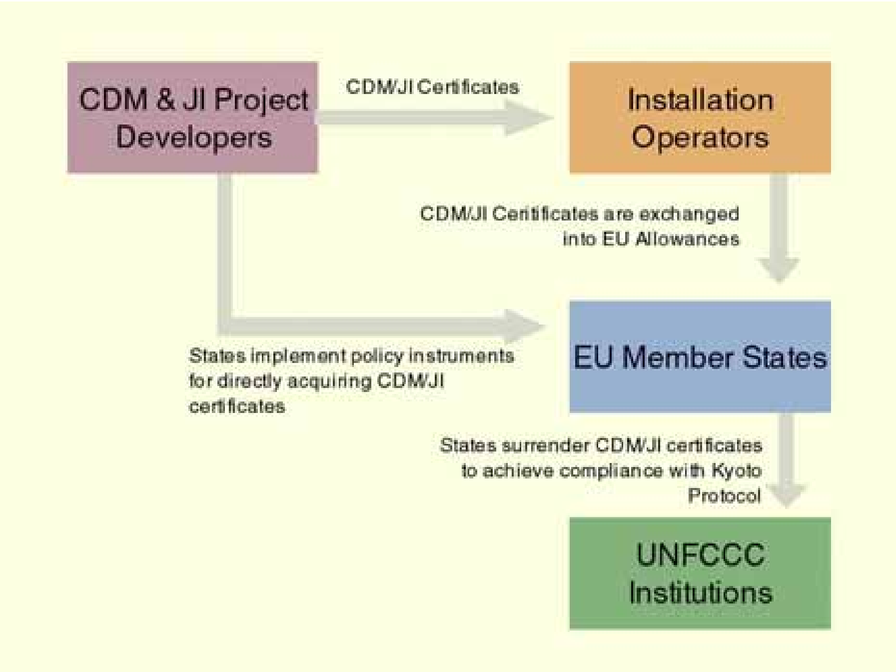

Figure 1: Means for EU Member States to Acquire CDM/JI Certificates

2.3 The Supplementarity Requirement

2.3.1 What Is the Problem?

As already mentioned, during the UNFCCC negotiations the EU had been quite vigorous in its demand that the use of the flexible mechanisms should only be supplemental to domestic action. You could therefore argue that keeping to the standards she once promoted is a matter of the EU's political credibility. Allowing CERs/ERUs to flow into the EU ETS and from there to the Member States therefore gives rise to the question if, and if yes how, this flow should be regulated.

This question is relevant in the present context since it directly affects how much competition there will be for certificates, which has a direct impact on Japan's policy options and will be further explored in Paper 3.

2.3.2 Negotiating History

The Commission's position was that this flow should be regulated. Consequently, a first internal draft of June 2003 contained a provision in Art. 11(bis), paragraph 3, according to which each member state would have been able to convert CERs/ERUs into Allowance only up to 6% of the total quantity of Allowances she had allocated (EU Commission 2003a). For example, Germany, which is going to allocate roughly 2,500 Mt of Allowances in the first Kyoto Commitment Period, could thus have converted a maximum of 150 Mt of CERs/ERUs. However, in the final Linking Proposal which was released on 23 July 2003 this provision had already been softened. According to Art. 11(bis), paragraph

2, the Commissions would have had to undertake an "immediate review" if the number of CERs/ERUs converted reached 6% of the total quantity of Allowances allocated by all Member States. In this review the Commission would have had to consider if a cap on the conversion of for example 8% of all Allowances should be introduced. In its explanatory memorandum the Commission estimated that 6% of the total quantity of allocated Allowances would correspond to 2% of the EU-15 base year emissions and thus to a quarter of the reduction commitment, whereas 8% would correspond to 2.7% of base year emissions and thus to a third of her reduction commitment (Linking Proposal: 8). The source does not indicate the corresponding volume of CERs/ERUs. EU-15 base year emissions were 4,231.44 Mt CO_2e (UNFCCC 2004b: 14). Based on this figure, the "immediate review" would therefore have been triggered if about 423 million CERs/ERUs had been converted EU-wide while a cap at 8% would have amounted to about 571.25 million CERs/ERUs.

As a matter of fact there were a lot of voices demanding that there not be any cap on the use of CDM/JI. Especially business argued that a cap would be contradictory to the objective of flexibility and cost-effectiveness. Moreover, the resulting uncertainty about the convertibility of certificates would discourage the implementation of projects and thus the contribution to sustainable development. Conversely, in line with their general scepticism outlined above the NGOs argued that there should be strict cap to ensure that meaningful domestic action does take place (Langrock / Sterk 2004: 9f).

In November 2003, the United Kingdom (UK), supported by Austria, proposed an alternative to the Commission proposal according to which there would not have been a cap on the overall use of CERs/ERUs but at the entity level. Operators would have been able to use CERs/ERUs up to the level of X % of the allocation to each installation, with the X to be further determined. Moreover, according to this proposal the operators would have surrendered the CERs/ERUs themselves to comply with their obligations instead of first exchanging them for Allowances (EU Council 2003).

But in fact most Member States followed the line of business and were also in favour of removing the cap altogether. In its capacity as president Italy proposed the deletion of Art. 11(bis), paragraph 3, which was supported by Portugal, Belgium, Denmark, France, Greece and Ireland. Instead the issue was supposed to be part of the review of the EU ETS set to take place in 2006. The Commission and the UK noted their reservation and Germany a scrutiny reservation. Finland and Sweden proposed the insertion of a new paragraph which simply stated that the Commission should regularly monitor the relationship between the number of CERs/ERUs and the total quantity of Allowances (EU Council 2003).

On 3 January 2004 the new Irish presidency submitted a compromise proposal according to which each member state would have had to set a limit for the conversion of CERs/ERUs with due regard to provision that the use of the mechanisms shall be supplemental to domestic action (EU Council 2004a).

However, this position ran counter to the position held by many Members of the European Parliament (MEPs). Especially Alexander de Roo, the Rapporteur of the Committee on Environment, Public Health and Consumer Policy, was very firm in his insistence on a concrete cap. In his draft report of 27 January 2004 he proposed to delete Art. 11(bis)(2) and amend Art. 30, paragraph 2, to state that the combined use of CERs/ERUs by companies within a member state and the state's government should not exceed 50% of the respective Member States' emission reduction effort. His was thus the first proposal to regulate not only companies' behaviour but also that of governments. Moreover, it would have required that Member States should annually publish their intended and actual use and conversion of these certificates and that the Commission should report on this in its annual progress report (EU Parliament 2004a: 10f).

This amendment was adopted by the Committee on 17 March 2004, together with an amendment by another MEP which reintroduced the UK proposal: installation operators would have been able to submit CERs/ERUs (without conversion) up to a percentage of the initial allocation to each installation, with the percentage to be defined by each member state (EU Council 2004b: 5).

De Roo and the Council then entered into informal negotiations as a result of which the UK proposal was agreed, with the twist that the use of CERs/ERUs would take place through the issuance and immediate surrender of one Allowance for one CER or ERU (Art 11a, paragraph 1). Art. 30, paragraph 3 was rewritten such that from the period 2008-2012 onward Member States will have to publish in their NAPs their intended overall use of CERs and ERUs as well as – as a subtotal of this overall target – the percentage of the allocation to each installation up to which operators will be allowed to use them. "The total use of CERs/ERUs shall be consistent with the relevant obligations under the Kyoto Protocol and the UNFCCC and the decisions adopted thereunder." Moreover, Member States shall report on their use of the project mechanisms every two years. The Commission shall report on this and make proposals to complement provisions by Member States if appropriate. This agreement was adopted by Parliament in the Directive's first reading on 20 April and confirmed by the Council on 27 October 2004.

The full final text on this issue reads as follows:

After Article 11 of the ET Directive the following is inserted:

"Article 11a

Use of CERs and ERUs from project activities in the Community scheme

1. Subject to paragraph 3, during each period referred to in Article 11(2), Member States may allow operators to use CERs and ERUs from project activities in the Community scheme up to a percentage of the allocation to each installation, to be specified by each Member State in its National Allocation Plan for that period. This shall take place through the issue and immediate surrender of one allowance by the Member State in exchange for one CER or ERU held by that operator in its national registry.

…

Article 30, paragraph 3 of the ET Directive is replaced by the following:

3. In advance of each period referred to in Article 11(2) of this Directive, each Member State shall publish in its national allocation plan its intended use of ERUs and CERs and the percentage of the allocation to each installation up to which operators are allowed to use ERUs and CERs in the Community scheme for that period. The total use of ERUs and CERs shall be consistent with the relevant supplementarity obligations under the Kyoto Protocol and the UNFCCC and the decisions adopted thereunder.

Member States shall, in accordance with Article 3 of Decision 80/2004/EC of the European Parliament and the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, report to the Commission every two years on the extent to which domestic action actually constitutes a significant element of the ef-

forts undertaken at national level, as well as the extent to which the use of the project mechanisms is actually supplemental to domestic action, and the ratio between them, in accordance with the relevant provisions of the Kyoto Protocol and the decisions adopted thereunder. The Commission shall report on this in accordance with Article 5 of the said Decision. In the light of this report, the Commission shall, if appropriate, make legislative or other proposals […] to complement provisions by Member States to ensure that the use of the mechanisms is supplemental to domestic action within the Community."

2.4 Project Baselines

2.4.1 What Is the Problem?

The Linking Directive not only regulates the integration of CDM/JI into the EU ETS but also aspects of the implementation of CDM and JI projects in EU countries. One such aspect is the so-called baseline, i.e. a scenario of which emissions would probably occur if the project was not implemented. The emission reduction of the project is constituted by the difference between the baseline emissions and the actual emissions of the project.

Baseline calculation has to take into account existing regulations, i.e. you cannot claim emission reductions for renovating a power plant if you are compelled to do so by law anyway. With their accession to the EU the new EU Member States and EU Accession Countries will have to bring their national legislation in line with the so-called *acquis communautaire*, which is the total body of existing EU legislation. In many parts the EU environmental legislation is much more demanding than the regulations which had previously applied in these countries. The question therefore was to what extent CDM and JI projects in the new EU Member States and EU Accession Countries would have to take the *acquis communautaire* into account.

2.4.2 Negotiating History

Art. 11(ter), paragraph 1 one of the Linking Proposal stated that the baseline of projects implemented in the new EU Member States and EU Accession Countries would have fully comply with the *acquis communautaire*. However, it made allowance for the temporary derogations set out in the accession treaties, i.e. if a particular regulation does not need to be implemented immediately upon accession, it does not need to be taken into account in the baseline up to the time when the temporary derogation expires.

The Japanese government took issue with this proposal. In a statement from November 2003 it held the position that this regulation was not in line with the provisions of the Marrakech Accords since under the JI 1st Track states can set the baselines themselves. Moreover, the approach taken by the CDM Executive Board was that present regulations did not necessarily determine the baseline if the project proponents were able to demonstrate that there were barriers preventing the adoption of or compliance with these regulations (Government of Japan 2003).

Still, the Commission proposal was not subject to much debate and the text remained almost unchanged:

Article 11(b)

Project activities:

1. Member States shall take all necessary measures to ensure that baselines for project activities, as defined by subsequent decisions adopted under the UNFCCC or the Kyoto Protocol, undertaken in countries having signed a Treaty of Accession with the Union fully comply with the acquis communautaire, including the temporary derogations set out in that Treaty of Accession.

2.5 Double Counting

2.5.1 What Is the Problem?

The parallel implementation of CDM and JI projects in and of the EU ETS EU Member States raises the so-called double counting issue. Without regulation, a CDM or JI project affecting an installation covered by the EU ETS could result in a) the issuance of CERs or ERUs and b) the freeing up of EU Emission Allowances, i.e. the reduction would be rewarded twice. In order to systematically approach the double counting problem three different types of CDM/JI projects in EU Member States must be distinguished:

- Type 1: CDM/JI projects with direct links to the EU ETS; i.e. project activities that are undertaken at installations covered by the EU ETS, e.g. the refurnishing or fuel switch in a power plant (above 20 MW);
- Type 2: CDM/JI projects with indirect links to the EU ETS; i.e. project activities that have no direct link to installations covered by the EU ETS but lead to emission reductions at such installations, e.g. the development of a wind park leading to the displacement of electricity from a power plant within the EU ETS or the improvement of energy end-use efficiency leading to a decreased withdrawal of electricity from a power plant within the EU ETS;
- Type 3: CDM/JI projects without links to the EU ETS; i.e. project activities reducing emissions at sources that are not connected to the EU ETS, e.g. renewable energy projects that are not connected to the national grid.

2.5.2 Negotiating History

To eliminate the double counting problem Art. 11(ter), paragraph 2 of the Commission's Linking Proposal would have held Member States not to award ERUs for project types 1 and 2. In recognition of the fact that some Member States had already made efforts to promote JI, paragraph 4 made an exception for projects approved before 31 December 2004 or, where later, the date of the state's accession. In the case of these projects no Allowances were to be allocated in respect of the emission reductions they achieved.

This provision would obviously have severely limited the JI potential in the new EU Member States and EU Accession Countries. Therefore, in November 2004 the Japanese government sharply intervened. It stated that Japan had agreed to the Kyoto Protocol on the precondition that it would be able to achieve its commitment by carrying out JI in the Central and Eastern European countries and therefore held that the Linking Proposal was inconsistent with the spirits of the Protocol and the Marrakech

Accords. It also noted that double counting could easily be avoided by deducting the amount of ERUs generated by a project from the amount of Allowances allocated to the respective installation (Government of Japan 2003).

The Italian Presidency proposal at the end of the year adopted this approach for type 1 projects. The Netherlands, Ireland and Austria supported this concept whereas Finland, the UK and the Commission noted reservations, while Denmark, France and Sweden noted scrutiny reservations. Conversely, Belgium suggested an alternative which would essentially have reintroduced the Commission proposal and Finland and Austria noted that they were open to this proposal.

For type 2 projects the Italian Presidency proposal suggested that Member States should create a special reserve in their NAPs and cancel one Allowance from this reserve for each ERU issued. The Netherlands noted that they supported this concept while France and the Commission noted reservations and Denmark, Finland, Ireland, Sweden and the UK noted scrutiny reservations. With the support of Austria, Belgium proposed an alternative according to which Member States would have had to foresee an "adequate compensation" for the ERUs issued in their NAPs, but without specifying the meaning of "adequate compensation" (EU Council 2003).

The Irish Presidency proposal of January 2004 essentially retained the Italian proposal for type 1 and also applied the same concept to type 2 projects (EU Council 2004a). Meanwhile, opinions in the EU Parliament varied, with some MEPs in favour of the reserve approach while others and especially the Committee on Industry, External Trade, Research and Energy proposed to lift all restrictions, which would essentially have meant to make double counting possible (EU Parliament 2004b: 27f; EU Parliament 2004c: 28).

Still, in the end it was in essence the Italian Presidency proposal which was adopted. The final text reads:

Article 11(b)

Project activities:

…

2. Except as provided for in paragraphs 3 and 4, Member States hosting project activities shall ensure that no ERUs or CERs are issued for reductions or limitations of greenhouse gas emissions from installations falling within the scope of this Directive.

3. Until 31 December 2012, for JI and CDM project activities which reduce or limit directly the emissions of an installation falling within the scope of this Directive, ERUs and CERs may only be issued if an equal number of allowances are cancelled by the operator of that installation.

4. Until 31 December 2012, for JI and CDM project activities which reduce or limit indirectly the emission level of installations falling within the scope of this Directive, ERUs and CERs may only be issued if an equal number of allowances are cancelled from the national registry of the Member State of the ERUs' or CERs' origin.

…

3 The Linking Directive's Impact on CDM/JI: Legal Analysis

3.1 Demand Side

The Linking Directive's impact on the demand side of CDM and JI is twofold: on the one hand, it creates a new demand for CDM and JI by allowing the installations covered by the EU ETS to use CERs and ERUs for their compliance. On the other hand, it requires EU Member States to impose a limit on these installations' as well as on their own use of CDM/JI.

As for the limit, if supplementarity is to be ensured, the original proposal by the Commission had two weaknesses: it did not provide a concrete cap and it only addressed one of the two channels Member States can use to acquire certificates. The UK proposal would have remedied the former problem but no the latter. The text finally agreed on covers both channels, but there is no concrete cap on the overall use Member States can make of CDM/JI, only a repetition of the Marrakech text. The cap on the use of CDM/JI within the EU ETS is left to the discretion of the Member States, which will have to publish it in their NAPs for the period 2008-2012.

One can therefore conclude that the EU Member States have left themselves a high degree of flexibility. They themselves can determine to which extent they want to make use of CDM and JI as well as to which extent their companies will be allowed to make use of them. On the other hand, the Member States have an incentive to harmonise the extent to which their companies will be allowed to make use of CDM and JI in order to avoid distortionary effects on competition. Moreover, the NAPs are subject to review by the Commission, though it remains to be seen in how far they will be willing and able to enforce a strict definition of supplementarity.

Finally, it also bears noticing that the Linking Directive text covers only CDM and JI and thus leaves the EU Member States completely free to purchase Assigned Amount Units (AAUs) via international emissions trading. This flexible mechanism is only addressed by the requirement to report on the degree to which domestic action constitutes a "significant element of the efforts undertaken".

As for the new demand from the installation operators, apart from the installation-level caps which the Member States are required to impose it is also influenced by the amount of scarcity within the EU ETS.

The installation-level caps to be imposed are currently under discussion within the individual Member States and details are not readily available. As for scarcity, the allocation for the period 2005-2007 has been considered to be relatively generous, but still in March 2005 prices for EU Allowances shot up to aboute EUR 15.[28] If this price level is maintained, CERs and ERUs with their current prices of about EUR 5 will be a very attractive alternative. But the EU ETS market is not yet mature enough to give a reliable picture.

[28] Daily prices are for example available at http://www.pointcarbon.com.

3.2 Supply Side

3.2.1 Baseline

3.2.1.1 Acquis Communautaire Affecting the Baseline of CDM/JI projects

Due to the Linking Directive, CDM and JI projects within the new EU Member States and EU Accession Countries will now have to calculate their baselines on the basis of the *acquis communautaire*. To this respect, three kinds of projects can be distinguished:

- first, there are projects which are not affected because the *acquis communautaire* does not contain regulations that are relevant,
- second, there are projects which can no longer be carried out as CDM or JI projects because they have now become part of the baseline and thus are no longer "additional",
- third, there are projects which would still be additional, but they would now generate fewer CERs or ERUs because the baseline has been raised. In some cases they might still be viable, in others the amount of certificates will now be too small to carry them out.

The relevance of the respective provisions in the *acquis communautaire* depends on their scope (see below) and the category of legislation they represent (see Table 1). While prescriptive legislation by the EU will be effective uniformly all over the EU, flexible legislation and market-based instruments are subject to national implementation.

Category	**CDM/JI Impact**
Prescriptive legislation establishing uniform minimum standards EU-wide.	Raises the baseline by making certain measures mandatory EU-wide. Projects will have to go beyond this standard to be "additional".
Flexible legislation imposing additional site-specific or national rules.	Raises the baseline by making certain state- or site-specific measures mandatory. Projects will have to go beyond this standard to be "additional", the impact will have to be determined for each concrete case
Voluntary and/or market-based instruments, such as feed-in tariffs or special grants for renewable energies.	Raise the baseline by making emission reduction measures more profitable. Project proponents will need to show that this is still not sufficient to make their projects viable.

Table 1: Types of EU legislation, Source: Own illustration based on Nondek et al. (2001: 8)

According to the Swedish Energy Agency (SEA 2002: 48f), the directives that are supposed to have the greatest impact on the baselines of projects are the Integrated Pollution Prevention and Control Directive (IPPC Directive), the Landfill Directive and the Large Combustion Plant Directive (LCP Directive). These directives have direct site-specific impacts. Conversely, other directives such as the Directive to limit carbon dioxide emissions by improving energy efficiency (SAVE Directive) or the Directive on the promotion of electricity from renewable energy sources are examples of flexible legislation setting frameworks or targets for national legislation. Since their impact is thus not directly due to EU Accession but depends on the national implementation (which may be rather soft), we decided to leave them out of the scope of this paper.

The IPPC Directive aims at reducing or eliminating the emission of harmful substances from industrial installations. For this purpose, it requires the use of the best available technology (BAT). As defined in the IPPC directive, "available" means already developed and possible to implement under economically and technically viable conditions. Availability is therefore a relative term that has to be examined by a regulator for each individual installation. The resulting requirements are laid down in the IPPC permit. As for JI projects, this means that measures at installations covered by the IPPC Directive must go beyond the requirements in the IPPC permit. However, Art. 26 of the ET Directive states that for installations covered by EU emissions trading Member States shall not impose emission limits for greenhouse gases covered by EU emissions trading and may choose not to impose requirements relating to energy efficiency in respect of combustion units or other units emitting carbon dioxide on the site. This provision substantially limits the IPPC Directive's potential impact on the baseline of JI projects, but an IPPC permit might also require measures with regard to other pollutants which might have an impact on GHG emissions.

The Landfill Directive includes two important provisions that affect GHG emissions: First, the Landfill Directive limits the amount of biodegradable waste that can be disposed in landfills, which limits the amount of landfill gas emissions. Second, from 2009 onwards the Directive requires the collection of landfill gas at all landfills in operation. Moreover, the collected gas has to be flared as a minimum. The Landfill Directive is thus an example of prescriptive legislation and additionality is limited to

- crediting in 2008,
- projects on closed landfills
- projects on landfills in operation which utilise the collected gas for energy production instead of flaring it.

The LCP Directive limits emissions of SO_2 and NO_x at new and existing plants exceeding a capacity of 50 MW. Operators basically have two options: end-of-pipe solutions or fuel switch. In case of the former, JI potential will basically not be affected since efficiency and the fuel mix is not changed. In case of the latter, however, JI potential at the installation will be reduced significantly (SEA 2002: 48).

3.2.1.2 The Relevance of Transition Periods for Directives

However, the *acquis communautaire* does not immediately have its full effect since the Linking Directive takes into account the temporary derogations set out in the accession treaties. In various instances (see Table 2), transition periods cover part or even all of the first commitment period. This means that projects implementing measures demanded by the *acquis* will be able to generate ERUs or CERs during this time. One could therefore say at a first glance that CDM or JI potential will not or only partly be affected. However, there are probably many potential projects which would be viable if they could generate certificates over their whole lifetime, but not if certificate generation is reduced or even totally cut off after some years, even if the period of (full) crediting is the whole first commitment period. On the other hand, there is the uncertainty about the continuation of the Kyoto Protocol post-2012. Due to this uncertainty it is generally unclear if projects will be able to generate certificates post-2012 and one can therefore probably assume that many investors and project developers will favour projects which are viable even if they generate certificates for a couple of years only. The conclusion therefore is that the expiry of transition periods towards the end of the first commitment period limits the theoretical JI potential, but the impact on what is actually going to be implemented is probably not as severe. If, however, there is no or only a short transition period, the impact will obviously be significant.

	IPPC Directive	Landfill Waste Directive	Large Combustion Plant Directive
Czech Republic	None	None	Until 31.12.2007
Hungary	None	None	Until 31.12.2004
Poland	Until 31.12.2010	Until 01.07.2012, intermediate targets	Until 31.12.2017, intermediate targets
Slovak Republic	Until 31.12.2011	Until 2013	Until 31.12.2007
Bulgaria	Until 2011	None	Until 2014
Romania	(2015)1)	(2017)1)	(2012)1)
1) Romania's request, under negotiation			

Table 2: Transition periods for most relevant Directives, Source: Compilation from Acts of Accession, Article 24; EU Commission 2004a: 93, 113; EU Commission 2004b: 100, 120; SEA 2002: 126, 129

On a theoretical note, it bears noticing that there are two tracks in JI: a first track for host countries which fulfill all the requirements for utilising the Kyoto Protocol's flexible mechanisms and a second track as an "emergency option" for countries which do not. While the second track involves an international procedure under the yet to be established JI Supervisory Committee, in the first track countries are basically free to establish their own procedures (UNFCCC 2002). They could thus approve any project, whether it is additional or not. But since projects which would have happened anyway do not yield them any benefit and would thus only make them lose AAUs (in the form of ERUs), this is probably not in their best interest.

3.2.2 Double Counting

Since projects which are not connected to the EU ETS ("type 3") do not raise the issue of double counting they were never discussed and can therefore be implemented without limitation.

Conversely, the Linking Directive specifically limits projects with indirect linkage ("type 2"). Member States will have to create a special reserve in their NAPs and CERs/ERUs can only be issued up to the amount of this reserve. From the analyst's point of view, this has the advantage that the maximum available potential can be exactly determined. However, the scope of type 2 is quite substantial. Determining the size of the NAP reserve for type 2 projects is therefore not a trivial question.

The scope of "type 1" is substantial since the EU ETS covers the CO_2 emissions of all energy combusting installations with a thermal power of more than 20 MW (except hazardous or municipal waste installations) as well as a number of specific process installations in refineries, coke ovens, metal industry, mineral industry and pulp and paper industry. This means that almost the whole energy sector and the bulk of emissions from industrial energy use are covered. The impact on JI is difficult to evaluate since now there is essentially a competition between financing emission reductions via JI and via the EU ETS. An installation operator has three options:

- She reduces her emissions herself as a result of which she will either not need to buy additional Allowances or even have a surplus of Allowances which she can sell,

- Or she agrees to having her emissions reduced by an external company and transfers the corresponding amount of Allowances to this enterprise. This might be an attractive option if she herself cannot raise the necessary capital or if the external company can reduce emissions at her installation at a lower cost than she herself,
- Or she agrees to having her emissions reduced by an external company in analogy to the second option but by means of a JI project.

Obviously, which option is more economical depends on the concrete case.

4 The Linking Directive's Impact on JI in Selected New EU Member States and EU Accession Countries

4.1 Emission Projections

As a first step the emission reduction potential in the new EU Member States and EU Accession Countries is estimated on the basis of the UNFCCC National Communications (NCs). The emission projections in the National Communications are usually provided for three different scenarios: "without measures", "with measures" and "with additional measures". The "without measures" scenario is a more or less theoretical scenario. The "with measures" scenario usually reflects the impacts of already implemented or currently planned policies and measures and can thus be regarded as the baseline, whereas the "without measures" scenario can be ignored for this paper. Finally, the "with additional measures" scenario includes further policies and measures. Since these are supposed to go beyond what has already been or is going to be implemented, i.e. "additional", they can be taken to give a first indication of the available JI potential.

However, there are several technical problems in analysing these projections. These concern especially the consistency and reliability of the data provided for emission projections. In the following, reduction potentials in the countries selected will be considered in more detail.

Country	Reduction Target	Annual Target for 2008-2012		Projected emissions (2010)		Emission Surplus for 2010 1)	Derived Annual JI Potential
	per cent	Mt CO_2e		Mt CO_2e		Mt CO_2e	Mt CO_2e
Czech Republic	8	172.5	WM	141.7	WM	30.8	6.5
			WAM	135.2	WAM	37.3	
Hungary	6	95.5	WM	100.3	WM	-4.8	n.a.
			WAM	97.7	WAM	-2.2	
Poland 2)	6	449.3	WM	413.0	WM	36.3	
			WAM	n.a.	WAM	n.a.	
Slovakia	8	66.7	WM	51.4	WM	15.3	5.4
			WAM	46.0	WAM	20.7	
Bulgaria	8	144.5	WM	133.7	WM	10.8	8.2
			WAM	125.5	WAM	19	
Romania 3)	8	251.9	WM	247.9	WM	4	38.8
			WAM	209.1	WAM	42.8	

WM = With Measures
WAM = With Additional Measures
1) = Projected emissions – Target
2) Only CO_2
3) Second National Communiction
n.a. – not available

Table 3: Projected Emissions for selected CEE Countries, Sources: Compilation from Third National Communications

4.2 Czech Republic

4.2.1 Emission Projections

The Czech Republic adopted an 8% reduction target with 1990 as the base year, which corresponds to an average annual target of 172,5 Mt, i.e. a total amount of 862,5 Mt CO_2e for the whole commitment period (Czech Republic 2001: 44).

NC3 defines a 'reference' and a 'high' scenario. While the 'reference' scenario is a linear continuation of the average development of the past years with annual GDP growth of 3% and an annual decrease of energy intensity of 2.5%, the 'high' scenario presupposes a more vigorous economic growth on the basis of modern technology with an annual GDP growth of 5 to 6% and an annual decrease of energy intensity of 4%. The Czech government considers the latter scenario to be more likely, especially due to the expected stimulating economic effects of EU accession. 2010 emissions for this case are projected to reach 141.656 Mt CO_2e in the 'with measures' and 135.242 Mt in the 'with additional measures' scenario. Both scenarios are obviously much below the Kyoto target (Czech Republic 2001: 72-82).

All the 'additional measures' mentioned in NC3 are legislative or other state measures that are currently being prepared or have already been implemented over the last years, as well as measures planned in connection with harmonisation with EU regulations (Czech Republic 2001: 45-57). Therefore, in the case of the Czech Republic the 'with additional measures' scenario has to be considered as the baseline and the NC thus does not give an indication of the JI potential.

4.2.2 Reduction Potential and JI Applicability by Sector

4.2.2.1 Conventional Energy Supply

At the end of 2001, the total installed capacity of the Czech power system was 15,443 MWe, 10,836 MW of which was accounted for by coal-fired power plants using mostly local brown coal. Nuclear power generating capacity amounted to 1,760 MW, hydro power and pumped storage hydro together came to 2,145 MW total capacity. Other energy generating capacities such as oil, gas, and renewable energy projects are small (oil 25 MW, gas 675 MW, and renewable energy sources 1.18 MW). The Czech Republic is a net exporter of electricity, with an estimated annual amount about 0.73 TWh (Maly et al. 2002a: 4-10).

The Czech government focuses on harmonising the energy sector standards with those of the EU, which means decreasing dependence on solid fuels, mainly coal as a primary energy source. Coal will be gradually replaced especially as a source of heat, or will be increasingly used for co-generation (US DOE 2004a).

High priority is placed on developing nuclear energy resources. The dominant electric power utility is Ceske Energeticke Zavody (CEZ), a 67% state-owned energy generating company which produced 71% of total electricity in 1999. Due to the fact that efforts after 1990 were focused primarily on substantial reductions of air pollution from coal-fired power facilities and in order to meet the requirements of the LCP Directive, the following measures were carried out:

- Gradual decommissioning of obsolete power units (possible as a result of decreasing power demand due to the economic transformation);
- Upgrading units selected for continued operation by installing fluidised bed boilers or scrubbers, and
- Completing two nuclear power units in the Temelin power facility.

These efforts were successfully carried out by the end of 1999. The loss of generating capacity will be more than compensated by the increases in nuclear and hydropower capacity (US DOE 2004a). Further cost-effective reduction potential at the facilities of CEZ is therefore probably limited.

4.2.2.2 Renewables

The Czech government's target for the development of renewable energy is to increase its share from currently 1.7% to 5 to 6% in 2010 (EVA 2004b). Besides strong political support for renewable energy development, the Czech Republic also has high renewable energy feed-in tariffs compared to other new EU Member States and EU Accession Countries. The country has thus established excellent institutional support mechanisms for the promotion of renewable energy (Wynne et al. 2003:5-6). However, this does not mean that all potential projects are not additional, as set out in detail below.

Solar

The solar insulation levels in the Czech Republic are mediocre, and despite the high feed-in tariffs of over 19 US cents/kWh the costs for photovoltaic applications may hinder project development (Wynne et al. 2003:5-6). Nondek et al. (2001: 57) estimate that in the area of solar systems with hot air collectors there is a potential for projects which are economically viable and would pass the additionality test which amounts to about 300 kt CO_2e per year.

Wind

Wind energy utilisation has a long tradition in the Czech Republic. The near-term technical potential is 2,220 MWe (US DOE 2004a). Maly et al. (2002a: 10) estimate that the emission reduction potential that is economically viable amounts to 1.3 Mt CO_2e. Nondek et al. (2001: 57) not only consider which projects are economically viable but also which would pass the additionality test and conclude that there is a JI potential of about 900 kt CO_2e per year.

Geothermal

The total geothermal potential for the whole country, based on heat flows, is 4,641 MW (EVA 2004b). The exploitable potential amounts to 2,500 to 3,000 MW, corresponding to an installed heat potential of 3,750 to 4,500 MW (EVA 2004b). However, Maly et al (2002a: 10) caution that the use of geothermal energy in the Czech Republic entails marginal abatement costs of more than 30 USD per t CO_2e and. In their view it is therefore not economically viable.

Biomass and Biogas

Only 30% of biomass resources are currently used (Wynne et al. 2003:5-6). About two thirds of bioenergy is consumed by households for low temperature heat generation. According to Maly et al. (2002a: 10), the reduction potential related to the utilisation of biomass for production of power and heat amounts to 4.4 Mt CO_2e with marginal abatement costs in the range from 2 to 8.6 USD/t CO_2e. However, Nondek et al. (2001: 57) identify only about 600 kt to be suitable for JI. On the other hand, they identify an additional potential of another 100 kt in the area of biogas-fired cogeneration.

Hydro

As of 2001, 2,155 MW of hydro power were installed, of which 1,145 MW were pumped storage hydro. Furthermore, 1,230 small hydro plants existed in 1999 with an installed capacity of 283 MW. The installed capacity represents approximately 50% of the technical hydro power potential. The overall potential for all sizes of hydropower plants is quite modest and amounts to a technical exploitable capability of 3,978 GWh/year (EIC 2001). According to Maly et al. (2002a: 10), the utilisation of hydro energy in the Czech Republic has an emission reduction potential of about 1.0 Mt per year at a price of 11 USD/t CO_2e. Nondek et al. (2001: 57) consider that the potential that is suitable for JI amounts to 600 kt.

Total Renewables Potential

According to Maly et al. (2002a: 10), the total technical reduction potential identified in the renewable energy sector amounts to 8.6 Mt per year with marginal abatement costs of 518 USD/t CO_2e. The total sum of the potential which Nondek et al. (2001: 29) judge to be economically viable and additional to business as usual amounts to roughly 2.3 Mt per year. However, a large share of this potential consists of small scale projects which at least at the moment is not suitable for JI. In their view, only a third of the identified potential is actually “tradeable” for JI, by which they mean that the emission reduction of a project is greater than 1 kt. This leaves a JI potential of about 700 kt CO_2e.

4.2.2.3 District Heating and Residential Sector

District heating is an important part of the energy system of the Czech Republic as 30% of the country’s households are connected to the local district heating network, providing 20% of the energy sector’s final consumption. District heating systems operate in some 50 cities. Of the total delivered 145.88 PJ of final energy heat, 119.42 is produced by using solid fuels, 15.75 by using liquid fuels and 47.79 by gas. The generation and network systems are generally aged between 30 to 60 years, which has a negative impact on efficiency and availability of services. The discrepancy in energy efficiency is 90% in modern gas fired CHPs compared to less than 50% in the case of old heat-only units (Maly et al., 2002a: 5-6, IEA 2004: 6f). However, the literature surveyed contains no data on which emission reductions could be achieved in this regard.

Potential to save energy can also be found in the residential and tertiary sector. Buildings are generally poorly insulated. About 1.1 million dwellings, comprising about one third of the Czech residential sector, are situated in panel prefab buildings. The thermal quality of these buildings is relatively low, resulting in high energy demand of about 240 kWh/m² and year (EVA 2004a). Moreover, switching from coal-fired to biomass-fired boilers for space and water heating entails a CO_2 reduction potential of about 3 Mt per year with marginal abatement costs of 2 USD/t of CO_2e. In total, the possible measures in the residential and tertiary sectors with marginal abatement costs below 30 USD/t of CO_2e are supposed to amount to 18.1 Mt per year (Maly et al. 2002a: 10). According to Nondek et al. (2001: 29f), the potential that is economically viable and would pass the additionality test in the residential and tertiary sectors amounts to about 8 Mt CO_2e. However, they consider that there is not one single project that is “tradable” for JI, i.e. with a reduction capacity above 1 kt. Therefore, the available potential could only be tapped by JI if suitable mechanisms for bundling small projects into larger ones could be designed.

4.2.2.4 Industry

Nondek et al. (2001: 57f) identify a range of possible measures to upgrade industrial processes such as implementing advanced electric motors, replacing heating furnaces or installing small CHP plants. All these measures could be carried out as JI projects and are supposed to entail a reduction potential of 6.6 Mt CO_2e.

However, some of these measures could be regulated under the IPPC Directive, which would reduce the potential by about 130 kt. Another 3.9 Mt become part of the baseline due to the transposition of the SAVE Directive into Czech legislation. This leaves a potential of about 2.6 Mt, 57% of which is contained in projects which are “tradeable”, leaving a JI potential of about 1.5 Mt.

There could also be potential in the capture and utilisation of methane from mining installations (REC 2004: 184), but the literature surveyed contains no data on the available potential.

4.2.2.5 Waste Management

Collection and use of landfill methane could provide substantial potential for emission reductions which amounts to 1.2 Mt per year at marginal abatement costs below 30 USD/t of CO_2e, of which 255 kt consist of projects which extract landfill gas and use it in large-scale cogeneration plants sited at the landfill, are available at a price of 7.8 USD/t of CO_2e (Maly et al. 2002a: 10).

4.2.2.6 Transport

In the transport sector, 20% of road freight transport could be switched to rail transport and diesel trains could be replaced by electric trains. These measures are supposed to entail a reduction potential of about 21 kt per year, but they may not be suitable for JI since they are difficult to monitor (Nondek et al. 2001: 57).

There is also a reduction potential of 170 kt per year through the use of biodiesel (REC 2004: 184), part of which could probably be tapped by JI, e.g. by retrofitting the bus fleets of public transport systems.

4.2.2.7 Agriculture and Forestry

Nondek et al. (2001: 29) indicate that measures to improve the energy efficiency of agricultural buildings could reduce emissions by about 90 kt. However, none of these projects are “tradable”.

Conversely, they consider that there is substantial JI potential in forestry, especially since there is no legislation to make such projects non-additional. They estimate that the afforestation of idling agricultural lands could yield a sequestration of 4-5 Mt CO_2 per year (Nondek et al. 2001: 21f).

4.2.3 Overall Potential and the Impact of EU Accession

Table 4 gives an overview of the reduction potential in the Czech Republic as derived from NC3 and the secondary literature surveyed. The potentials that have been quantified alone are estimated at more than 28 Mt CO_2e per annum (p.a.). By sector the following situation can be noted:

- The energy sector has already undergone significant renovation. It is probable that there are still further cost-effective emission reduction opportunities which could be mobilised by JI, but the literature surveyed gives no details.
- The technical reduction potential in the renewables sector amounts to about 7 Mt CO_2e per year. of which 2.2 Mt are estimated to be economically viable and additional to business as usual is. However, only 700 kt are contained in projects with a size above 1 kt per year, which is considered to be the minimum size to be viable for JI.
- Efficiency improvements and fuel switch in individual buildings is supposed to entail a technical emission reduction potential of 18.1 Mt and an economically feasible potential of 8 Mt. However, potential projects seem to be too small for JI. They would need to be bundled to become viable. Moreover, the transposition of the SAVE Directive into Czech law could make some measures mandatory.

- The district heating systems are aged between 30 to 60 years and therefore contain a substantial emission reduction potential, but the literature surveyed does not indicate any figures.
- The viable emission reduction potential in industrial processes and energy generation is estimated at about 6.6 Mt.
- The potential for emission reductions from collecting and using landfill methane are estimated at 1.2 Mt per year. The literature surveyed does not indicate which part of this potential could be viable for JI.
- The options identified in the transport sector amount to about 200 kt, part of which could be tapped by JI.
- The measures identified in agriculture amount to 90 kt, but the emission reductions of potential projects seem to be too small to be suitable for JI. Conversely, afforestation could yield 4-5 Mt per year.

The Czech Republic has negotiated hardly any transition periods. The impact of the *acquis communautaire* is therefore quite severe. Most notably, projects in the energy and industry sectors are affected by both the LCP and IPPC Directives.

The draft NAP (Czech Republic 2004: 13) states that the Czech Republic considers JI to be very important and that the NAP for 2008-2012 is going to contain a reserve for indirect linkage. However, the Czech Republic does not seem to be too favourable towards projects with direct linkage. In the long run, the Czech Republic will consider restricting JI projects to activities that do not have any link with the EU ETS and supporting other projects by issuing AAUs.

In 2000, emissions from the covered installations totalled 89.03 Mt CO_2 (Czech Republic 2004: 18). The NAP does not give an indication which part of the energy and industry sectors is covered by the EU ETS. According to the Czech Republic's inventory data, in 2000 CO_2 emissions from fossil fuel combustion in the energy sector amounted to 60.16 Mt, CO_2 emissions from fossil fuel combustion in manufacturing industries and construction to 34.88 Mt, amounting to a total of 95.04 Mt; emissions from industrial processes (2) added 2.25 Mt (Czech Republic 2001: 92). Construction is not covered by the EU ETS and therefore distorts the picture a bit, but one can conclude that CO_2 emissions from energy production and industrial processes are covered to a very large extent. This is confirmed by REC 2004 (179) which states that 10 of the country's 12 coal-fired plants fall under the EU ETS. Given the statement in the NAP one can therefore conclude that the relevant JI potential in this regard has been removed by the EU ETS.

Due to the Landfill Directive, options at landfills are reduced to closed landfills and to energy production, but the literature surveyed does not quantify the potential. Such projects as well as projects utilising methane emissions in the mining sector for electricity production would probably be connected to the grid and thus be indirectly linked to the EU ETS. They therefore depend on the establishment of a sufficient JI reserve.

The options identified in the transport sector are not affected by the elements of the *acquis communautaire* discussed above, nor are they covered by the EU ETS. The situation regarding district heating and renewable energy projects will be discussed in the conclusions.

Sector/Measure	Reduction potential (Mt CO_2e p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
Rehabilitating and replacing existing plants, fuel-switch (1A1)	Not quantified	Unclear 1)	Severe
Renewables			
Solar	0,3	Yes	Possibly
Wind	1.3	Yes (0.9 Mt)	Possibly
Geothermal energy, potential of 3,750-4,500 MW installed capacity	Not quantified	Yes	Possibly
Biomass	4.4	Yes (0.7 Mt)	Possibly
Hydro	1	Yes (0.6 Mt)	Possibly
District Heating and Buildings			
Improving energy networks	0.23	Yes	No
Improvement of buildings and fuel-switch in individual boilers (technical / economic potential)	18.1 / 8	Yes	No
Industry			
Upgrading industrial processes	1.5	Yes	Yes
Installation of gas-fired CHP	5	Yes	Possibly
Capture and utilisation of methane from mining	Not quantified	Yes	Possibly
Waste Management			
Collection and use of landfill gas	1.2	Yes	Severe
Transport			
Switch from road transport to rail transport (20%)	0,02	No 2)	No
Replacement of diesel freight trains by electric trains	0,01	No 2)	No
Use of biodiesel, e.g. in bus fleets	0,17	Yes	No
Agriculture and Forestry			
Improve energy efficiency in agricultural buildings	0,09	No 3)	No
Afforestation	4-5	Yes	No
Total quantified potential (lower estimate)	**28,12**		

1) Sector has already undergone significant renovation
2) Problematic monitoring and assessment process
3) Projects too small

Table 4: Overview of Reduction Measures in the Czech Republic

4.3 Hungary

4.3.1 Emission Projections

Hungary has committed to a 6% reduction with the annual average emission level of the period 1985 to 1987 as the base level, which corresponds to an average annual target of 95.535 Mt (UNFCCC 2004a: 22), and thus a total amount of 477.675 Mt CO_2e for the whole commitment period.

In contrast to all other countries considered, Hungary might have problems with reaching this target. The UNFCCC report on the in-depth review of NC3 states that the country had adopted a "relatively optimistic approach" for its emission projections. The report corrects the emission figures with the result that 2010 emissions in the "with measures" scenario will be 100,325 Mt CO_2e and 97,696 Mt in the "with additional measures" scenario, i.e. well above the target (UNFCCC 2004a: 21f).

The difference between the "with measures" and the "with additional measures" scenarios indicates an additional reduction potential of about 3 Mt CO_2e. The "with measures" scenario is supposed to include ongoing and planned measures (Hungary 2002: 80), but unfortunately the reductions are not broken down according to the various measures listed in NC3, nor is it clear which measure belongs to which scenario. The latter point was clarified during the in-depth review, according to which the differences between the two scenarios are:

- the doubling of renewable energy use to meet targets agreed with the EU, i.e. 6 to 7% of total energy consumption by 2010,
- a lower number of livestock,
- the maximum rate of afforestation potential, i.e. 15,000 ha annually until 2050 (UNFCCC 2004a: 18).

However, the review found that even if the maximum potential for renewable energy were to be realised, it would still not be possible to achieve the reduction of 2 Mt CO_2e projected in the scenario. A corrected figure is not given, however. Conversely, given the significant national as well as EU commitment to afforestation, the review states that the annual afforestation rate of 15,000 ha in the "with additional measures" scenario should rather be held to represent the "with measures" scenario (UNFCCC 2004a: 18f).

4.3.2 Reduction Potential and JI Applicability by Sector

4.3.2.1 Conventional Energy Supply

49 power-generating units are operating in Hungary, of which 16 have a capacity greater than 100 MWe. Those 16 units represented 94% of the total power production capacity in 2000. The main sources of electricity are nuclear power with approximately 37%, coal and lignite with 24%, and oil and natural gas with 28%. The share of gas has grown over the last decade. In the period 1990 to 2001, emissions from coal combustion declined by 2 Mt and petroleum by 2.04 Mt, while those from gas

increased by 1.16 Mt. Combined cycle gas turbine power plants are rapidly gaining popularity in Hungary. Several new plants are in development or under construction (US DOE 2004b).

Magyar Villamos Müvek (MVM) was the former sole importer and exporter of energy as well as the operator of the national electricity grid. Hungary's eight power generation companies (seven thermal and one hydroelectric power producer) were unbundled during the last few years. All power plants and six local distribution companies were sold mainly to foreign investors, except for the oldest coal-fired units. Power plant privatisation was carried out in package deals with the associated coal mines. Thus, privatisation of the power sector is practically finished (Maly et al. 2002b: 3; US DOE 2004b).

The existing power plants are very obsolete. There is a need to build about 6,000 MW of new power plant capacity over the next fifteen years, with three fourths of this amount being needed to replace existing obsolete capacity. Most of these plants are coal-based, so switching to alternative fuels would entail huge emission reductions (REC 2004: 210).

MVM is planning to retrofit 300 to 700 MWe of existing capacity and had planned to construct plants of 1,000 to 1,100 MWe capacities by the year 2006. The capacity expansion was tendered in 1997, but due to the pending privatisation and break-up of MVM these plans were put on hold (US DOE 2004b).

Modernising the Hungarian energy industry and switching from coal to gas therefore seems to entail significant possibilities for JI. However, the literature surveyed contains no figures on the available reduction potential.

4.3.2.2 Renewables

The energy policy concept of Hungary includes the objective to increase the share of renewable energy sources in the primary energy balance from the current 1% to 3.6% by 2010, in line with the Council Directive 2001/77/EC (Hungary 2004: 8). An energy efficiency programme was introduced in 2001 with the main objective of promoting renewable energy sources. Subsidies are available from certain funds, for example the Central Environment Protection Fund. Furthermore, electricity supply companies have been obliged since 2003 to purchase energy produced from renewable sources above 0.1 MW and from small scale CHP (from 0.5 MW up to 20 MW) at guaranteed prices. In 2000, gross electricity produced for sale from renewable sources amounted to a total of 286 GWh, with a total generating capacity of 73 MW, of which 48 MW were from hydro, 24 MW from municipal solid waste and 1 MW from solid biomass. The government plans to introduce a system of tradable "green certificates" as soon as the market for renewable energy reaches a critical mass for competition of 300 to 350 MW (EVA 2004c).

Despite these steps, producers of renewable energy do not have the premium prices that are needed for sustainable and economic development and for the operation of the particular installations and facilities (EVA 2004c). Projects might therefore still be additional.

Solar

Wynne et al. 2003 (5-8) consider that solar insulation levels in Hungary are relatively low and high costs for photovoltaic solar project development do not seem justified even with relatively high feed-in tariffs. Conversely, REC 2004 (213) estimates that photovoltaics could achieve a modest 2 MW of installed capacity with an output of 2-3 GWh per year. According to NC 3 (20, 54), the technical potential of solar energy amounts to 3.6 PJ per year and it is feasible to achieve a reduction of about 300 kt per year by the year 2012. However, there is no indication which part of this potential could be utilised by JI.

Wind

Wind energy potential is seen as reasonable (EVA 2004c). A lack of state-of-the-art wind measurements currently inhibits wind energy development. Suitable projects could be identified if more accurate wind data became available (Wynne et al., 2003: 5-7:5-8). Two larger unit installations have recently been made, one 250 kW unit in Niota and another one in Skulks. The latter project is expected to provide 1.2 Mill. kWh per year (EVA 2004c; US DOE 2004b). According to REC 2004 (213), wind energy could have a potential of 500 to 2,000 MW installed capacity. According to NC 3, the technical potential of wind energy amounts to 1.3 PJ and it is feasible to reduce emission by about 200 kt per year by the year 2012 (Hungary 2002: 20, 54). However, there is no indication which part of this potential could be utilised by JI.

Geothermal

Hungary has some of the largest reserves of geothermal energy in Eastern Europe. However, the geothermal reserves are primarily of low to medium enthalpy, which is suitable for heat supply but not for electricity generation. The residential and industrial demand for low enthalpy geothermal energy has led to 2,000 wells being in operation with an estimated total capacity of 350 MW supplying 11 PJ of energy per year. There is some evidence of high-enthalpy resources, but none have been explored so far (EVA 2004c; Wynne et al. 2003: 5-8).

According to NC 3 (20f, 53f), the technical potential amounts to 50 PJ per year and it is feasible to reduce emission by about 1 Mt per year by the year 2012. However, there is a severe technical problem in that when large quantities are extracted, the aquifer needs to be sufficiently refilled to sustain underground water and there is not yet a safe and economic way of doing this. Considerable development can therefore only take place if this problem is resolved.

Biomass

Currently biomass, mainly fuel-wood combustion, accounts for the largest share of Hungary's renewable energy consumption. Nearly 40% of the round-wood production and 10% of forestry waste and sawmill by-products are used to provide heat for the forestry industry or other energy purposes. According to Wynne et al. (2003: 5-8), the technical potential for biomass is 1,000 MWe. According to NC 3, the technical potential of biomass amounts to 165.8 PJ and it is feasible to reduce emission by about 3.6 Mt per year by the year 2012 (Hungary 2002: 20, 54).

One example of the potential is the Dutch Borsod Power Plant project. Its aim is to switch the plant's fuel from brown coal to biomass and thus reduce emissions by 630 kt over the period 2008-2012. Another project at the Bakony Power Plant aims to reduce emissions by 450 kt per year by the same means. The Pannon Power project of the World Bank's Prototype Carbon Fund (PCF) aims to reduce emissions by 2.7 Mt over the period 2004-2018, of which 932 kt would fall into the first commitment period, by converting coal furnaces into natural gas and biogas furnaces (REC 2004: 217f).

Hydro

Presently, hydropower generates less than 1% of Hungary's electricity. This is due to the fact that Hungary is one of the less mountainous countries in Central Europe. In 2003, three commercial hydropower plants were in operation with a total generation capacity of 44 MWe. The annual power generation was 200 GWh (US DOE 2004b; EVA 2004c). According to NC 3 (Hungary 2002: 20, 54), the technical potential of hydro energy amounts to 1.2 PJ per year and it is feasible to reduce emission by about 260 kt by the year 2012.

District heating and residential sector

District heating was developed on a large scale in the 1960s and currently has a market share of 16% in the dwelling heating market. The total district heat produced by power plants in 1998 amounted to 12.7 TWh, of which 10.4 TWh fell to heat supply combined with power production (Maly et al. 2002b: 5). 142 companies operate 240 systems in 109 towns and cities (IEA 2003: 6-7). The dominant fuel is natural gas which accounts for 66% of the fuel used, followed by coal and oil with 19% and renewables and waste with 4% (REC 2004: 214).

A District Heating Law adopted by the Hungarian Parliament in March 1998 considers the reconstruction of the district heating system as highest priority. A conceptual proposal about the modernisation of the system is supported by an Action Programme. The objective is to save 10 PJ of energy per year until 2010 (Maly et al. 2002b: 5).

According to the Draft NAP, the residential sector provides a significant potential for the improvement of energy efficiency and resulting savings in primary energy use (Hungary 2004: 8). Neither the technical potential of energy savings nor the total amount of emission reductions possible is mentioned.

4.3.2.3 Industry

According to REC 2004 (215) only 5% of Hungary's total emissions stem from production processes. The bulk of these are caused by a small number of companies and sub-sectors, many of which show a significant environmental commitment. Taking also into consideration the requirements of EU accession, they conclude that there is no basis for JI.

4.3.2.4 Waste Management

There might be potential in landfill gas projects since NC3 states that currently its use is only occasional (Hungary 2002: 22). However, the literature surveyed provides no details about the present situation. Hungary did not negotiate a transition period for the EU Landfill Directive, so that projects will be restricted to crediting in 2008, closed landfills or utilisation of landfill gas for energy purposes.

A planned JI project by Green Partner Kft. And BGP Engineers BV in Nagykanizsa, Orosháza and Baja intends to reduce emissions by 70 kt CO_2e over the period 2008-2012 by rehabilitating landfills. Another project by Exim-Invest Biogas Ltd. at Nyíregyháza plans to reduce emissions by 13.875 kt over the same period by installing gas motor block heating system at a landfill (REC 2004: 218, 220).

4.3.2.5 Agriculture and Forestry

REC 2004 (215) considers that there is an urgent need for disseminating advanced agricultural and animal husbandry methods like proper fertiliser application. These would lead to emission reductions but might not be suitable for JI due to problems with determining the baseline.

There seems to be a vast potential for afforestation, but given the strong national engagement in this sector as indicated by the in-depth review of NC3 it is unclear in how far projects would be additional.

4.3.3 Overall Potential and the Impact of EU Accession

Table 5 gives an overview of the reduction potential in Hungary as derived from NC3 and the secondary literature surveyed. There should be considerable emission reduction potential in almost all sectors considered, but the sources surveyed give hardly any figures. The potentials that have been quantified alone are estimated at more than 5 Mt CO_2e p.a. By sector the following situation can be noted:

- The existing power plants are very obsolete. There is a need to build about 6,000 MW of new power plant capacity over the next fifteen years, with three fourths of this amount being needed to replace existing obsolete capacity. Most of these plants are coal-based, so switching to alternative fuels would entail huge emission reductions. However, the literature surveyed contains no figures on the available reduction potential.
- The feasible reduction potential identified in the renewables sector is above 5 Mt per year, but it is not clear which part might be utilised for JI.
- Potential in the district heating and residential sectors is supposed to be substantial but not quantified, either.
- As for industry, it is claimed that only 5% of Hungary's total emissions stem from production processe. The bulk of these are caused by a small number of companies which show a significant environmental commitment. JI potential is therefore considered to be negligible.
- There might be potential in landfill gas projects since currently its use is only occasional. However, the literature surveyed provides no details about the present situation.
- In agriculture, there is potential for disseminating advanced agricultural and animal husbandry methods like proper fertiliser application. These would lead to emission reductions but might not be suitable for JI due to problems with determining the baseline. As for afforestation, there seems to be a vast potential, but given a strong national engagement in this sector it is unclear in how far projects would be additional.

According to the draft NAP (Hungary 2004: 13), CO_2 emissions from the activities covered by the EU ETS amounted to 30.52 Mt in 2002. According to Hungary's inventory for 2002, CO_2 emissions from fossil fuel combustion in the energy sector amounted to 19.68 Mt, CO_2 emissions from fossil fuel combustion in industry to 10.13 Mt amounting to a total of 29.81 Mt (UNFCCC 2004b: 14, 18). CO2 emissions from industrial processes (2) were at 2.44 Mt. One can therefore assume that more than 95% of the CO_2 emissions from these two sectors are covered by the EU ETS and that the bulk of the remaining installations are probably too small to be viable for JI. Moreover, Hungary has not negotiated a transition period for the IPPC Directive, which raises the baseline. The transition period for the LCP Directive runs till the end of the first commitment period, so that its impact on JI should be limited.

If there is potential in landfill gas, due to the Landfill Directive options would be reduced to closed landfills and to energy production. Reductions of methane emissions would not be affected, but projects using the landfill gas to produce electricity would probably be connected to the grid and thus be indirectly linked to the EU ETS. The generation of ERUs for the emission reductions resulting from this electricity production would therefore depend on the establishment of a sufficient JI reserve.

The situation regarding district heating and renewable energy projects will be discussed in the conclusions.

Sector/Measure	Reduction potential (Mt CO_2e p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
Rehabilitating and replacing existing plants, fuel-switch	Not quantified	Yes	Severe
Renewables			
Solar	0.3	Yes	Possibly
Wind	0.2	Yes	Possibly
Geothermal	1	Yes	Possibly
Biomass	3.6	Yes	Possibly
Hydro	0,26	Yes	Possibly
District heating and buildings			
Save 10 PJ p.a. by modernising district heating system	Not quantified	Yes	No
Energy efficiency in buildings	Not quantified	Yes	No
Industry			
Energy efficiency	Not quantified	Unclear	Yes
Transport			
None mentioned			
Waste Management			
Landfill gas	Not quantified	Yes	Severe
Agriculture and Forestry			
Lower number of livestock	Not quantified	No 1)	No
Introducing advanced practices	Not quantified	No 1)	No
Afforestation	Not quantified	Unclear 2)	No
Total quantified potential	**5.36**		

1) Problematic monitoring and assessment process
2) Strong national engagement in this sector

Table 5: Overview of Reduction Measures in Hungary

4.4 Poland

4.4.1 Emission Projections

Poland's reduction target is 6% with 1988 as base year. Base year emissions were 565.24 Mt (Poland 2001: 31), so that the target is 531.326 Mt per year on average and thus a total amount of 2,656.63 Mt CO_2e for the whole commitment period.

NC3 points out that different expert groups worked independently from each other and used different models for developing emission projections, thus results might not be compatible with each other. Moreover, there are three different types of scenarios – a passive (with weak economic development), a baseline (stronger economic development "with measures") and a reduction scenario ("with additional measures") – but these are not provided for all sectors of the economy, the economy as a whole or all GHGs. In fact, the three scenarios are not even consistently named throughout. Furthermore, there is only a figure for overall CO_2 emissions in the baseline scenario but no corresponding figure for the reduction scenario nor any figure for overall GHG emissions (Poland 2001: 46-48). Still, it is clear that Poland's emissions will stay comfortably below its Kyoto target. Updated projections presented in the report of the UNFCCC in-depth review of NC3 indicate that 2010 emissions will be 24 to 26% below 1988 levels (UNFCCC 2003: 22).

4.4.2 Reduction Potential and JI Applicability by Sector

4.4.2.1 Conventional Energy Supply

Coal-fired power plants account for approximately 94% of the installed electricity generation capacity, amounting to 31 GW. Included in this figure are CHP power plants which apart from electricity (a 13% of the total electricity production) also provide heat for municipal as well as for industrial needs. Hydro power accounts for the remaining 6%, with 2 GWe installed capacity. In contrast to most of the other new EU Member States and EU Accession Countries, Poland currently does not operate nuclear power plants. Poland is a net exporter of electricity. In 2001, the exports totalled 9.666 GWh, whereas imports amounted to 2.330 GWh (EVA 2004d).

Due to the fact that generation capacity construction has been inconsistent over the past 30 years, the system is aging and problems are increasing. More than half of the current capacity was built in the 1970s (EVA 2004d). Accordingly, 20,000 MW of electricity generation capacity need rehabilitation and 3,500 have to be retired by 2005. The 55 plants producing 97% of total power production are coal-fired and produced about 160 Mt CO_2e of emissions in 1988, a figure that could rise to above 200 Mt by 2020. Just switching to natural gas could therefore yield a technical reduction potential of 60-80 Mt (SEA (2002: 110-113).

However, switching from coal to gas is part of the government's long-term strategy and the ongoing liberalisation of the energy market could strengthen the competitiveness of gas. This calls project's additionality into question. Moreover, Poland has not been granted any transitional arrangements for the implementation of the LCP Directive, so that the country will have to take measures to reduce SO_2 and NO_x emissions. Conversely, due to the transitional period granted the IPPC Directive is not as likely to have an impact. SEA (2002: 112f) considers that despite these factors there should still be a JI potential of several Mt CO_2e, consisting mainly of a few large and low-cost projects.

4.4.2.2 Renewables

There are favourable technical and economical factors which promote renewable energy sources in Poland. A shift in policies and public support away from traditional fossil fuel towards the development of renewable energy resources can be noted. The Polish government introduced an obligation to purchase electricity produced in co-generation with heat from unconventional or renewable resources in 2001. Tax incentives are in place to support production from renewable energy sources and the government has established a target of 7.5% of energy production from renewables in 2010. This ambitious target in combination with strong economic growth provides a healthy investment climate for renewable energy developers (Wynne et al. 2003: 5-11).

Solar

Solar energy is of low significance at the moment. The potential of solar energy in the country is an estimated 370 to 1,340 PJ per year. The figures vary greatly between studies, which imply that probably more research on technical and economical feasibility of solar energy projects in Poland is needed. However, due to the solar radiation in Poland it is unrealistic to expect a considerable growth in the utilisation of solar energy in the near future (EVA 2004d).

Wind

Poland has some of the best documented wind resources in Central and Eastern Europe. Some areas reach 1,000 W/m² in power density. Currently, 33 MW of wind capacity is installed with another 40 MW project under construction. Many international wind developers have secured land rights in northern Poland. The technical potential of wind power is estimated at about 4,000 MWe (Wynne et al. 2003: 5-11).

SEA 2002 (114) considers that the economically feasible potential amounts to 1,300 MWe installed capacity. Based on a planned Dutch JI project at Skrobotowo, a 60 MWe wind farm which is supposed to reduce emissions by 130,000 kt per year, they estimate that the feasible JI potential is “at least” 2.5 Mt CO_2e. A Danish project at Zagórze consisting of 15 wind turbines with 2 MWe each is supposed to reduce emissions by 60 kt per year (REC 2004: 267).

Geothermal

Poland disposes of sizable low enthalpy geothermal reserves. Currently, the country is utilising them mainly for space heating and balneology purposes. There are research projects to use geothermal energy for industrial purposes like timber-drying, greenhouse heating and fish farming. Currently, approximately 68.5 MWt are installed of which 26.2 MWt is from heat pumps. Total energy generation is up to 274 TJ per year (EVA 2004d).

REC 2004 (258) considers that the geothermal energy in Poland is particularly attractive for JI. Potential projects are of a considerable size. The cost of a 20 MW geothermal unit is estimated to be about 15 million USD. Due to these costs projects are likely to be additional.

The estimates of the technical potential range from 200 to 1,512 PJ (SEA 2002: 115), but the literature surveyed contains no data on which part could feasibly be used.

Biomass

Liquid and solid biomass is considered to be the main source of renewable energy in Poland, for both electricity and thermal energy production. Fuel-wood production is 1.5 Mill. m³ of which 70% is utilised. It is estimated that another 2.0 to 2.5 Mill. m³ fuel-wood can be harvested. Furthermore, wood waste from processing amounts to another 2 to 3.5 Mill. m³, of which currently 40% is utilised. Another 2 to 3 Mill. m³ waste wood accrues from construction and demolition activities (Wisniewski 2004: 19).

Other areas include the expanded use of biogas generated from wastewater treatment plants and agricultural and livestock activities. In addition, bio-fuels are an area that appears to be developing, because the increase of its use is a political priority of the Polish government. In 2001, approximately 209 t of bio-fuel were utilised for heating (EC BREC / EREC 2004 5; EVA 2004d).

Biomass technologies are relatively mature and the investment costs are lower than for other renewable energy technologies. According to Wynne et al. (2003: 5-11), the technical potential is about 4,000 MWe. However, there is no information on which part could feasibly be used.

A Dutch demonstration project is supposed to reduce emission by 1.6 kt per year by installing a biomass-fired boiler with 350 kWt in Jelenia Góra (REC 2004: 267).

Hydro

Although the southern part of Poland is mountainous, the installed capacity currently only amounts to 2 GW, as already mentioned above. The total technical potential is estimated at about 12 TWh per year, but the literature surveyed gives no indication as to which part could feasibly be utilised. The total technical potential of small hydro-electric power stations is an additional estimated 1.6 TWh per year. In this sector, about 200 MW of installed capacity can be refurbished or built over the next years which could lead to emission reductions of up to 1.25 Mt CO_2e (SEA 2002:113).

A Canadian JI project aims to reduce emissions by 25 kt per year by constructing 3 small hydro power plants with a maximum capacity of 1300 kW each at the Upper Odra. Another Canadian JI project aims to reduce emissions by 4,685 t per year by constructing a hydro power plant with a capacity of 900 kW at the Bobr river (REC 2004: 267).

4.4.2.3 District heating and Residential Sector

There is a long history of cogeneration in Poland, with capacity in the industrial and district heating sectors. District heating systems are operated in approximately 800 Polish cities, including the world’s largest network in Warsaw. District heating networks supply more than half of Poland’s households with heat and power, amounting to 134 TWh per year. The energy efficiency of the district heating systems is poor as a result of under-investment. Energy losses amount to 45% as compared with a typical figure of 10% in well-maintained systems (Maly et al. 2002c: 5; Kolar et al. 2001: 7).

Due to these circumstances, JI potential in the district heating area should be huge. The most interesting options seem to be modernising distributing networks, converting heat-only boilers to CHP and fuel switching from coal to gas or renewables. Moreover, most boilers are below 20 MW and thus are not covered by EU emissions trading (REC 2004: 256f).

However, the literature surveyed contains no data on the available potential. An indication is given by the PCF's Stargard Geothermal Heating project, which aims to replace a coal-based heat plant with a 14 MWt geothermal system and expects to reduce emissions by 341 kt over the period 2003-2012 (PCF 2002). A Finish project in Elblag aims to reduce emission by 113k t per year by building a new cogeneration plant which will be based on gas instead of coal as previously (REC 2004: 267).

4.4.2.4 Industry

Although the energy intensity per Gross Domestic Product (GDP) decreased by approximately 42% from 1991 to 2002, which was mainly due to stagnation of the energy conversion and industry sectors, energy efficiency is still lagging behind Western European countries. Cost-effective energy saving potential in industry (including energy sector) is estimated at 20 to 30% which is an estimated emission reduction potential of 50 to 75 Mt (FEWE 2004: 1).

NC3 states that in the manufacturing industries sector "additional measures arising from the introduction of climate policy instruments" are supposed to entail a reduction potential of 24 Mt CO_2e for 2010, but there is no description of these instruments (Poland 2001: 46f).

In the mining sector, there is probably significant reduction potential in the degasification of hard coal beds, but it has not been sufficiently researched (REC 2004: 255).

4.4.2.5 Waste Management

Poland has about 1,000 landfills, of which approximately 70 to 100 sites have extractable methane in concentrations greater than 240 million m³ per year. The potential for utilisation for energy purposes is very good, 15.4 MW of capacity has already been already installed. Still, at present only 125 landfills have installations for capturing landfill gas and energy is recovered at 25 landfills only (EVA 2004d; REC 2004: 261).

This denotes a huge emission reduction potential, but since the utilisation of collected gas for power generation has negative costs of -4.6 USD/t CO_2e and CHP has costs of 1 USD, the additionality of projects is questionable. Sites would have to be analysed individually in order to determine their JI potential (SEA 2002: 116).

Since Poland has been granted a transition period till 2012 regarding the Landfill Directive, its impact on JI potential should be limited. An already existing Dutch landfill gas recovery project in Konin aims to reduce emissions by 253 kt over the period 2004-2012 (SenterNovem 2004a).

4.4.2.6 Transport

NC3's "reduction baseline" scenario for the transport sector is supposed to entail a reduction potential of about 3 Mt CO_2e for 2010, but the corresponding measures are only vaguely described: decreasing the motorisation growth rate, decreasing mobility, decreasing the economy's transport intensity and decreasing the unit emissions of cargo transport (Poland 2001: 47). None of these measures seem to lend themselves to JI.

In 2002, 265 cities in Poland operated public transport systems. The total bus fleet numbers 10,000 and uses 770 t of fuel every day. 50% of buses have been in service for more than 10 years and only 30% less than 6 years. REC 2002 (263f) considers that it would be a viable idea for JI to modernise the bus fleet of cities with more than 100,000 inhabitants, of which there are 23 in Poland. However, they do not indicate the related reduction potential.

4.4.2.7 Agriculture and Forestry

REC 2002 (260) considers that there are emission reduction opportunities such as rationalising the use of nitrate fertilisation, increasing humus content in the soil, using biogas from liquid manure and biofuel production. Especially the latter two could in principle be relevant for JI. However, Polish agriculture is characterised by considerable fragmentation, so that potential projects are probably too small for JI application.

The government has set the target of increasing forest cover from the current 28.5% to 30% per 2020 and 33% by 2050. This implies an afforestation of about 680 000 ha by 2020 and would imply sequestration of about 3 Mt CO_2 (Poland 2001: 47f; REC 2004: 260f). A part of this potential could probably be tapped by JI, but the literature surveyed contains no further data.

4.4.3 Overall Potential and the Impact of EU Accession

Table 6 gives an overview of the reduction potential in Poland as derived from NC3 and the secondary literature surveyed. The potentials that have been quantified alone are estimated at well more than 100 Mt CO_2e p.a. By sector the following situation can be noted:

- 20,000 MW of electricity generation capacity need rehabilitation and 3,500 have to be retired by 2005. The 55 plants producing 97 per cent of total power production are coal-fired and produced about 160 Mt CO_2e of emissions in 1988, a figure that could rise to above 200 Mt by 2020. Just switching to natural gas could therefore yield a technical reduction potential of 60-80 Mt. However, switching from coal to gas is part of the government's long-term strategy and the ongoing liberalisation of the energy market could strengthen the competitiveness of gas. This obviously calls project's additionality into question.
- Potential emission reductions from wind energy are estimated at 2.5 Mt per year. There should also be a significant potential in other renewables, especially biomass, but apart from a supposed potential of 1.25 Mt in the small hydro sector it has not been quantified in the literature surveyed.
- The energy efficiency of the district heat system is poor as a result of under-investment. Energy losses amount to 45% as compared with a typical figure of 10% in well-maintained systems. The potential available from district heating should therefore be significant, but it has not been quantified, either.
- Regarding industry, NC3 states that "additional measures arising from the introduction of climate policy instruments" are supposed to entail a reduction potential of 24 Mt CO_2e for 2010, but further details are not given.
- The reduction potential at landfills is substantial but additionality is questionable since the utilisation of collected gas for power generation is supposed to entail negative costs. Sites would have to be analysed individually to determine in how far they are available for JI.

- Projects in public transport like the modernisation of bus fleets might be viable for JI, the total reduction potential in this sector is estimated at 3 Mt.
- Projects in agriculture are supposed to be too small for JI. In forestry, 3 Mt could be sequestered by 2020, but neither the amount available for the first commitment period nor the JI potential are indicated.

According to the draft NAP (Poland 2004: 14f), total CO_2 emissions in 2001 were 317.8 Mt. Of these, emissions from combustion installations in the energy sector accounted for 166.9 Mt and emissions in the processing industry for 64.3, i.e a total of 231.2 Mt. CO_2 emissions from the installations covered by the EU ETS make up 68% of the total national CO_2 emissions, amounting to an average 219.77 Mt per year in the period 1999-2002 (Poland 2004: 20, 33). One can therefore conclude that only about 5% of the two sectors affected by the EU ETS are not covered and that the remaining installations not covered will probably be to small to be viable for JI. Conversely, due to the transitional periods granted the IPPC and especially the LCP Directive are not likely to have an impact on any remaining JI potential.

Since Poland negotiated a transition period till 2012 for the Landfill Directive, the impact on the JI potential, if there is any, should also be limited. If connected to the grid, using landfill gas for electricity purposes would entail an indirect linkage with the EU ETS. However, the draft NAP for the period 2005-2007 establishes a sizable reserve of 9.9 Mt to account for projects and for “unidentified other sources”, i.e. sources which have not yet been identified as being covered by the EU ETS but may yet be (Poland 2004: 41). One can therefore assume that the reserve in the NAP for the period 2008-2012 will also be sufficient.

The situation regarding district heating and renewable energy projects will be discussed in the conclusions.

Sector/Measure	Reduction potential ($Mt\ CO_2e$ p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
Switching from coal to gas	60-80	Unclear 1)	Severe
Limit thermal and electric energy losses in transmission to below 20%	Not quantified	Yes	Severe
Rehabilitating 20 GW of installed capacity	Not quantified	Yes	Severe
Renewables			
Solar	Not quantified	Yes	No
Wind power up to 1300 MW installed capacity	2.5 Mt	Yes	No
Geothermal, technical potential 200 to 1.512 PJ p.a.	Not quantified	Yes	No
Biomass, technical potential about 4,000 MWe installed capacity	Not quantified	Yes	No
Renovating or building 1000 small hydro plants with total capacity of more than 200 MW	1.25	Yes	No
District heating and buildings			
Modernising distribution networks, converting heat-only boilers to CHP, fuel-switch	Not quantified	Yes	No
Thermal modernisation of blocks of flats, replacement and additional sealing of windows, changes of the current building thermal protection standards or expanding renew-able energy sources	8	Yes	Possibly
Industry			
"Introduction of climate policy instruments" (NC3)	24	Unclear	Yes
Improving Boilers	Not quantified	Yes	Yes
Energy efficiency	Not quantified	Yes	Yes
Waste Management			
Landfill gas	Not quantified	Unclear 2)	No
Transport			
Decreasing the motorisation growth rate, decreasing mo-bility, decreasing the economy's transport intensity and decreasing the unit emissions of cargo transport	3	No 3)	No
Agriculture and Forestry			
Improving agricultural practices, such as rationalising fertiliser use, increasing humus content in soil, biogas and biofuels	Not quantified	No 4)	No
Afforestation	3 Mt by 2020	Yes	No
Total quantified potential (lower estimate)	**98.75**		

1) Switch from coal to gas part of government's long-term strategy, liberalisation of energy market will strengthen competitiveness of gas
2) Utilisation of collected gas for power generation supposed to entail negative costs.
3) Monitoring problematic
4) Projects too small

Table 6: Overview of Reduction Measures in Poland

4.5 Slovakia

4.5.1 Emission Projections

Slovakia has committed to an 8% emission reduction with 1990 as the base year. Base year emissions were 72.53 Mt CO_2e (Slovakia 2001: 95), so that the target amounts to 66,728 Mt and thus a total amount of 333.638 Mt CO_2e for the whole commitment period.

In NC3, four different scenarios for the energy sector, industry, agriculture, forestry and waste management were established: a pessimistic "high scenario" as well as scenarios "without measures", "with measures" and "with additional measures". The "with measures" scenario includes the expected impact of adopted measures, especially the legislation in the area of air protection, and can therefore be taken as the baseline. For 2010, the difference between the "with measures" and the "with additional measures" scenario amounts to about 5 Mt CO_2e (Slovakia 2001: 68). The individual measures and their individual emission reduction potentials regarding fossil fuel combustion and transformation are broken down in detail as follows (Slovakia 2001: 57):

- the expansion of the utilisation of the use of combined cycles in power plants would reduce emissions from 40.128 to 39.314 Mt, i.e. by 0.814 Mt,
- the increase of renewables, specifically of the use of biomass from 2-9 to 10-18%, the increase of geothermal energy from 102 to 229 MWt and the increase of solar energy from 163 to 326 TJ would reduce emissions to 37.457 Mt, i.e. by a further 1.857 Mt,
- the decrease of energy consumption by about 30% through the thermal insulation of buildings would reduce emissions to 36.654 Mt, i.e. by a further 0.803 Mt,
- improvements in public transport would reduce emissions to 36.385 Mt, i.e. by a further 0.269 Mt.

Energy-related CH_4 emissions would be reduced by 0.155 Mt CO_2e and energy-related N_2O emissions by 0.25 Mt CO_2e if all of the above measures were implemented (Slovakia 2001: 58-62, 103).

4.5.2 Reduction Potential and JI Applicability by Sector

4.5.2.1 Conventional Energy Supply

The share of fossil fuels in primary energy sources is about 80%. 73% of primary energy supply is imported, including coal, crude oil, natural gas and nuclear fuels. The indigenous energy resources mainly consist of low-quality lignite and hydropower. Lignite usage in power generation will probably be phased out by 2010 (REC 2004: 351). There has in fact already been a marked shift from coal to gas: CO_2 emissions from coal combustion fell from 5.93 Mt in 1993 to 4.34 Mt in 2001, while CO_2 emissions from natural gas combustion increased from 3.18 Mt in 1993 to 4.08 Mt in 2001 (US DOE 2004c).

Installed electric generating capacity is about 7,800 MWe. Of these, hydro power plants account for 2,420 MWe, nuclear power plants for 2,390 MWe and thermal power plants for 2,390 MWe (US DOE 2004c).

Slovakia has two nuclear power plants, Jaslovevske Bohunice with four 440 MWe units and Mochovce with two 440 MWe reactors. On account of EU accession, the Slovak government negotiated decommissioning of Bohunice units 1 and 2 in the period 2006-2008 (US DOE 2004c). According to the draft NAP, the resulting decrease is going to be substituted either by existing capacities of solid fuel plants or by a new power plant (Slovakia 2004: 9).

The dominant electricity generator is Slovenské Elektráme a.s. (SE), which makes up 85% of Slovakia's annual electricity production. At present, 6,999 MWe are operated by SE, including the two nuclear power plants. Installed capacities of SE is split into 2,640 MWe nuclear power, 1,964 MWe thermal power and 2,395 MWe hydro power. SE is also responsible for the trade and sale of electricity (EVA 2004e: 1). SE is currently in the process of privatisation. It is expected that SE will be split into two companies. The nuclear power plants will be detached into a separate entity (US DOE 2004c).

The main task for SE is to comply with the EU standards of the *acquis communautaire*. Most of the power generating facilities are being reconstructed with fluidised-bed-combustion, which reduces emissions significantly (US DOE 2004c).

Due to these refurbishments and the ongoing shift from coal to gas, emission reduction options have probably already been utilised to a significant extent.

4.5.2.2 Renewables

One of the main goals in Slovak energy policy is to achieve a 6% share of energy production coming from renewable energy sources in 2010. In 2002, renewable energy sources represented only 1.6 % of the total primary energy consumption if large hydro power plants are excluded (EVA 2004f).

The overall technical potential for renewable energy resources is estimated at 87,754 TJ per year. This figure excludes large hydro power plants above 10 MW, including them, the potential increases to 107,820 TJ per year (ECB / EREC 2004: 7). The Slovak government has encouraged the expansion of renewable energy projects by offering tax-based incentives (Wynne et al. 2003: 5-13). Different support programmes are in place but the overall amount of funding available for renewable energy resources is very limited. The budget is insufficient to meet requests from applicants (ECB / EREC 2004: 17). Project additionality is therefore probably not affected substantially.

Solar

A considerable potential for solar energy in Slovakia lies in the field of passive solar systems, especially in the building's thermal quality, like double glazing, orientation of glass surfaces to optimal directions etc. There is also a significant potential in solar thermal installations. Conversely, photovoltaic installations are not viable under present conditions. The total technical potential for solar energy is estimated at 18,720 TJ (5,200 GWh) per year, of which photovoltaic installations account for only 210 TJ. 23.9% or 4,460 TJ of this potential are economically viable and the market potential, which takes market barriers into account, amounts to 6.8% or 1,270 TJ. 25 TJ per year are currently utilised (Marias 2003: 5; ECB / EREC 2004: 12-14).

Wind

Due to a lack of appropriate locations, the technical potential for wind energy in Slovakia is only 2,178 TJ (605 GWh) per year. There are no wind power generation facilities in operation. Despite improvements in economic viability, there are still important barriers to installing wind power plants due to the lack of information and interest on the part of the national utilities. The economic potential 550 is GWh and the market potential 150 GWh per year. The market potential is likely to be realised over the next decade (Marias 2003: 5; ECB / EREC 2004:14f).

Geothermal

Slovakia has good conditions for developing and using energy from thermal water. Geothermal reserves are primarily low to medium enthalpy, but there are some high enthalpy areas in the Kosice basin, suitable for electric geothermal development (Wynne et al. 2003: 5-13f). The unused technical potential of geothermal energy amounts to 21,456 TJ or 5,960 GWh per year. As the energy sources need to be close to the consumers, the economic potential probably is only 8,424 TJ per year, with a small share of co-generation, which amounts to 140 GWh per year or 6% of the economic potential. The market potential amounts to 4,355 TJ (ECB / EREC 2004: 15). However, the literature surveyed does not indicate the corresponding emission reduction potential.

Biomass

Beside hydro power generation, biomass utilisation is the most promising renewable energy resource in Slovakia. With 42% it has the highest share of the technical potential of renewable energy resources in Slovakia. This corresponds to an energy value of 40,453 TJ per year. The present use of biomass resources amounts to 11,491 TJ or 3,192 GWh per year (Marias 2003: 5; ECB / EREC 2004: 9f).

The upgrading of district heating systems based on fossil fuel combustion is economically viable, with a potential of 6,156 TJ. However, it would still be 17% more expensive than gas district heating. Another barrier is the long payback period of 16 years. The market potential is therefore estimated to be only 20% of the economic potential. Other options are using biomass for individual boilers in buildings, generating electricity through CHP, treating domestic waste and using waste wood for the wood-processing industry's own energy purposes. The total economic potential is estimated at 11,868 TJ and the market potential at 2,932 TJ (ECB / EREC 2004: 9f). However, the literature surveyed does not indicate the corresponding emission reduction potential.

Hydro

The total technical potential for hydro power is estimated at 23,785 TJ or 6,607 GWh per year (ECB / EREC 2004:11). 47.6% of Slovakia's hydroelectric power potential are already being utilised. Most of the hydroelectric power plants are operated by Slovakia's Vodné Elekttrárne Trecín (VET), a subsidiary of SE, that manages 21 hydro power plants in the Váh basin with a total installed capacity of 2,300 MWe (US DOE 2004c).

The technical potential for small hydro power is 3,722 TJ or 1,034 GWh per year. Of this potential currently 19.5% are exploited, leaving an amount of 831 GWh per year (2,995 TJ per year). Taking economic conditions into account, small hydro power plants are perfectly viable with a pay-back period of approximately 5 to 7 years. However, investors are currently reluctant to invest because of perceived risks related to unscheduled delays due to lengthy administrative procedures and potential opposition from environmental groups. The economic potential is therefore estimated at 749 TJ but the market potential at only 299. (ECB / EREC 2004: 11).

Based on the baseline emission factors established by the Dutch MOEA (2004: 42), the total technical hydro power potential equals a reduction potential of about 8.3 Mt CO_2e. However, there is no detail on which part might actually be used. The technical potential in small hydro power equals a reduction potential of 2.2 Mt CO_2e, the economic potential equals 0.55 Mt and the market potential 0.22 Mt.

4.5.2.3 District Heating and Residential Sector

Approximately 50% of Slovakia's inhabitants live in apartment buildings. 40% of these are supplied with heat and hot water by district heating systems. The total heat production amounted to approximately 29,520 GWh in 1997. In the early 1990s, district heating systems were privatised and are now owned and operated mostly by municipalities, joint stock companies and/or limited liability companies. Nowadays, the approximately 1,300 district heating systems are operated by 1,200 utilities. Using biomass in district heating could reduce emissions by 380 kt and using geothermal energy by another 160 kt CO_2e. However, a large part of this potential could be achieved at negative abatement costs, so that additionality is questionable. The same goes for the 680 kt CO_2e that could be achieved by using biomass for individual space heating (Maly et al. 2002d: 5-7).

In 1998, more than 30 small CHP units were in operation in the service and household sectors, with total electric capacity of 17 MW. 320 MW new CHP capacity is considered to be possible by 2010 (SEA 2002: 151). However, no details on the emission reduction potential are given.

4.5.2.4 Industry

Beside the large power plants, there are many smaller ones at industrial sites which co-generate electricity with heat. Some of these are fuelled with coal and are either obsolete, uneconomic or do not meet emission regulations (US DOE 2004c). 480 MW new CHP capacity is considered to be possible by 2010 in the industry sector (SEA 2002: 151).

Maly et al. (2002d: 7) indicate that using biomass for industrial energy purposes could reduce emissions by 320 kt CO_2e. However, the abatement costs given are negative, so additionality seems questionable. Conversely, increasing the use of combined cycles in industrial energy could reduce emissions by 220 kt at costs of 22-24 USD/t CO_2e. Combined cycles in public CHP could reduce emissions by 520 kt at 26-28 USD/t CO_2e. It is not clear which part of this potential could be tapped by JI.

4.5.2.5 Waste Management

Landfill gas is currently not recovered in Slovakia but many landfill sites are too small for recovery to be economic. If a current ERUPT landfill gas project covering 8 sites with an annual reduction potential of 100 to 120 kt CO_2e is carried out, the remaining potential will probably be rather limited (SEA 2002: 152). Slovakia negotiated a transitional period extending until 2013 for the Landfill Directive, which should therefore have no impact.

4.5.3 Overall Potential and the Impact of EU Accession

Table 7 gives an overview of the reduction potential in Slovakia as derived from NC3 and the secondary literature surveyed. The economic potentials that have been quantified alone are estimated at about 9 Mt CO_2e p.a. while the technical potential is above 50 Mt CO_2e p.a. By sector the following situation can be noted:

- Conventional energy supply is already undergoing a shift from coal to gas and major refurbishment is taking place. It is unclear in how far there is still cost-effective emission reduction potential.
- There is considerable scope for utilising renewable energies in Slovakia, but the emission reduction potential is not clearly quantified. The market potential for biomass might be 2.2 Mt. The market potential for small hydro might be 0.22 Mt and there is probably a significant potential in large hydro.
- Switching to renewable energies in district heating is supposed to entail a reduction potential of about 0.5 Mt, but additionality is questionable. Measures in individual buildings are also possible, but they either do not seem to be additional or are not sufficiently quantified.
- Upgrading power plants in industry or switching fuels are also possible measures. However, only the emission reduction potential entailed by increasing the use of combined cycles is given, it is supposed to amount to about 740 kt.
- JI potential regarding landfills is very likely to have already been exhausted by a Dutch JI project which covers 8 landfills and plans to thus reduce emission by 100 to 120 kt CO_2e p.a.

According to the draft NAP (Slovakia 2004: 7), CO_2 emissions from the installations covered by the EU ETS in 2002 amounted to 26.69 Mt. The draft NAP does not indicate which part of the energy and industry sectors is covered by the EU ETS. According to Slovakia's inventory for 2002, CO_2 emissions from fossil fuel combustion in the energy sector amounted to 12.8 Mt, CO_2 emissions from fossil fuel combustion in industry to 14.23 Mt, amounting to a total of 27.03 Mt. CO_2 emissions from industrial processes were at 3.47 Mt (UNFCCC 2004b: 15, 19). One can therefore estimate that almost every installation of the two sectors affected by emissions trading fall under the EU ETS. Moreover, Slovakia is planning to introduce a complementary national emissions trading system from 2008 onwards which is going to cover part of the installations not covered by the EU ETS (Slovakia 2004: 8). One can therefore conclude that nearly all the theoretical JI potential in the energy and industrial sector is going to be covered by one or the other form of emissions trading.

Slovakia also clearly states that emissions trading is the preferred policy instrument and that JI projects should rather focus on sectors not covered by emissions trading and on non-CO_2 greenhouse gases (Slovakia 2004: 8). This probably means that Slovakia is going to be very reluctant to approve JI projects at sources which are directly covered by emissions trading. As for projects which are indirectly connected to emissions trading, the draft NAP for 2005-2007 contains no reserve for JI, though this might change for the period 2008-2012. But for the moment one must probably conclude that projects will indeed be restricted to sources not connected with emissions trading and to non-CO_2 greenhouse gases. In this context, it probably does not even matter that the transition period for the LCP Directive ends in 2007 already.

As for renewables for electricity, one can assume that a large part of this potential will be connected to either form of emissions trading. Availability for JI therefore depends on the establishment of a JI reserve in the NAP for the period 2008-2012.

As for district heating, even if one can conclude from the Polish case (see conclusions) that district heating boilers are mostly not covered by the EU ETS, they might be covered by the complementary system.

Sector /Measure	Reduction potential (Mt CO_2e p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
Increased use of combined cycles	0.8	Unclear 2)	Severe
Fuel switch from coal to gas	Not quantified	Unclear 2)	Severe
Renewables			
Increasing solar energy from 163 to 326 TJ	1)	Yes	Possibly
Increasing biomass from 2 to 9 to 10 to 18%	1)	Yes	Possibly
Increasing geothermal energy from 102 to 229 MWt	1)	Yes	Possibly
Increased treatment of animal excrements to biogas up to 20%	1	Yes	Possibly
Solar, technical/market potential	14/1	Yes	Possibly
Wind, technical potential 605 GWh p.a., market potential 150 GWh p.a.	Not quantified	Yes	Possibly
Geothermal, technical potential 8,424 TJ p.a., market potential 4,355 TJ p.a.	Not quantified	Yes	Possibly
Biomass, technical/market potential	30/2.2	Yes	Possibly
Hydro, technical potential	8.3	Yes	Possibly
District heating and buildings			
Decrease of energy consumption by 30% through thermal insulation of buildings	0.8	Yes	Possibly
Install 320 MW new CHP capacity in buildings	Not quantified	Yes	Possibly
Industry			
Modernisation of small industrial power plants	Not quantified	Yes	Possibly
Install 480 MW new CHP capacity	Not quantified	Yes	Possibly
Increase use of combined cycles	0.74	Yes	Possibly
Waste Management			
Landfill gas	0.1-0.12	Yes 3)	Possibly
Increasing amount of waste waters from which nitrogen is eliminated	0.2	Yes	No
Transport			
Improvements in public transport	0.3	No 4)	No
Agriculture and Forestry			
None mentioned			
Total quantified potential (lower estimate)	**16.34**		

1) Total: 1.9
2) Energy sector already undergoing major refurbishment and shift from coal to gas
3) Already exhausted by Dutch JI project
4) Monitoring problematic

Table 7: Overview of Reduction Measures in Slovakia

4.6 Bulgaria

4.6.1 Emission Projections

Bulgaria has committed to an emission reduction of 8% with 1988 as the base year, which corresponds to an average annual target of 144.523 Mt, i.e. a total amount of 722.615 Mt CO_2e for the whole commitment period (Bulgaria 2002: 57, 97).

Bulgaria's annual emission surplus is about 11 Mt CO_2e in the "with measures" and 19 Mt CO_2e in the "with additional measures" scenario. The "with measures" scenario of NC3 includes "currently implemented and adopted policies and measures, and those measures that are related to the energy sector" and can therefore be taken as the baseline, which means that there is a further reduction potential of about 8 Mt per year (Bulgaria 2002: 13-15).

In detail, the differences between "with measures" and "with additional measures" are (Bulgaria 2002: 88):

- One less lignite fired unit in thermal power plant Maritza East 1;
- New 100 MW hydropower plant Tzenov Kamak;
- Doubling of the renewable capacity to 160 MW;
- Electricity export is kept at an annual level of 4,200 GWh instead of an increase to 8,000 GWh;
- Units 3 and 4 of Kozloduy nuclear power plant are to be decommissioned according to their technological lifetime – in 2010 and 2012, respectively;
- No commissioning of new power production units running on imported coal.

Bulgaria also states that there is yet further potential for emission reductions, but it cannot be realised due to lack of investments. The total is not further quantified, but a subtotal of 10-15 Mt CO_2e is supposed to lie in the area of energy efficiency in the industry and building sectors and in developing the natural gas household network (Bulgaria 2002: 97).

NC3 therefore indicates an overall reduction potential of about 20-25 Mt CO_2e, but the lack of detail does not allow a detailed assessment of the JI potential. This deficit is partly remedied by the available secondary literature.

4.6.2 Reduction Potential and JI Applicability by Sector

4.6.2.1 Conventional Energy Supply

Coal accounts for 33% of primary energy supply, crude oil for 29%, nuclear energy for 22%, natural gas for 13%, biomass for 2% and hydro energy for 1%. Electricity production is dominated by solid fuels (45%) and nuclear energy (41%), while renewable energies have a share of 7%, gas 5% and oil and oil products have 2% (REC 2004: 138).

Bulgaria depends on imports for 70% of its energy supplies. No domestic oil resources and only a small proven reserve of gas are available. Large deposits of low-quality brown coal, estimated at 3.0 billion tonnes of lignite and 200 Mt of sub-bituminous coal, are the major energy reserves (US DOE

2004d). Losing the lignite-based energy production would not only endanger the position as a major energy supplier in the region, but would also increase the Bulgarian dependency on imported energy sources (SEA 2002: 57).

Thermal power plants (TPPs) largely have a low efficiency of 25 to 30% and losses in transmission and distribution amount to about 20%. Moreover, more than 75% of TPPs are more than 20 years old, so that 40% of capacity is scheduled to be retired by 2010 (SEA 2002: 57).

The Bulgarian government ambitiously plans to establish the country as an energy hub in south-eastern Europe. Efforts have been made to restructure the energy sector, such as the unbundling of the national electricity company into fifteen different companies, seven generation and seven distribution and one transmission enterprise (IEA 2002: 104). All seven distribution companies are currently state-owned. A much smaller eighth distribution company, Zlatni Piasazi-Service, located in Varna, is already in private hands. There are more than 100 state-owned energy companies in Bulgaria; three quarters of them are to be sold by the government. Energy prices were raised to market levels and a similar price increase is expected for district heating (US DOE 2004d).

As a part of an Understanding Programme signed with the EU Commission, units 1 and 2 of the Kozloduy nuclear power plant (NPP) were closed in 2002 and Reactors 3 and 4 will be closed in 2006, each reactor having a capacity of 440 MWe. The share of nuclear energy in energy supply will therefore decrease, even if the construction of the Belene NPP with a capacity of 600 MW is finished as planned (US DOE 2004d). Conversely, the share of fossil fuels is going to increase since Bulgaria plans to construct several major fossil-fuel based power plant over the next 10 years, of which the largest one is the replacement of 900 MWe of capacity at the Maritsa East Minemouth power plant complex. Maritsa East accounts for two thirds of power generation from fossil-fueled plants and will increase from about 12 billion kWh to 19.5 billion kWh in 2005 and 21.0 billion in 2010. Rehabilitation of existing coal-fired plants Maritsa East, Bobov Dol, and Varna is also currently in progress (US DOE 2004d).

Due to major investment deals already made with AES (USA), Entergy (USA), RWE (Germany), and the European Bank for Reconstruction and Development (EBRD) regarding Maritsa East 1 and 3, Bobov Dol and Varna, only the Rousse power plant, which equals about 10% of total capacity, is left as JI potential. However, additionality can be questioned since the other investments were secured without having to rely on carbon value (US DOE 2004d; SEA 2002:59).

The World Bank (2001: 27-29) states that conversion to natural gas, backed by existing long-term contracts on Russian gas supplies, could be an option for the electricity sector. However, as SEA (2002: 60) points out, since Bulgaria is clearly focussing on coal and nuclear power, a major shift towards gas seems unlikely.

4.6.2.2 Renewables

Bulgaria is seeking for outside investments to expand generating capacities with renewable energies. In January 2002, Bulgaria passed an Ordinance on Setting and Applying prices and Rates of Electric Energy that requires power transmission and distribution companies to purchase all quantities of renewable power at preferential rates from independent power producers. According to a personal communication of a government representative, the ambition of the Bulgarian government is to reduce 7 Mt CO_2e by 2020 with renewable energy projects, mainly hydropower.

Solar

The literature (EVA 2004g; REC 2004: 153f; Wynne et al. 2003:5-4) identifies possibilities for solar thermal applications, but the potential is not quantified. Solar electricity production would be only viable with the use of subsidies or if the price for conventional energies increased significantly.

Wind

The natural conditions for using wind power in Bulgaria are very good. A state-of-the-art wind atlas is available and supports development. The technical potential of wind energy is estimated at 2,200 to 3,400 MWe (US DOE 2004d; EVA 2004g).

There is a German JI project in the pipeline which aims to establish a wind park with either 9.1 or 19.5 MWe installed capacity at the Peak Murgash, 20 km to the north-east of Sofia. Calculated for five years and based on the estimate that the baseline emissions for this project are 643 kg CO_2e/MWh, it is supposed to reduce emissions by 61 kt CO_2e in the former and 119 kt CO_2e in the latter version (Langrock et al. 2004: 35f).

Extrapolation from the emission reduction expected from this project indicates that the technical reduction potential available might range from 3 to 4.5 Mt per year, i.e. 15 to 22.5 Mt for the whole first commitment period. However, the literature surveyed gives no indication which part of this potential could viably be used.

Geothermal

Approximately 1,000 thermal springs and aquifers are available in Bulgaria. About 30% of the country's potential is being used for space heating, greenhouses, drinking water and balneology. In 1999, total installed capacity for these purposes was 95.35 MWt (Bojadgieva et al. 2000: 93). The overall potential in unexploited proven reserves is estimated to be 440 MWt or 14,122 TJ per year. There may also be a potential of up to 200 MWe for electricity generation from geothermal wells. Currently, there is no operating geothermal power plant in the country (Wynne et al., 2003: 5-4, EVA 2004g: 7).

Biomass

Biomass is also a promising opportunity for project development, since 60% of the overall land area consists of arable and agricultural lands, and 30% is covered by forest. Biomass accounts for 3.7% of calculated total energy consumption. The majority of biomass energy consumption exists in rural areas, followed by residential consumption of wood briquettes, produced from forest waste and sawmill by-products which amount to 2 million m^3 per year. Wastes generated from agricultural and farming activities are also produced in large quantities, which opens up further potential for energy generation from biomass (EVA 2004g).

The total technical potential identified amounts to about 30,000 GWh per year, of which 10-25% may actually be utilised (REC 2004: 156). Yet today only about 0.03 billion kWh energy is produced by utilisation of biomass (US DOE 2004d). Presupposing that this potential would be used for producing electricity for the grid, according to the baseline carbon emissions factors derived by the Dutch MOEA (2004: 42) it would yield emission reductions of about 11 to 27 Mt CO_2e during the period 2008-2012. A part of which could probably be tapped by JI, but the lack of data does not allow for a more specific determination.

Hydro

Currently, 2,057 MW of hydro power is installed in Bulgaria, together with a pumped-storage hydropower capacity of 1,098 MW. The total technical potential is estimated at 15 TWh per year (Lako et al. 2003: 61). Presupposing that this new capacity would be connected to the grid, according to the baseline carbon emissions factors established by the Dutch MOEA (2004: 42) it would yield emission reductions of about 54 Mt CO_2e during the period 2008-2012. However, there is no data regarding which part of this potential could actually be realised in economic terms.

The Tsankov Kamak hydro power project with a capacity of 80 MW is already being developed as a JI project for the Republic of Austria. The project envisages a reduction of 700,000 t CO_2e for the period 2008-2012 (REC 2004: 172).

The potential mentioned above does not include small hydro. SEA (2002: 61) notes that here a capacity of 180 MW can be reached until 2010 and 520 MW until 2020, which combined would result in emissions reductions of 13 Mt CO_2e.

A part of this hydro potential could probably be tapped by JI, but the lack of data does not allow for a more specific determination.

4.6.2.3 District Heating and Residential Sector

At present, there are 22 heat supply companies in 21 cities. About 570,000 homes with 1,650,000 occupants are heated centrally, which represents about 18% of Bulgaria's population (US DOE 2004d: 19). Nine companies have combined heat and power generation (CHP). Fourteen companies use gas as the main fuel. Four can only use fuel oil, and four burn mainly local coal (Akermanis 2004: 1f).

The district heating systems' equipment is worn-out and obsolete, resulting in low efficiency and high transmission losses. The government has developed an investment programme, according to which CHP expansion with natural gas and efficiency improvements at plant facilities would reduce 2 Mt of emissions, decreasing transmissions losses would amount to a further reduction of 0.5 to 2 Mt and individual heat consumption measurements and regulation to another 0.5 to 4 Mt. This amounts to an overall potential of 3 to 8 Mt CO_2e (SEA 2002: 62).

SEA 2002 (62) considers that possibilities for JI projects are concentrated on CHP expansion and rehabilitation of plant facilities since international financial institutions and domestic sources will cover investments in the distribution system. However, JI projects of the World Bank's Prototype Carbon Fund in Sofia and Pernik also include the rehabilitation of the transmission and distribution networks. The projects are supposed to generate about 1,5 Mt CO_2e in emission reductions over the period of 2004 to 2012 (Bulgarian MoEW 2004; PCF 2004). Considering that the network in Sofia already covers about 900,000 people or 60% of national district heating subscribers (REC 2004: 148f) and that the reduction in Sofia is supposed to amount to about 1.35 Mt (Bulgarian MoEW 2004), i.e 150,000 t per year, rehabilitating the district heating systems for the remaining 19 cities with their roughly 700,000 subscribers might amount to a JI potential of another 100 kt per year., i.e. 500 kt for the whole commitment period.

Rehabilitating buildings and individual heating systems should also entail a significant reduction potential, but the literature surveyed does not discuss this option. A JI project by the German RWE is planning to modernise the heating systems and improve the insulation of 93 kindergartens and schools in Sofia. The project is supposed to reduce emissions by 4.2 kt CO_2e per year (Langrock et al. 2004: 32-34).

4.6.2.4 Industry

The potential for efficiency improvements and fuel switching at boilers in industry, public buildings and apartment compounds outside district heating grids could be in the range of 30 to 40%. Unfortunately, data for the emission reduction potential is not available.

An indication is given by the JI project at the Svilosa pulp, rayon and cellulose plant that will reduce emissions by 500,000 t CO_2e by switching from coal to wood wastes and by thus reducing the enormous stockpile of wood wastes that has accumulated at the facility, which reduces CH_4 emissions from the said stockpile.

Another example is the ERUPT gasification project in the towns of Veliko Tarnovo, Gorna Oryahovitsa and Lyaskovets. The project will involve end users in industries, public and administrative sector plus households and aims to switch from carbon-rich liquid and solid fuels to natural gas. It involves construction of a gas main branch, and gas distribution networks, and restructuring of the end users' installations. The energy efficiency of the combustion installations will also be increased. The project is supposed to reduce emissions by about 500 kt in the period 2008 to 2012 (Senter Novem 2004b).

An Austrian project at a Nikopol cardboard plant aims to reduce emissions by 372,530 t by reducing electricity and heat consumption through efficiency measures and installing a CHP unit fired by natural gas or biomass (REC 2004: 172f).

REC 2004 (160f) also identifies a range of possible energy efficiency measures in the cement and ferrous metallurgy sectors, but does not indicate the corresponding emission reduction potential.

The ongoing restructuring and privatisation of industry is reducing the JI potential. Firstly, uneconomic facilities are shut down, and secondly, privatisation usually results in upgrading the efficiency of production facilities. The IPPC Directive will further reduce the JI potential because the use of the best available technology is required. But this requirement is under the condition that it is economically and technically viable in the given national context, and it is not plausible that very strict standards on energy efficiency will emerge in Bulgaria (SEA 2002: 63).

4.6.2.5 Waste Management

Bulgaria utilises only landfills for municipal waste disposal. The 720 registered landfills account for 99% of all collected solid waste. These landfills emit 4 Mt CO_2e annually and there are no landfills operating where methane is collected and utilised. Methane extraction might be applied to up to 70% of the controlled landfills, whereby below 50% of the methane emissions could be recuperated (SEA 2002: 64f; REC 2004: 165). The potential could therefore be above 1 Mt CO_2e annually.

However, according to the EU Landfill Directive, for which Bulgaria did not negotiate a transition period, methane from new and existing landfills must be collected and flared by 2009. If implemented strictly, this would limit JI eligibility to

- crediting in 2008,

- closed landfills,
- utilisation of the recovered gas for energy production.

Another option might be municipal waste incineration, but it faces the obstacle of high investment costs (SEA 2002: 65; REC 2004: 165).

REC (2004: 165) also identifies an urgent need to invest in the expansion, reconstruction and modernisation of wastewater treatment plants but does not indicate the corresponding emission reduction potential.

4.6.3 Overall Potential and the Impact of EU Accession

Table 8 gives an overview of the reduction potential in Bulgaria as derived from NC3 and the secondary literature surveyed. The potentials that have been quantified alone are estimated at more than 30 Mt CO_2e p.a. By sector the following situation can be noted:

- Thermal power plants largely have a low efficiency of 25 to 30% and losses in transmission and distribution amount to about 20%. Moreover, more than 75% of thermal power plants are more than 20 years old, so that 40% of capacity is scheduled to be retired by 2010. However, major refurbishments are already underway and shifting from coal to gas does not seem to be politically feasible. The remaining potential is therefore unclear.
- The technical reduction potential from renewable energies probably amounts to up to 100 Mt over the first commitment period. However, it is not clear which part of this potential could actually be utilised in economic terms.
- The district heating systems are worn-out and obsolete, resulting in low efficiency and high transmissions losses. Based on a planned JI project which is going to renovate the system in Sofia, one can estimate that rehabilitating all district heating systems might yield 250 kt of emission reductions per year. There should also be a significant potential in renovating buildings and individual heating systems, but no figures are available.
- The potential for efficiency improvements and fuel-switching at boilers in industry is estimated at 30 to 40%, but here as well no emission reduction figures are given.
- The amount of landfill gas that could be utilised seems to range at 1 Mt per year.

Bulgaria will accede to the EU not earlier than 2007. The NAP will not be developed before that time. One can assume that a significant share of emissions from the energy and industrial sectors is going to fall under the EU ETS and thus will not be available for JI, but the data surveyed does not allow for a concrete estimate. Conversely, since Bulgaria negotiated a transition period till 2011 for the IPPC Directive and until 2014 for the LCP Directive, their impact on the JI potential in the energy and industrial sectors is probably going to be limited, especially when considering that best “available” technology will probably mean a relatively low standard in Bulgaria’s case.

Due to the Landfill Directive, JI potential at landfills is restricted to closed landfills and utilisation of landfill gas for energy purposes, but no figures for the corresponding emission reduction potential are available. Moreover, if the energy generated from landfill gas displaces energy from sources within the EU ETS, the viability of projects depends on Bulgaria’s establishing a sufficient reserve for indirect linkage in its NAP.

The situation regarding district heating and renewable energy projects will be discussed in the conclusions.

Sector/Measure	Reduction potential (Mt CO_2e p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
One less lignite fired unit in TPP Maritza East 1	1)	No	No
Energy export kept at annual 4,200 GWh	1)	No	No
Units 3 and 4 of Kozloduy NPP decommissioned according to technological lifetime	1)	No	No
No new power production units running on imported coal	1)	No	No
Developing natural gas household network	2)	Yes	No
Rehabilitation and upgrading of existing plants	Not quantified	Unclear 3)	Severe
Small co-generation	Not quantified	Yes	No
Fuel switching	Not quantified	Unclear 4)	Severe
Renewables			
New 100 MW HPP Tzenov Kamak	1)	No	Possibly
Doubling renewable capacity to 160 MW	1)	Yes	Possibly
Solar	Not quantified	Yes	Possibly
Wind, technical potential	4.5	Yes	Possibly
Geothermal, unexploited potential of 14.122 TJ p.a.	Not quantified	Yes	Possibly
Biomasss, technical potential 30,000 GWh, economic potential 3,000 to 7.500 GWh p.a.	Not quantified	Yes	Possibly
Large hydro, technical potential 15 TWh p.a.	54 in 2008-2012		Possibly
Increasing small hydro capacity to 180 MW in 2010 and 520 MW in 2020	13 by 2020	Yes	Possibly
District Heating and Buildings			
Rehabilitation of plants, expansion of CHP, rehabilitation of distribution networks	0.25	Yes	No
Energy efficiency in buildings	2)	Yes	No
Industry			
Energy efficiency, not further specified	2)	Yes	Yes
Replacement or rehabilitation of boilers	Not quantified	Yes	Possibly
Waste Management			
Unspecified measures according to NC3	2)	Unclear	Unclear
Landfill gas	1	Yes	Severe
Transport			
None mentioned			
Agriculture and Forestry			
None mentioned			
Total quantified potential	**About 32**		

1) Total: 6
2) Total: 10-15
3) Major refurbishment already underway
4) Shift away from coal does not seem to be politically feasible

Table 8: Overview of Reduction Measures in Bulgaria

4.7 Romania

4.7.1 Emission Projections

Romania committed to an 8% reduction of its GHG emissions with 1989 as the base year. Base year emissions were 273.787 Mt CO_2e (Romania 1998: 34), leading to an average annual target of 251.88 Mt and thus a total amount of 1,259.42 Mt CO_2e for the whole commitment period.

In NC2 Romania distinguishes between three different scenarios: a "reference scenario" with business as usual, a "low scenario" with limited restructuring and modernisation of industry which can be taken as the baseline and a "high scenario" including significant emission reduction measures. The difference between the low and the high scenario amounts to about 39 Mt CO_2e per year (Romania 1998: 49-61). Appendix 2 of NC2 lists reduction measures but it does not become clear which belong to which scenario. The UNFCCC in-depth review clarified that they all belong to the high scenario (UNFCCC 2000: 20). Unfortunately, their descriptions are relatively vague and the reduction potential of 39 Mt CO_2e they are supposed to entail is not broken down into individual measures (Romania 1998: Appendix 2).

4.7.2 Reduction Potential and JI Applicability by Sector

4.7.2.1 Conventional Energy Supply

Of the 22.65 MW electricity generation capacity installed in 2001, hydro power plants accounted for 6.08 MW, nuclear for 0.71 MW and conventional thermal plants for 15.86 MW (REC 2004: 284).

The largest thermal power plants are fuelled by coal. The four largest are all greater than 1,000 MWe installed capacity, and the 25 largest thermal-electric power utilities represent 95% of the fossil-fuel generating capacity. Most of the technology of the thermal-electric power plants is from the 1960s and early 1970s and increasingly in need of refurbishment or replacement. It is estimated that 8,000 MWe of the thermal electric capacity will need to be replaced or rehabilitated by 2010. The Romanian government already intends to rehabilitate 10 thermal power plants with a combined capacity of 1,360 MWe by 2005. Older plants with a combined capacity of 5.900 MWe will probably be shut down. Long-term investment needs are estimated at 4-5 billion US-$, of which 0.9 billion are needed for the modernisation of transmission and distribution networks (US DOE 2004e; SEA 2002: 124f). However, the literature surveyed does not indicate the emission reduction potential associated with these measures.

Losses in power transmission and distribution amount to 13% of all electricity dispatched. However, the costs and additionality of projects improving the network are unclear (SEA 2002: 130).

Switching from lignite-fuelled power plants to gas would also be an option, but SEA (2002: 126) considers that the political constraints will not allow this to take place on a large scale: Maintaining a role for the coal industry is one of the government's priorities and even the limited ongoing restructuring of the mining sector has already led to violent clashes.

4.7.2.2 Renewables

Hydro energy and biomass are already being utilised to a significant extent in Romania and there is considerable potential for further expansion. The "Roadmap of the Romanian energy sector" has established ambitious targets for the use of renewables, but due to the lack of financial resources this is rather a declaration of political will (REC 2004: 291-293). The baseline of projects is therefore not affected.

Solar

Installation and research activities regarding solar energy were abandoned in the 1990s due to the economic transformation. However, there is a relatively high solar insolation of 1,100 to 1,300 kWh/m²/year in Romania (EVA 2004h). The technical potential of solar heating amounts to 60 PJ per year, which could replace about 50% of households' hot water supply or 15% of the current thermal energy used for heating. Under current legislation, it is planned to install 2.6 million m^2 of solar collectors by 2005, producing 1 TWh thermal energy and reducing emissions by 1 Mt CO_2e. The government's objective for photovoltaic applications is 1.86 GWh per year by 2010. Due to the high cost of connection to the grid, they may be an attractive option for isolated consumers (REC 2004: 293-295).

However, Wynne et al. 2003 (5-12) consider that high capital costs of solar equipment and lack of incentives may render solar projects uneconomical. The JI potential regarding solar energy projects may therefore be rather mediocre.

Wind

Romania ranks as one of the most promising countries in Central Europe for the development of wind energy projects. Wind resources are well documented and support a broad range of applications from autonomous units in rural areas to large off-shore potential. Large areas with wind speeds above 11 m/s have been identified. At the moment, there is only one wind project at Constanta, Black Sea, with four 2 MW turbines (EVA 2004h). According to Wynne et al. (2003: 5-12), the total estimated mid-term wind power potential is 3,000 MW. The Romanian government has established the target to install 200 MW by 2010 (REC 2010: 297).

Geothermal

In the western region of Romania there is some potential for geothermal applications. At present about 137 MWt are installed at 61 active wells producing hot water. Proven reserves including already drilled wells contain a potential of about 200 PJ for 20 years (EVA 2004h). High enthalpy areas to support electricity generation from geothermal resources are limited so that heating is the main are of application (Wynne et al. 2003: 5-12).

REC (2004: 305) identifies 5 areas with especially high potential: the Caciulata locality and the Calimanesti locality with 6.9 MW each, the Tomnatec locality with 6.3 MW, the San Nicolau Mare locality with 4.9 MW and the Santandrei locality with 24.7 MW. Moreover, methane emissions at geothermal wells in Romania are very high. Methane capture and flaring or use for electricity production is therefore part of the emission reduction potential. However, there is no information on the potential amount (REC 2004: 307f).

Biomass

There are also good opportunities for biomass utilisation in Romania. About 40 % of the country is covered by arable land and 27% by forests. Top priority is the use of biomass for thermal applications, displacing the use of oil. District heating is the most immediate and low-cost biomass application, especially for CHP plants, industrial co-generation, and co-firing. The technical potential in biomass utilisation could be five times as high as the consumption in 2000, which accounted for 8% of total primary energy consumption, i.e. 1.689 PJ, with an installed capacity of over 4,000 MWt. There are no special governmental incentives for the implementation of biomass projects (Wynne et al. 2003: 5-12, EVA 2004h: 10; REC 2004: 303).

Hydro

Romania has many rivers, which are already being utilised to a significant extent to produce hydro power. There are 362 plants with a total installed capacity of 6.120 MW, which is 27.9% of the overall installed capacity. In 2000, they produced 14,778 GWh, i.e. 28.5% of the total energy production. The government has established the target of adding another 840 MW installed capacity by 2015 (REC 2004: 298f).

But the actual opportunities may be even greater. The total available potential, including the part that has already been developed, amounts to 14,800 MWe installed capacity, with an output of 40 TWh per year (US DOE 2004e). There are about 35 large-scale hydroelectric installations comprising a total capacity of 1,400 MWe which have been stalled due to lack of funds and are looking for investment (SEA 2002: 126). Hidroelectrica recently issued a tender to privatise 21 such plants with a combined capacity of 666 MWe, which could result in a production of an additional 2,700 GWh per year. Hidroelectrica is also looking for partners for other 14 hydropower projects with a combined capacity of 780 MWe. These projects will include construction completion, upgrading, and management (US DOE 2004e). Moreover, there is a potential of 1,060 MW of small-scale hydro, of which 332 MW are already utilised and 125 MW are under construction (SEA 2002:126).

A Dutch JI project aims at modernising 3 of the existing 6 units at the Portile de Fier I hydro power plant and increasing their capacity from 175 to 194.5 MW. It is supposed to deliver about 1.6 Mt CO_2e of emission reductions over the first commitment period. Another Dutch project aims at modernising 4 of the existing 8 units at the Portile de Fier II hydro power plant and increasing their capacity by 22 MW. The project is expected to deliver about 850,000 ERUs over the first commitment period. Yet another Dutch project aims at completing the unfinished Surduc-Nehoisu hydro power plant, with a capacity of 55 MW and a yearly output of 153 GWh. It is supposed to deliver about 600,000 ERUs during the first commitment period (REC 2004: 273f).

Extrapolating from these figures, one can conclude that the realisation of the remaining technical potential might reduce emissions by about 20 Mt CO_2e per year. Realising the 1,400 MWe the construction of which has been stalled and which obviously lend themselves to foreign investment might reduce emissions by about 3 Mt. There are probably also other opportunities for developing large-scale hydro power facilities. Realising the roughly 600 MW of small-scale hydro capacity which are not yet developed might reduce emissions by 1.3 Mt.

The JI potential in hydro could therefore be well above to 4 Mt annually.

4.7.2.3 District Heating and Residential Sector

251 towns and cities have district heating networks, as a result of which approximately 30% of Romania's total building stock receives heat and hot water through district heating. About 60% of the country's total heat demand is covered by district heating sourced from co-generation plants (Energy Charter Secretariat 2002: 17).

However, dissatisfaction with the service has been growing, resulting in low connection rates and uncontrolled disconnection. District heating is inefficient in all aspects of heat production, transport, distribution and end-use. Losses in transmission and distribution amount to 30 to 35%. Since 1999 emission from CHP and heat plants were about 30 Mt CO_2, the reduction potential might be above 10 Mt (SEA 2002: 127f).

There is in fact already a large number of projects in the pipeline. A Swiss JI project aims at rehabilitating the district heating systems in the cities of Buzau and Pascani by installing one cogeneration unit and three gas-fired boilers in both cities and improving the distribution system. The project is supposed to reduce emissions by 144 kt CO_2e per year. Another Swiss project intends to upgrade the distribution system in Bucharest with the result of 67 kt to 70 kt CO_2e of emission reductions per year (REC 2004: 272).

A Danish project in the towns of Gheorgheni, Vatra Dornei, Vlahita, Huedin and Intorsura Buzaului aims to implement new automatically controlled boiler systems and upgrade the distribution system, thus reducing emissions by about 510 kt CO_2e over ten years. A Dutch project in Targoviste intends to build a new 26.4 MWe cogeneration plant, rehabilitate the existing heat-only boilers, upgrade and partly replace the heat transport and distribution networks and carry out demand-side management activities. The project aims to thus reduce emissions by 307.2 kt CO_2e per year. A Norwegian JI project aims to rehabilitate the district heating system in Fagaras, including 8 thermal plants as well as the distribution system, delivering about 170,000 ERUs over the period 2008-2012 (REC 2004: 272-275).

The residential sector also offers very significant potential for energy conservation, which could be realised on a cost-effective basis. Pay-back periods for investments in thermal rehabilitation of about 8 to 9 years are a clear indicator of the economic benefits of these measures. However, the problem may still be the huge amount of investment needed (Energy Charter Secretariat 2002: 34). In addition, pay-back periods might be too long for JI, taking into account project lead times and the duration of the first Kyoto commitment period of five years.

4.7.2.4 Industry

REC (2004: 307) points out that there are 550 obsolete biomass-fired thermal plants in industry that urgently need reconstruction and upgrading. However, they do not indicate the corresponding reduction potential.

There is also a massive potential for energy savings in industry, especially in the areas of iron, steel, chemical and petrochemicals, which account for 55% of overall energy consumption in industry. The potential amounts to 20% in cast iron production, 20% in steel production in electrical furnaces, 10-30% in ammonia production, 15-30% in sodium hydroxide production, 12-50% in the petrochemical industry and 25-45% in pulp and paper production. However, further details on the type of savings, costs and emission reduction potential are not available (SEA 2002: 128f).

A Dutch JI project aims to modernise the production of two cement plants in Bicaz and Deva, thus reducing emissions by about 450 kt CO_2e over the period 2008-2012 (REC 2004: 274).

4.7.2.5 Waste Management

Almost all urban waste is disposed of in landfills and hardly submitted to any pre-treatment process. In 2001, methane emissions from these landfills amounted to 337.9 kt, i.e. 7.1 Mt CO_2e. About 80% of the landfills are relatively small, with a size of 0.5 to 5 ha, but 20% which are used for the disposal of waste from the larger cities are 5-20 ha large. Methane emissions from waste water treatment were another 106.9 kt, i.e. 2.25 Mt CO_2e (REC 2004: 314-320).

However, Government Decision No. 162/2002 provides for the reduction of landfilled biodegradable waste, which is going to lower the baseline methane emissions. Moreover, the decision introduced the obligation that from 2010 all operating as well as closed landfills will have to extract landfill gas and flare or utilise it, if the latter is economically feasible (REC 2004: 324).

JI projects are therefore restricted to crediting in 2008-9 and to utilising landfill gas for power generation where this is not economically feasible. The remaining potential would therefore have to be assessed on a site-by-site basis. That there is still some potential is demonstrated by a Dutch project which aims to extract methane and convert it into electricity at four landfills and thus deliver 750,00 ERUs (REC 2004: 275).

4.7.2.6 Agriculture and Forestry

There is considerable potential for afforestation. Since most state activities also collapsed with the collapse of communism, most projects would probably be additional. REC 2004 (313) estimates that 5,000-9,000 ha could additionally be planted per year, which could lead to an annual average sequestration of 1 to 1.5 t C/ha and year. This would lead to a JI potential of about 75,000 to 200,000 t CO_2 for the first commitment period.

A PCF project aims to reforest 6,728 hectares, resulting in a sequestration of about 1 Mt CO_2 over 15 years (REC 2004: 276).

4.7.3 Overall Potential and the Impact of EU Accession

Table 9 gives an overview of the reduction potential in Romania as derived from NC3 and the secondary literature surveyed. The economic potentials that have been quantified alone are estimated at more than 50 Mt CO_2e p.a. By sector the following situation can be noted:

- It is estimated that 8,000 MWe of the thermal electric capacity will need to be replaced or rehabilitated by 2010. Losses in power transmission and distribution amount to 13% of all electricity dispatched, but the costs and additionality of projects improving the network are unclear. Switching from lignite-fuelled power plants to gas would also be an option, but it seems likely that political constraints with regard to employment and security of supply considerations will not allow this to take place on a large scale.
- The emission reduction potential from utilising hydro power should be well above 4 Mt per year. The potential of other renewable energies, notably biomass, geothermal and wind energy, is also supposed to be very high, but no figures are available.

- The potential from rehabilitating the transmission and distribution networks of district heating systems is estimated at 10 Mt per year. Rehabilitating or replacing power plants should also offer potential, but no figures are given.
- In industry, there are about 550 obsolete biomass-fired thermal plants that urgently need reconstruction and upgrading. There is also a massive potential for energy savings in the areas of iron, steel, chemical and petrochemicals, which account for 55% of overall energy consumption in industry. However, further details on the type of savings, costs and emission reduction potential are not available
- Almost all urban waste is disposed of in landfills and hardly submitted to any pre-treatment process. In 2001, methane emissions from these landfills amounted to 337.9 kt, i.e. 7.1 Mt CO_2e.
- There is considerable potential for afforestation. An "additional" 5,000 to 9,000 ha could be planted per year, which could lead to an annual average sequestration of 1 to 1.5 t C/ha and year. The result would be a sequestration of about 270 to 730 kt CO_2 for the first commitment period.

Romania will accede to the EU not earlier than 2007. The NAP will not be developed before that time. But given that the largest 25 thermal-electric power plants account for 95% of fossil-fuel generating capacity (US DOE 2004e), it seems likely that a huge part of the energy sector is going to be covered by the EU ETS. The potential emission reductions at power plants and processes in industry are also supposed to be significant, but here as well no figures are given. Again, a significant part of this potential might fall under the EU ETS.

Romania has requested the following transition periods: until 2012 for the LCP Directive, until 2015 for the IPPC Directive and until 2017 for the Landfill Directive. If these requests were granted, the country's JI potential at the energy and industry installations would basically not be affected (EU Commission 2004b: 99f).

As for landfill gas, however, even though Romania has requested a transition period till 2017 for the Landfill Directive, Government Decision No. 162/2002 introduced the obligation that from 2010 all operating as well as closed landfills will have to extract landfill gas and flare or utilise it, if the latter is economically feasible (REC 2004: 324). From 2010, the JI potential in landfill gas is thus reduced to power generation in cases where it is not feasible without ERU revenue and would have to be assessed on a site-by-site basis. Such projects would probably be connected to the grid and thus be indirectly linked to the EU ETS. They therefore depend on the establishment of a sufficient JI reserve.

Sector/Measure	Reduction potential ($Mt\ CO_2e$ p.a.)	Suitable as JI	Accession Impact
Conventional Energy Supply			
Improving efficiency or switching fuels from lignite to natural gas in electricity generation	Not quantified	Unclear 2)	Severe
Upgrading the natural gas network	Not quantified	Yes	No
Upgrading the electricity network	Not quantified	Yes	Severe
Increase number of cogeneration plants up to a capacity of 455 MW	1)	Yes	Yes
Renewables			
Solar, technical potential 60 PJ, 1.86 GWh per year from photovoltaics by 2010	Not quantified	Yes	Possibly
Wind, technical potential 3,000 MWe installed capacity, government target 200 MWe by 2010	Not quantified	Yes	Possibly
Geothermal, proven reserves 200 PJ	Not quantified	Yes	Possibly
Multiply biomass' share of total primary energy consumption by five	Not quantified	Yes	Possibly
Hydro, technical potential	20	Yes	Possibly
Finish 35 stalled large-scale hydropower projects with total capacity of 1,400 MW and realise small-scale hydro potential of 1,060 MW	4	Yes	Possibly
District heating and buildings			
Upgrading the district heating system	10	Yes	No
Improve thermal insulation of all new flats supplied with heat from centralised sources, reduction of demand by 11.1 GWh per year and residence	1)	Yes	No
Reduction of maximum hourly heat demand by 8% for 100,000 existing residences and 28% for another 100,000 existing residences.	1)	Yes	No
Industry			
Energy efficiency improvements at small boilers	Not quantified	Yes	Yes
Energy savings, potential 20% in cast iron production, 20% in steel production in electrical furnaces, 10-30% in ammonia production, 15-30% in sodium hydroxide production, 12-50% in the petrochemical industry and 25-45% in pulp and paper industry	Not quantified	Yes	Yes
Modernise installations	1)	Yes	Yes
Increase average energy intensity to 2.09 kg ce/$, with energy demand at 33.5×10^6 tce	1)	Yes	Yes
Waste Management			
Collect and utilise landfill gas	3-4	Yes	Severe
Transport			
Reduction of transport of goods as result of industrial restructuring	1)	No 3)	No
Increase fuel efficiency of vehicle fleet	1)	No 3)	No
Improve public transport	1)	Yes	No
Agriculture and Forestry			
Improve nutrition quality of animal feed	Decrease by 5-10% 1)	No 4)	No

Improve use of nitrogen fertilisers	Decrease by up to 25% 1)	No 4)	No
Reduce energy consumption in greenhouses by 3% through modification and retrofitting	1)	No 4)	Possibly
Optimise use of agricultural machines through unification of fields and re-organisation of activity and thus lower fuel demand by 15%	1)	No 3)	No
Modernise livestock farms in order to reduce electricity demand by 8%, heat demand by 8% and fuel demand by 10%	1)	No 4)	Possibly
Increase forest area from 100,000 to 190,000 ha and optimise structures	1)	Yes	No
Total quantified potential	**77**		

1) Total: 40
2) Shift away from lignite does not seem to be politically feasible
3) Monitoring problematic
4) Project size too small

Table 9: Overview of Reduction Measures in Romania

Conclusions

The Linking Directive's impact on the demand side of CDM and JI is twofold: on the one hand, it creates a new demand for CDM and JI by allowing the installations covered by the EU ETS to use CERs and ERUs for their compliance. On the other hand, it requires EU Member States to impose a limit on these installations' as well as on their own use of CDM/JI. The Member States have left themselves considerable flexibility in defining this limit while on the other hand the price for EU Allowances is currently three times as high as that for CERs/ERUs, which makes the latter a very attractive alternative. However, the EU ETS market does not yet seem mature enough to give a reliable picture and it remains to be seen what the national caps on the use of CERs/ERUs will be.

As for the supply side, the CDM and JI potential has been reduced by the Linking Directive's baseline and double counting provisions. CDM and JI projects within the new EU Member States and EU Accession Countries will now have to calculate their baselines on the basis of the *acquis communautaire*. To this respect, three kinds of projects can be distinguished:

- first, there are projects which are not affected because the *acquis communautaire* does not contain regulations that are relevant,
- second, there are projects which can no longer be carried out as CDM or JI projects because they have now become part of the baseline and thus are no longer "additional",
- third, there are projects which would still be additional, but they would now generate fewer CERs or ERUs because the baseline has been raised. In some cases they might still be viable, in others the amount of certificates will now be too small to carry them out.

The concrete impact for a project depends on the relevant legislation applicable to this project as well as on the transition periods negotiated by the new Member States and EU Accession Countries.

As for the Linking Directive's double counting provisions, again three kinds of projects must be distinguished, as outlined in Table 10.

Type	Description	Regulation (new Article 11(b) ET Dir ective)
1	JI projects with direct links to the EU ETS; i.e. project activities that are undertaken at installations covered by the EU ETS, e.g. the refurnishing or fuel switch in a power plant (above 20 MW).	ERUs may be issued if an equal number of EU Allowances is cancelled by the operator of the respective installation.
2	JI projects with indirect links to the EU ETS; i.e. project activities that have no direct link to installations covered by EU ETS but lead to emission reductions at such installations, e.g. the development of a wind park leading to the displacement of electricity from a power plant within the EU ETS or the improvement of energy end-use efficiency leading to a decreased withdrawal of electricity from a power plant within the EU ETS.	ERUs may be issued if an equal number of EU Allowances is cancelled from the national registry of the respective member state.
3	JI projects without links to the EU ETS; i.e. project activities reducing emissions at sources that are not connected to the EU ETS, e.g. renewable energy projects that are not connected to the national grid or projects in the agriculture or transport sectors.	Do not pose a problem and are therefore not regulated by the Linking Directive. ERUs may be issued without restriction.

Table 10: Types of Linkages between JI and the EU ETS

Following the results of existing studies, potentials for reducing greenhouse gas emissions in Central and Eastern European countries are substantial. The largest and most cost-effective emission reductions can be found in the waste sector and in the power sector of the analysed countries. Further large potentials are in district heating systems, renovation of dwellings, and expansion of renewable energy.

However, the interplay of the introduction of the EU ETS in the countries acceding to the EU and the baseline and double counting provisions of the Linking Directive significantly reduces the JI potential in the Central and Eastern European countries. By project type, the following situation can be noted.

The reduction is especially severe in the **energy and industry sectors**, CO_2 emissions of which are almost totally subject to the EU ETS. Even in those countries which have negotiated generous transition periods the fact remains that most emissions from these two sectors will be covered by the EU ETS. JI projects within the EU ETS are in theory still possible, but are in competition with the EU ETS. Moreover, the Czech Republic and Slovakia do not seem to be favourably disposed towards allowing such projects with direct linkage.

JI potentials among the extensive potential for emission reductions in the **waste sector** are affected directly by the implementation of the Landfill Directive which renders most of the potential to be baseline.

Renewable electricity projects connected to the EU ETS will depend on the establishment of sufficient reserves in the NAPs to be viable. The sources surveyed do not allow an estimate of which part of potential projects will feature indirect linkage. But one can assume that electricity generation projects which are large enough to be viable for JI will for the most part probably be connected to the grid. The same applies to **landfill gas projects generating electricity**, which in four of the countries considered is the only remaining JI option in the waste sector.

Energy efficiency projects and smaller renewable energy projects typically do not reach critical size to be viable for JI. Their establishment will thus depend on instruments to bundle projects. If these succeed, they might make up a significant share of the remaining potential available for JI in the countries analysed.

Projects in **district heating** are considered to entail substantial emission reduction potential. According to REC (2004: 257), the situation in Poland is such that most boilers are below 20 MW and thus not covered by the EU ETS. JI potential should therefore not be much affected by the EU ETS, neither directly nor indirectly. Since the former socialist countries tend to be rather similar in their basic infrastructures, the same probably also holds for the other countries considered, except for Slovakia with its complementary emissions trading system.

As outlined in the countries' NAPs, emissions from installations falling under the EU ETS account for 50% or even more of total national emissions. When also taking into account the reduced JI opportunities in the landfill area, one can estimate that at least half of the JI potential in the new EU Member States and EU Accession Countries has been or will be removed by EU Accession. The data surveyed does not allow for a quantitative estimate. Interestingly, landfills seem to be the only areas that are directly impacted by the Linking Directive's baseline provision. The other directives considered mainly address the energy and industry sectors, which are mostly removed from JI by the EU ETS anyway.

However, one should note that it was always clear that the Central and Eastern European countries were going to join the EU and thus would have to adopt the *acquis communautaire* and participate in EU emissions trading. Many of the *acquis communautaire*'s requirements have in fact already been implemented in the new EU Member States and EU Accession Countries. Therefore, any hopes for JI that may have been dashed now – by the adoption of the Linking Directive – were rather false hopes to begin with. Moreover, from the environmental point of view the introduction of general high standards is vastly preferable to the implementation of individual projects with high standards while the general situation remains one of low standards.

Of the reduction potentials that are in principle suitable for JI and have been quantified in the literature, about 60 Mt CO_2e do not seem to be affected by EU Accession. They chiefly relate to renovating buildings and district heating systems and afforestation. Adding measures featuring indirect linkage with the EU ETS, which are mainly renewable energy projects, raises the potential to about 130 Mt CO_2e. Conversely, about 100 Mt CO_2e of the quantified potential now fall under the EU ETS. However, on the one hand the figures in the literature surveyed usually only refer to technical potentials where it is not clear which part of them could feasibly be implemented. This is especially the case for renewable energy projects. On the other hand many possible reduction measures were not quantified at all. These figures are therefore only of very limited value.

For a buyer country like Japan, three main conclusions can be drawn:

- Projects in the building and district heating sectors of the new EU Member States and Accession Countries are supposed to entail significant emission reduction potential and are not touched by their EU Accession. Projects are often too small to be viable for JI, but if suitable bundling mechanisms can be developed, such projects can provide a substantial amount of emission certificates.
- Renewable electricity projects are also supposed to entail a substantial emission reduction potential but are dependent on the establishment of sufficient reserves in the countries' NAPs. The Japanese government could intercede with these countries to make sure that these reserves are indeed established.

- Half of the emission from the new EU Member States now fall under the EU ETS and would seem to have largely been removed from JI. However, there is another means by which these potentials could still be accessed: the establishment of a domestic ETS and its linkage with the EU ETS. This is a novel mechanism which should be further studied. We will come back to this issue in Paper 4.

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Background Paper 3

March 2005

Demand and Supply on the Global Market for Emission Certificates

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Under the Kyoto Protocol, which has recently come into effect, several industrialised countries have committed themselves to reducing their greenhouse gas emissions by various degrees. These commitments can be met through national policies and measures and through acquiring emission certificates on the global market. Most Western European states as well as non-European states such as Canada and Japan have already announced that they intend to include the latter option in their plans to reach their Kyoto Protocol reduction target. Whether the resulting demand will be satisfied by global supply of emission certificates is becoming a question that can be addressed, as countries are slowly declaring their interest in selling and buying certificates. In this paper, we analyse the most recent information available (as of February 2005) to determine whether it will be a seller's or a buyer's market.

The first section of this paper analyses the potential demand for emission certificates. Countries that belong to the EU-15 group have submitted their National Allocation Plans that indicate their emission shortfall or surplus in comparison with their respective Kyoto target. On the basis of these documents as well as the data provided by the European Environment Agency, we have been able to compile the aggregate potential demand for emission certificates from EU-15 countries. In addition, the paper also discusses potential demand from non-European states, such as Canada.

In the second section, we tackle estimating the potential supply of emission certificates. Emission certificates can be generated by introducing unused emission allowances or by conducting Clean Development Mechanism (CDM) or Joint Implementation (JI) projects. The paper in turn analyses supply by the new EU Member states and EU Accession countries, supply by Russia and the Ukraine as well as supply from CDM projects.

The last section of this paper is dedicated to drawing conclusions from the data presented in national reports and purchasing programmes.

This is the third paper in a series of four papers commissioned by the Ministry of the Environment of Japan and elaborated jointly with the Institute for Global Environmental Strategies.

1 Demand

1.1 EU-15 Demand

1.1.1 General Situation

The “old” 15 EU Member States’ (EU-15) demand for emission certicates is increasingly taking shape. According to the latest technical report of the European Environment Agency (EEA) greenhouse gas (GHG) emissions in the EU-15 have fallen by 2.9% since 1990. However, projections for 2010 expect a reverse tendency of rising aggregate emissions up to only 1.0% below 1990 levels. Considering the EU’s emission reduction target of 8%, this implies a gap of 7% (EEA 2004: 19). The situation at the Member State level varies, as displayed in Table 1.

Country	**Base Year Emissions (for projections)**	**Projected gap (over-delivery (+) or shortfall (-)) between target and projected emissions in 2010**	**Projected gap (over-delivery (+) or shortfall (-)) between target and projected emissions in 2010**
		Based on existing domestic policies and measures (PAMs)	**Based on additional domestic policies and measures (PAMs)**
	Mt CO_2e	**Mt CO_2e**	**Mt CO_2e**
Austria	77.6	-16.9	-3
Belgium	141.0	-19.7	-5.9
Denmark	69.0	-25.3	n.a.
Finland	77.2	-12.7	+0.4
France	545.0	-49.3	+9
Germany	1218.2	-15.4	n.a.
Greece	109.3	-14.8	+2.9
Ireland	53.4	-8.7	+5.1
Italy	521.0	-53.0	-16.1
Luxembourg	12.7	-0.7	n.a.
Netherlands	212.0	-19.7	n.a.
Portugal	65.1	-17.0	-12.2
Spain	207.0	-68.9	-26.9
Sweden	71.9	+3.0	n.a.
United Kingdom	744.7	+10.7	+74.3
Total EU-15	**4125.1**	**-308,4**	**+28,2**

n.a. – not available

Table 1: Gaps between burden-sharing target and projected emissions in 2010 of EU 15 countries, Source: EEA 2004.

The EEA reports follow the format required for the National Communications (NCs) under the United Nations Framework Convention on Climate Change in that they provide two of the three different scenarios usually contained in the NCs: “with measures” and “with additional measures”. The scenario “with measures” usually reflects the impacts of already implemented or currently planned policies and measures and can thus be regarded as the baseline, whereas the scenario “with additional measures” includes policies and measures that have been suggested but have not yet been introduced into the domestic political process. As pointed out in Paper 2, the labelling of the scenarios is not consistent across countries, the level of detail and reliability varies to a great extent and the emission reductions attributed to policies and measures (PAMs) are not always credible. Still, the EEA reports are among the most comprehensive data sources available. Further in-depth analysis of the individual country reports is beyond the scope of this paper.

As will be outlined in more detail below, some EU-15 Member States expect to meet their commitments through domestic policies and measures alone. A few states, such as Sweden and the UK, even expect to gain a surplus. Other states have rather grim prospects of meeting their respective commitments unless they implement significant additional measures. Some of these countries are therefore already taking steps to utilise the project-based mechanisms. The situation is becoming increasingly transparent because the National Allocation Plans (NAPs) under the EU emission trading system (EU ETS) not only contain the allocation of EU Allowances to the regulated installations but also a description of how the country is planning to meet its Kyoto target. Several countries already stated their intention to use the Clean Development Mechanism (CDM) and Joint Implementation (JI) and launched national programmes or invested in carbon funds as a means to acquire Certified Emission Reductions (CERs) and/or Emission Reduction Units (ERUs).

In the following, an approximate estimation of the CER and ERU demand by each EU-15 Member State will be presented. We have taken into consideration the following data points: the emission projections outlined in Table 1, the intended use of the flexible mechanisms described in the NAPs, purchase targets of national CDM/JI-programmes, as well as participation in carbon funds. We multiplied the projected emission gaps for 2010 by five to make them comparable with the reduction targets for the first Kyoto commitment period of 2008-2012 and with the purchase targets for CERs/ERUs that have been announced.

In some cases the available information only indicated the budget of a programme but not the purchase target. In these cases we translated the monetary amounts into amounts of certificates, applying a moderate price of 5 EUR per t CO_2e. This estimate is based on 2004 prices for CERs/ERUs which ranged between 3.95 – 6.00 EUR.[29] We assume that countries used this price estimate to budget their financial support of the carbon funds. An investment amount divided by the estimated price of 5 EUR therefore indicates their perceived demand for certificates. It should be noted, however, that this procedure limits calculations of demand for certificates when the data provided is in monetary terms in at least two ways: First, future price developments may run counter to our calculations, i.e. rising prices will mean less certificates for the buyers and vice versa. Second, it is probable that a certain share of a programme’s budget will be used to cover transaction costs in which case less certificates will be purchased than we had calculated.

It bears noting that direct purchases are not the only channel through which the EU Member States will acquire CERs and ERUs. Companies covered by the EU ETS will be able to surrender CERs/ERUs to their governments to comply with their domestic commitments, which the govern-

[29] Current prices can for example be found at the Point Carbon Website: http://www.pointcarbon.com.

ments can then use to comply with their Kyoto commitments (see Paper 2 for further details). The total demand of a country is therefore the sum of its government's procurement programmes plus the purchases by its companies. It is not yet clear to what extent EU companies will take advantage of this option.

1.1.2 Country-by-Country Analysis

1.1.2.1 Austria

Description

EU Burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	2008-2012	2010	2008-2012
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 13	-16.9	-84.5	-3.0	-15

Table 2: Emission Projections for Austria, Source: EEA 2004: 110

The Austrian NAP stipulates a purchase target of 3-5 Mt CO_2 in 2005-2007; data for the commitment period of 2008-2012 is not yet available (Austria 2004: 13). The Austrian Government already launched a JI/CDM programme which is managed by the public bank Kommunalkredit. This programme has a target of 35 Mt CO_2e for 2008-2012 and can dispose of a budget of EUR 11 million in 2004, EUR 24 million in 2005, and EUR 36 million in 2006.[30]

Evaluation

Comparing the required amount for closing the gap of 16.9 Mt CO_2e in 2010 and 84.5 Mt CO_2e for 2008-2012 in the scenario with existing PAMs with the intended purchase of 35 Mt CO_2e leaves a deficit of 49.5 Mt CO_2e. The scenario with additional PAMs shows an over-delivery of 20 Mt CO_2e in the period from 2008 to 2012.

1.1.2.2 Belgium

Description

EU Burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	2008-2012	2010	2008-2012
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 7.5	-19.7	-98,5	-5.9	-29.5

Table 3: Emission Projections for Belgium, Sources: EEA 2004: 111

[30] Österreichisches JI/CDM-Programm: http://www.klimaschutzprojekte.at [15.02.2005].

Belgium plans to use the project-based Kyoto mechanisms to achieve its EU burden-sharing commitments (Belgium 2004: 5). The Belgian NAP is subdivided into three parts, distributing the reduction target to the regions of Flanders (-7.5%), Wallonia (-5.2%), and the Brussels Capital Region (-3.475%). The shortfall for complying with the national target will be set off by the national government through the purchase of certificates from CDM/JI. Flanders and Wallonia also decided to fall back on the use of the project-based mechanisms.

According to the NAP, the federal level intends to purchase an amount of 12.3 Mt CO_2e during 2008-2012, while Wallonia intends to purchase 5.5 Mt CO_2e in 2005-2007 and Flanders 2.0 Mt CO_2e in 2005-2007 (Belgium 2004: 6). These plans have already been partly implemented: The federal government launched a JI/CDM Tender, and the Flemish government also launched its own tender. The federal government JI/CDM Tender intends to purchase an amount of 12.3 Mt CO_2e in 2008-2012, i.e. an annual amount of 2.46 Mt CO_2e (Belgium 2004: 6). The first tender will start in April 2005 with a budget of EUR 10 million.[31] The Flemish Tender started in September 2004 and intends to purchase 23.93 Mt CO_2e until 2012.[32]

Evaluation

The projected gap for Belgium in the scenario with existing measures amounts to 19.7 Mt CO_2e in 2010 and 98.5 Mt CO_2e for 2008-2012, facing a purchase target of 36.23 Mt CO_2e (not including possible purchases by Wallonia). Therefore, a shortfall of about 62.27 Mt CO_2e remains. In the scenario with additional PAMs, a shortfall of 29.5 Mt CO_2e faces a purchase target of 36.23 Mt CO_2e, which leads to an over-delivery of 6.73 Mt CO_2e.

1.1.2.3 Denmark

Description

EU Burden-sharing target 2008-2012	**Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs**		**Projected gap (over-delivery (+) or shortfall (-))with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 21	-25.3	-126.5	n.a.	n.a.

Table 4: Emission Projections for Denmark, Source: EEA 2004: 113

Denmark also plans to use CDM/JI (Denmark 2004: 15). The NAP stipulates a purchase target of 18.7 Mt CO_2e for 2008-12, i.e. an annual amount of 3.7 Mt CO_2e. The Danish Government purchases emission reduction certificates through the tender window DanishCarbon.dk, which is administered by the Danish Environmental Protection Agency (DEPA). The first tender round has alreay been successfully conducted from June 15 to September 15, 2004. The second tender round was running till February 15, 2005 and the third tender round is expected to start soon.[33]

[31] Belgian JI/CDM Tender: http://www.climat.be/jicdmtender/index.htm [16.02.2005].

[32] tender by the Flemish Region for CDM and JI projects focusing on the purchase of emission credits from project developers: http://193.190.148.16/ned/sites/economie/energiesparen/paginas/fxm/fxm_beginpagina_en.htm [16.02.2005].

[33] DanishCarbon.dk: http://www.danishcarbon.dk [16.02.2005].

Evaluation

Comparing the projected gap of 25.3 Mt CO_2e in 2010, corresponding to 126.5 Mt CO2e for the whole first commitment period, with planned purchases of 18.7 Mt CO_2e still leaves a significant gap of 107.8 Mt CO_2e. There is no information available on potential additional PAMs.

1.1.2.4 Finland

Description

EU Burden-sharing target 2008-2012	**Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs**		**Projected gap (over-delivery (–) or shortfall (+)) with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+- 0	-12.7	-63.5	+0.4	+2.0

Table 5: Emission Projections for Finland, Source: EEA 2004: 115

Finland also intends to meet a certain part of its target through the use of CDM/JI (Finland 2004: 31f.). No concrete data is given in the NAP, but a JI and small-scale CDM pilot programme, directed by the Ministry of Foreign Affairs, has already been launched. The purchase target amounts to 1.0-1.4 Mt CO_2e for 2008-12. Since the beginning of the pilot programme in 1999, Finland invested EUR 20 million, half of which went to the Prototype Carbon Fund of the World Bank. Assuming a price of EUR 5 per certificate, this estimates a demand of approximately 2 Mt CO_2e. Within in the framework of the pilot programme, Finland also invested in the Testing Ground Facility of the Baltic Sea Region Energy Cooperation (BASREC)[34].

Evaluation

Considering the projected gap of 12.7 Mt CO_2e in 2010 or 63.5 Mt CO_2e in 2008-2012 in the with existing measures scenario and the purchase target of about 3 Mt CO_2e, there is still a deficit of about 60.5 Mt CO_2e. The scenario with additional PAMs shows a small over-delivery of 3 Mt CO_2e.

1.1.2.5 France

Description

EU Burden-sharing target 2008-2012	**Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs**		**Projected gap (over-delivery (+) or shortfall (-))with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+- 0	-49.3	-246.5	+9	+45

Table 6: Emission Projections for France, Source: EEA 2004: 117

[34] Finnish CDM/JI Pilot Programme: http://global.finland.fi/english/projects/cdm/ [16.02.2005].
BASREC was established by the energy ministers of the Baltic Sea Region Countries (Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia and Sweden) and the European Commission at their conference in Helsinki in October 1999. It has its own secretariat and mainly serves as forum for exchange of information and coordination of energy policy strategies (http://www.cbss.st/basrec/).

France committed to stabilising its GHG emissions at 1990 levels. France is striving to meet its emission target by domestic measures alone (France 2004: 6). So far, there are no governmental purchase activities. The projections for the first commitment period show an immense shortfall for the scenario with existing domestic PAMs; on the other hand, the scenario with additional PAMs projects an over-delivery.

1.1.2.6 Germany

Description

EU Burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 21	-15.4	-77	n.a.	n.a.

Table 7: Emission Projections for Germany, Source: EEA 2004: 119

Germany aims to meet its reduction target through domestic reductions alone (Germany 2004: 13). Nevertheless, Germany aims to stimulate the project-based mechanisms by investing EUR 5 million in the Testing Ground Facility (TGF) of the Baltic Sea Region Energy Cooperation (BASREC). In addition, Germany plans to invest EUR 8 million into the KfW Banking Group's Carbon Fund.[35] Assuming a price of EUR 5 per certificate, these investments can be estimated to yield 2.6 Mt CO_2e.

Evaluation

Comparing the projected gap of 77 Mt CO_2e in the scenario with existing domestic PAMs in the period of 2008-2012 with a purchase of 2.6 Mt CO_2e, a shortfall of 74.4 Mt CO_2e remains.

1.1.2.7 Greece

Description

EU Burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+ 25	-14.8	-74	+2.9	+14.5

Table 8: Emission Projections for Greece, Source: EEA 2004: 121

Evaluation

Governmental procurement programmes have not been implemented so far. A shortfall of 74 Mt CO_2e with existing PAMs and an over-delivery of 14.5 Mt CO_2e with additional PAMs is expected for the first commitment period.

[35] KfW Bankengruppe – Der KfW-Klimaschutzfonds: http://www.kfw.de/klimaschutzfonds [15.02.2005]

1.1.2.8 Ireland

Description

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+ 13	-8.7	-43.5	+5.1	+25.5

Table 9: Emission Projections for Ireland, Source: EEA 2004: 123

Ireland also plans to use CDM/JI in addition to domestic measures to meet its target (Ireland 2004: 10f.). The NAP stipulates an annual CDM/JI purchase of 3.7 Mt CO_2e, i.e. an amount of 18.5 Mt CO_2e in 2008-2012. However, no concrete action has been taken so far.

Evaluation

Comparing the expected gap of 43.5 Mt CO_2e in 2008-2012 with the anticipated purchase of 18.5 Mt CO_2e, there is still a deficit of 25.0 Mt CO_2e in the scenario with existing PAMs. Conversely, the scenario with additional PAMs projects an over-delivery of 44 Mt CO_2e.

1.1.2.9 Italy

Description

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (–) or shortfall (+))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 6.5	-53	-265	-16.1	-80.5

Table 10: Source: EEA 2004: 125

Italy also intends to purchase CERs/ERUs as one means of reaching its target (Italy 2004: 5). An earlier draft of the NAP stipulated an annual amount of 57 Mt CO_2e, i.e. 285 Mt CO_2e in 2008-2012, to be purchased (Gilbert / Bode / Phylipsen 2004: 37).

So far, the Italian Ministry for the Environment and Territory entered into an agreement with the World Bank to create a fund to purchase greenhouse gas emission reductions: the Italian Carbon Fund (ICF). Italy invested USD 15 million in the ICF and additionally USD 7 million in World Bank's Community Development Carbon Fund (CDCF).[36] Assuming a price of EUR 5 (USD 1 = EUR 0.77 as of 07.02.2005) per certificate, these investments will translate into 5.7 Mt. CO_2e.

[36] Italian Carbon Fund: http://carbonfinance.org [17.02.2005]
News and Events: Italy Brings the Community Development Carbon Fund Closer to Reality: http://carbonfinance.org/cdcf/router.cfm?Page=NewsArchives [17.02.2005]

Evaluation

Comparing the projected gap of 53.0 Mt CO_2e in 2010 / 265.0 Mt CO_2e in 2008-2012 in the scenario with existing PAMs with the intended purchase of 285 Mt CO_2e, an over-delivery of 20 Mt CO_2e can be expected. Considering the scenario with additional PAMs yields an over-delivery of 204.5 Mt CO_2e. However, Italy has so far secured only 2% of the intended purchase.

1.1.2.10 Luxembourg

Description

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-))with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 28	-0.7	-3.5	n.a.	n.a.

Table 11: Emission Projections for Luxembourg, Source: EEA 2004: 126

Luxembourg also plans to purchase CDM/JI certificates in addition to domestic action (Luxemburg 2004: 15). As pointed out in its NAP, 3 Mt CO_2e are supposed to be purchased in 2008-12. However, so far no concrete action has been taken.

Evaluation

Considering the projected gap in the scenario with existing measures and the target for CDM/JI, it can be expected that a small shortfall of 0.5 Mt CO_2e will remain.

1.1.2.11 Netherlands

Description

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-))with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 6	-19.7	-98.5	n.a.	n.a.

Table 12: Emission Projections for the Netherlands, Source: EEA 2004: 128

The Dutch NAP envisages an annual purchase of 20 Mt CO_2e of CERs/ERUs in 2008-2012 (The Netherlands 2004: 15), i.e. 100 Mt CO_2e in total.

In the Netherlands, the Ministry of Economic Affairs is responsible for the implementation of the flexible Kyoto mechanisms. The Ministry of Economic Affairs has contracted SenterNovem, a governmental agency, to purchase Emission Reductions through two public procurement procedures called CERUPT (Certified Emission Reduction Units Procurement Tender) targeting CDM projects and ERUPT (Emission Reduction Units Procurement Tender) targeting JI projects. In October 2004, the fifth end last round of ERUPT closed. In total, the portfolio of SenterNovem holds 24 JI and CDM projects with a total contracted volume of more than 14 Mt CO_2e.[37]

Apart from own tenders, the Netherlands also invest in carbon funds of the World Bank (The Netherlands 2004: 16). In 2002, the Netherlands CDM Facility was launched. The Facility's initial target was to purchase 16.0 Mt CO_2e during the first two years of the agreement. The agreement has now been extended, with a firm commitment to purchase an additional 5 Mt CO_2e by mid-2005. The agreement also allows for a further purchase of up to approximately 11 Mt CO_2e.[38] In total, this sums up to a purchase target of 32 Mt CO_2e. Additionally, the Netherlands invested USD 10 million (≈ 2.0 Mt CO_2e) in the Prototype Carbon Fund (PCF) and contracted 4.0 Mt CO_2e with the Community Development Carbon Fund (CDCF).

Furthermore, the Netherlands agreed to purchase certificates with several financial institutions (The Netherlands 2004: 16). This includes agreements with the International Finance Corporation (IFC), where the Netherlands has allocated EUR 44 million and agreed a target of 10 Mt CO_2e, the Andean Development Corporation (CAF) with a target of up to 10 Mt CO_2e, the International Bank for Reconstruction and Development (IBRD) with a budget of EUR 70 million (≈ 14 Mt CO_2e), the European Bank for Reconstruction and Development (EBRD) with a budget of EUR 32 million (≈ 6.4 Mt CO_2e), and the Rabobank with a contract of 10 Mt CO_2e.

Evaluation

Due to the number of agreements and differences in content it is not easy to accurately estimate the amounts already contracted. However, regarding the detailed table of contracts and plans included in the NAP (The Netherlands 2004: 16) and an approximate translation of budgets into certificates, the intended purchase of 100 Mt CO_2e seems to be reachable. Summing up all contracts and agreements, the anticipated purchase actually totals approximately 104.4 Mt CO_2e. Since the projected shortfall in the period 2008-2012 amounts to 98.5 Mt CO_2e in the scenario with existing domestic PAMs, the Netherlands should be able to reach their Kyoto target.

1.1.2.12 Portugal

Description

EU burden-sharing target 2008-2012	**Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs**		**Projected gap (over-delivery (+) or shortfall (-))with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+ 27	-17	-85	-12.2	-61

Table 13: Emission Projections for Portugal, Source: EEA 2004: 130

Portugal also plans to include the purchase of CERs/ERUs into its efforts to meet its target. According to the NAP, up to 5.1 Mt CO_2e of CERs/ERUs should be purchased annually in 2008-2012, i.e. a total of 25.5 Mt CO_2e. This number was derived from an assumed deficit of 5.1 Mt CO_2e in 2010 (Portugal

[37] SenterNovem – CarbonCredits.nl: http://www.senternovem.nl/Carboncredits/index.asp [15.02.2005].
[38] Carbon Finance at the World Bank: Netherlands Clean Development Facility: http://carbonfinance.org/NetherlandsClean.htm [15.02.2005].

2004: 11) that is supposed to be offset by the flexible mechanisms, the EU ETS and, possibly, by new national policies and measures. However, no concrete action regarding the project-based mechanisms can be identified so far.

Evaluation

It is questionable whether the projected deficit of 5.1 Mt CO_2e assumed in the NAP is still valid as the latest projections of the European Environment Agency show a much higher deficit. Comparing this projected shortfall of 85.0 Mt CO_2e in 2008-2012 in the scenario with existing PAMs with the purchase target of 25.5 Mt CO_2e, a deficit of 59.5 Mt CO_2e remains. The scenario with additional PAMs also shows a shortfall, which amounts to 35.5 Mt CO_2e.

1.1.2.13 Spain

Description

EU burden-sharing target 2008-2012	**Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs**		**Projected gap (over-delivery (+) or shortfall (-)) with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+ 15	-68.9	-344.5	-26.9	-134.5

Table 14: Emission Projections for Spain, Source: EEA 2004: 132

Spain also included the use of the flexible mechanisms into its climate strategy. According to the NAP, an amount equal to 7% of 1990 emissions, i.e. 100 Mt CO_2e, should be purchased for the period 2008-2012 (Spain 2004: 24ff.). Recently, Spain started negotiations to create a Spanish Carbon Fund to be managed by the World Bank. This fund is supposed to cover 40% of the total planned purchase of CERs/ERUs. The capital investment amounts to EUR 170 million with the intention to purchase 34.0 Mt CO_2e at a maximum price of EUR 5 per tonne. Additionally, the fund will participate in the World Bank's CDCF to obtain 4.0 Mt CO_2e for EUR 20 million, as well as in the Bio Carbon Fund to obtain 2.0 Mt CO_2e for EUR 10 million. Another 2.5% of the planned purchase will be covered by the Carbon Finance Asset program.[39]

Evaluation

Regarding the estimated shortfall of 68.9 Mt CO_2e in 2010, i.e. 344.5 for 2008-2012, in the scenario with existing PAMs, and an intended purchase of 100 Mt CO_2e, a gap of 244.5 Mt CO_2e remains. The scenario with additional PAMs still indicates a deficit of 34.5 Mt CO_2e.

[39] Ana Gutierrez Dewar: 02.12.2004 World Bank to manage €200 million Spanish Carbon Fund: http://www.pointcarbon.com/article.php?articleID=5514 [16.02.2005].

1.1.2.14 Sweden

Description

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-)) with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
+ 4	+3	+15	n.a.	n.a.

Table 15: Emission Projections for Sweden, Source: EEA 2004: 143

Sweden also intends to purchase CERs/ERUs (Sweden 2004: 11f.). Although no data or purchase plan regarding the flexible mechanisms is discussed in the NAP, a CDM and JI programme has already been launched. The CDM and JI tenders under the Swedish International Climate-Investment Program (SICLIP-CDM and SICLIP-JI) are operated by the Swedish Energy Agency (STEM) under a mandate from the Swedish Ministry of Industry. The budget for 2005 amounts to EUR 2.2 million for 2005; the same amount is expected for 2006 and 2007. Assuming a price of EUR 5 per certificate, the investments in these three years will translate into approximately 1.32 Mt CO_2e. Additionally, Sweden invested USD 10 million in the PCF and EUR 4 million in the BASREC's TGF, which translates into about 2.8 Mt CO_2e.[40]

Evaluation

Considering the estimated surplus of 15 Mt CO_2e in the scenario with existing policies and measures and the intended purchase of 4.12 Mt CO_2e leads to a surplus of 19.12 Mt CO_2e.

1.1.2.15 United Kingdom

Evaluation

EU burden-sharing target 2008-2012	Projected gap (over-delivery (+) or shortfall (-)) with existing domestic PAMs		Projected gap (over-delivery (+) or shortfall (-)) with additional PAMs	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 12.5	+10.7	+53.5	+74.3	+371.5

Table 16: Emission Projections for the United Kingdom, Source: EEA 2004: 136

Evaluation

As projections show that the reduction target can be reached by domestic measures in the UK, there is no intention to include the flexible mechanisms into the climate strategy. Considering the projections, a surplus of 53.5 Mt CO_2e in the period of 2008-2012 can be expected according to the scenario with existing PAMs and of 371.5 Mt CO_2e in the scenario with additional PAMs.

[40] SICLIP – Swedish International Climate Investment Programme: http://www.stem.se/WEB/STEMEx01Eng.nsf/F_PreGen01?ReadForm&MenuSelect=1CD39988A74C248BC1256E78002E5CDD&WT=International%20#Climate%20Investments.SICLIP [17.02.2005].

1.1.3 Overall EU-15 Demand

The following table gives an overview of the officially stated purchase targets as opposed to the activity that has actually taken place so far. Evidently, the programmes that have already been initiated do not cover even half of the officially stated purchase targets. One also has to take into account that several countries still show a significant compliance gap even if the intended purchases were carried out, as outlined in the tables further below. These countries would therefore have to take additional domestic measures or increase their purchase targets.

However, there is a limit to the amounts the EU Member States can purchase if they want to remain true to the supplementarity principle they championed during the negotiations at the UN level, i.e. the principle that domestic action should constitute at least half of the effort made by a country to meet its Kyoto target. The general principle is contained in both the Kyoto Protocol and in the Marrakesh Accords, but despite the efforts by the EU neither document contains a concrete numerical definition. As outlined in Paper 2, the principle was reaffirmed in the Linking Directive, but it leaves it up to the individual Member States to decide the concrete definition. These will have to elaborate it in their NAPs for the trading period 2008-2012. This definition will have to cover both direct government procurement as well as the extent up to which companies covered by the EU ETS may use CERs/ERUs to comply with their commitments.

Country	**Purchase target for 2008-2012 as stated in NAP** **Mt CO_2e**	**Covered by existing national CDM/JI-purchasing activities for 2008-2012** **Mt CO_2e**
Austria	3-5 in 20 05-2007	35
Belgium	19.8	36.23
Denmark	18.7	6
Finland	No quantification	3
France	0	0
Germany	0	2.6
Greece	No quantification	0
Ireland	18.5	0
Italy	285	5.7
Luxembourg	3	0
Netherlands	100	104.4
Portugal	Up to 25.5	0
Spain	100	40
Sweden	No quantification	4.12
UK	0	0
Total EU-15	**566.0-568.0**	**234.63**

Table 17: Overview of Stated Purchase Plans

To get a workable figure, this paper adopts the formulation of the supplementarity requirement as suggested by the EU during the UN negotiations. The EU formulation was far from precise, but in essence it stated that each party should acquire and surrender no more emission certificates than the equivalent of 50% of the difference between five times the emissions in one of the years between 1994 and 2002, on the one hand, and its number of Assigned Amount Units (AAUs), on the other (EU 1999). Based on this formula, Langrock and Sterk (2004: 14) calculated a supplementarity cap for each EU Member State as well as for the EU-15 as a whole. This is merely a hypothetical value but the only one available until the NAPs have been elaborated.

Table 18 shows the projected emissions for the first commitment period based on existing policies and measures, the supplementarity caps as calculated by Langrock and Sterk as well as the purchase targets that have been announced by governments so far. It becomes apparent that among the countries showing a compliance gap, Germany is the only one which could close this gap completely through the purchase of certificates, if the supplementarity principle is to be upheld. The projected deficits of the other countries are all in excess of the supplementarity cap. If supplementarity is to be maintained, these countries could therefore not buy their way out of non-compliance but would have to take meaningful further action to reduce emissions domestically.

It also becomes apparent that the purchases intended by the governments of Italy, Luxembourg, the Netherlands and Portugal are in conflict with the supplementarity requirement. This situation is further exacerbated by the fact that the companies covered by the EU ETS will also purchase CERs and ERUs for complying with their commitments. These purchases will be in addition to those made by the national governments. If the supplementarity principle is to be upheld, Italy, Luxembourg, the Netherlands and Portugal will therefore have to lower their purchase targets and instead implement domestic measures to achieve the corresponding amount of emission reductions.

Country	**Projected gap (over-delivery (+) or shortfall (-)) for 2008-2012 based on existing domestic policies and measures**	**Supplementarity Cap (Source: Langrock / Sterk 2004: 14)**	**To be covered by CDM/JI in 2008-2012**	**Remaining Gap in 2008-2012**
	Mt CO_2e	**Mt CO_2e**	**Mt CO_2e**	**Mt CO_2e**
Austria	**-84.5**	**44.3**	35.0	-49.5
Belgium	**-98.5**	**58.9**	36.23	-62.27
Denmark	**-126.5**	**89.6**	18.7	-107.8
Finland	**-63.5**	**12.2**	3.0	-60.5
France	**-246.5**	**59.2**	0	-246.5
Germany	-77.0	292.8	2.6	-74.4
Greece	**-74.0**	**-4.3**[1)]	0	-74.0
Ireland	**-43.5**	**24.1**	18.5	-25.0
Italy	**-265.0**	**176.6**	**285**	+20.0
Luxembourg	**-3.5**	**1.4**	**3.0**	-0.5
Netherlands	**-98.5**	**86.1**	**100.0**	+1.5
Portugal	**-85.0**	**14.5**	**25.5**	-59.5
Spain	**-344.5**	**134.4**	100.0	-244.5
Sweden	+15.0	7.3	4.12	+19.12
United Kingdom	+53.5	138.2	0	+53.5
Total EU-15	**-1542**	**1135.5**	**631.65**	**-910.35**

[1)] The negative figure for Greece is due to the formula proposed by the EU, which was not yet sufficiently elaborated.

Table 18: Projected deficit / surplus in 2008-2012 based on existing policies and measures with consideration of the supplementarity requirement

Table 19 details the situation for the countries where scenarios including additional domestic policies and measures are available. In this case the remaining deficits would stay below the supplementarity cap for all countries, except for Portugal and Spain. Actually, most countries would achieve a massive surplus when adding the announced purchase targets to the projected domestic emission reductions.

However, there are several caveats. First, it should be noted that we have not critically examined the emission reductions projected in the scenarios with additional policies and measures. Governments may be overestimating the climate benefit these policies and measures could achieve. Second, is unclear to what extent it will be politically feasible to implement these policies and measures. The debate about the EU ETS, which will probably deliver far fewer emission reductions than initially expected, serves as a pertinent example. Third, given these political difficulties it can be assumed that governments will not aim for the overcompliance emerging from Table 19 but only effect additional domestic measures and purchases up to the level required for compliance with Kyoto.

Country	**Projected gap (over-delivery (+) or shortfall (-)) for 2008-2012 based on additional domestic PAMs**	**Supplementarity Cap (Source: Langrock / Sterk 2004: 14)**	**To be covered by CDM/JI in 2008-2012**	**Remaining Gap in 2008-2012**
	Mt CO_2e	**Mt CO_2e**	**Mt CO_2e**	**Mt CO_2e**
Austria	-15.0	44.3	35.0	+20.0
Belgium	-29.5	58.9	36.23	+6.73
Finland	+2.0	12.2	3.0	+5.0
France	+45.0	59.2	0	+45.0
Greece	+14.5	-4.3[1)]	0	+14.5
Ireland	+25.5	24.1	18.5	+44.0
Italy	-80.5	**176.6**	**285**	+204.5
Portugal	**-61.0**	**14.5**	**25.5**	-35.5
Spain	**-134.5**	**134.4**	100.0	-34.5
United Kingdom	+371.5	138.2	0	+371.5
Total EU-15	**138**	**527.2**	**482.83**	**+641.23**

1) The negative figure for Greece is due to the formula proposed by the EU, which was not yet sufficiently elaborated.

Table 19: Projected deficit / surplus in 2008-2012 based on additional policies and measures with consideration of the supplementarity requirement

Three archetypical policy scenarios for potential EU demand representing a lower, a medium and a higher estimate seem plausible:

Scenario 1: Meaningful Domestic Action

The EU-15 Member States take meaningful domestic action as indicated in the scenarios with additional policies and measures. In this case the deficits and surpluses of the individual countries will probably balance each other out, i.e. the EU 15 as a whole would be in compliance with its joint commitment in accordance with Art. 4 of the Kyoto Protocol. However, the question is whether the countries with surpluses (projected for Finland, France, Greece, Ireland, Sweden and the United Kingdom) would indeed be willing to yield these surpluses to cover the deficits of the other countries. One can rather expect that the countries with surpluses would prefer to bank them; at a minimum the countries with deficits would probably have to buy them. We therefore disregard the surpluses of individual countries and assume that the potential EU 15 demand in the scenario with additional policies and measures is equal to the combined deficits of Austria, Belgium, Italy, Portugal and Spain, i.e. 320.5 Mt CO_2e for the whole commitment period and 64.1 Mt CO_2e per year. One has to note that this figure would probably be higher if figures were available for all countries.

Scenario 2: Maintaining Supplementarity

The EU-15 Member States take domestic action to ensure that they stay within their supplementarity caps but purchase certificates up to this limit. Based on the supplementarity formula proposed by the EU at the UN negotiations this would amount to a demand of about 1,135.5 Mt CO_2e for the whole commitment period.

However, 292.8 Mt CO_2e relate to Germany which has announced that it does not intend to establish a procurement programme. Another 138.2 Mt CO_2e relate to the United Kingdom, but according to their projections they have even less need to resort to the Kyoto mechanisms. This leaves about 700 Mt CO_2e.

On the other hand, the companies in these countries which fall under the EU ETS will certainly cover part of their commitments via CERs and ERUs, which will in turn be used by their governments for their Kyoto compliance. In the first commitment period, Germany allocated roughly 500 Mt CO_2 per year and the UK 240 Mt CO_2 to their companies (Germany 2004; UK 2004). Assuming that the allocation for the second trading period will be in the same range and that companies' use of CERs/ERUs will be capped at 6% of this amount as proposed in the first version of the Linking Directive (see Paper 2), the companies from these two countries could utilise a maximum of about 45 million CERs/ERUs per year, i.e. 225 million for the whole commitment period. For the other countries we assume that governments will cap their companies' use of CDM/JI such that the total purchases will stay within the supplementarity cap. We therefore estimate a potential demand of about 925 Mt CO_2e for the whole commitment period, i.e. 185 Mt CO_2e per year, for this scenario.

Scenario 3: No Additional Domestic Action

The EU-15 takes no additional domestic action but covers its deficits via purchases. Assuming that the countries with surpluses will not yield them to cover the deficits of other countries, projected EU demand would be 1,610.5 Mt CO_2e for the whole commitment period, i.e. 322.1 Mt CO_2e per year.

As outlined in Table 17, the actual demand from the governmental procurement programmes that have been established so far amounts to 234.63 Mt CO_2e.

1.2 Demand from Non-EU Annex B Buyer Countries

1.2.1 Overview

Table 20 details the projected compliance gaps of the Non-EU Annex B buyer countries as outlined in their National Communications (NCs). Evidently, all of these countries face a serious compliance gap in the scenario with existing policies and measures. Even the optimistic forecast in the scenario with additional measures amounts to about two thirds of the most pessimistic forecast for the EU-15. The total deficit projected for these countries in the with existing policies and measures scenarios is one third above the deficit projected for the EU-15 in this scenario.

	Projected gap (over-delivery (–) or shortfall (+)) with existing PAMs		**Projected gap (over-delivery (–) or shortfall (+)) with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
Canada	-238.0	-1,190.0	-159.0	-795.0
Iceland	-0.2	-1	+0.3	+1.5
Japan	-162.0	-810.0	-18.0	-90.0
New Zealand	-15.0	-75.0	+-0	+-0
Norway	-10.7	-53.5	-5.4	-27.0
Switzerland	-0.4	-2.0	+2.6	+13.0
Total	**-426.3**	**-2,131.5**	**-179.5**	**-897.5**

Table 20: Demand from Non-EU Annex B buyer countries, Source: Compilation from National Communications

Given their emission volumes, especially Canada and Japan warrant a more detailed analysis. The below gives an overview of the situation in Canada whereas the Japanese situation is extensively dealt with in Paper 1.

1.2.2 Canada

Description

Kyoto target 2008-2012	**Projected gap (over-delivery (–) or shortfall (+)) with existing domestic PAMs**		**Projected gap (over-delivery (–) or shortfall (+)) with additional PAMs**	
	2010	**2008-2012**	**2010**	**2008-2012**
%	Mt CO_2e	Mt CO_2e	Mt CO_2e	Mt CO_2e
- 6	-238,0	-1190,0	-159,0	-795,0

Table 21: Emission Projections for Canada, Sources: Canada 2001, UNFCCC 2003

In its third National Communication (NC3), Canada estimated its 2010 emissions to be 770 Mt CO_2e under the business-as-usual GHG emissions projection (Canada 2001: 59). This was corrected upward to 809 Mt CO_2e by the in-depth review of the UNFCCC (UNFCCC 2003: 22). The Kyoto target is 571 Mt CO_2e. Considering the corrected numbers, this leaves a shortfall of 238 Mt CO_2e. Despite the urgency that these numbers elicit, the Canadian government has not laid out specific plans to overcome the Kyoto gap. The Action Plan 2000 has indicated the intended purchase of certificates totalling 20 Mt CO_2e from JI and CDM, which will hardly close Canada's emission gap. The UNFCCC review team believed that the reduction assumptions for the Action Plan 2000 in general were too optimistic (UNFCCC 2003: 18). In the NC3 scenario with additional measures, Canada plans to purchase certificates in the emission trading market with a heavy emphasis on "hot air" worth up to 75 Mt CO_2e

(UNFCCC 2003: 23). Canada established a Clean Development Mechanism and Joint Implementation (CDM & JI) Office in 1998 but its activity has been rather insignificant.[41]

Evaluation

Canada faces an immense task to reach its Kyoto target and will most certainly be a buyer in the emission certificate market. Bringing down emissions by domestic policies and measures would be an enormous task. In NC3, Canada estimates to buy certificates totalling between 20 and 75 Mt CO_2e (UNFCCC 2003). It is very likely that this figure will end up being much higher.

1.3 Overall Demand

Table 22 summarises the emission deficits established in this paper. The potential demand from the Annex B buyer countries ranges from 286.1 to 789.9 Mt CO_2e. The question is to what extent available supply will be able to cover this projected demand.

Deficits in 2010 (Mt CO_2e)	**With existing PAMs**	**With additional PAMs**	**EU Supplementarity**
EU-15	322,1	64.1	185
Other Annex B buyer countries	426.3	179.5	
Total	**748.4**	**243.6**	

Table 22: Summary of lower and upper estimates of total emission deficits in Annex B buyer countries

2 Supply

2.1 Supply Sources

The potential supply of from the Kyoto Mechanisms can be broken down into four source categories, each of which will be discussed in turn:

- JI supply from the new EU Member States and the EU Accession Countries
- AAU supply from the EU Accession Countries under Art. 17 of the Kyoto Protocol
- JI and AAU supply from Russia and the Ukraine
- CDM supply

[41] Canada's Clean Development Mechanism & Joint Implementation Office: http://www.dfait-maeci.gc.ca/cdm-ji/ [16.02.2005].

2.2 JI Supply from the New EU Member States and the EU Accession Countries

As pointed out in Paper 2, potentials for reducing greenhouse gas emissions in Central and Eastern European countries are substantial. However, the interplay of the introduction of the EU ETS in the new EU Member States and the EU Accession Countries and the baseline and double counting provisions of the Linking Directive significantly reduces this potential.

Of the reduction potentials that are in principle suitable for JI and have been quantified in the literature surveyed in Paper 2, about 60 Mt CO_2e do not seem to be affected by EU Accession. They chiefly relate to renovating buildings and district heating systems as well as afforestation. Adding measures featuring indirect linkage with the EU ETS, which are mainly renewable energy projects, raises the potential to about 130 Mt CO_2e.

Conversely, 100 Mt CO_2e of the quantified potential now fall directly under the EU ETS. JI projects in these areas are in theory still possible but are now in direct competition with financing emission reductions via the EU ETS. Moreover, some host countries have indicated that they are not favourable towards these kinds of projects.

One has to note that the figures in the documents surveyed for Paper 2 usually only refer to technical potentials, but it is not clear to what extent these are feasible. This is especially true for renewable energy projects. On the other hand, many possible reduction measures were not quantified at all in the documents surveyed. The above figures are therefore only of a limited value.

Another issue is that the eligibility of a country to participate in any of the Kyoto mechanisms is "dependent on its compliance with methodological and reporting requirements under Article 5, paragraph 1 and 2, and Article 7, paragraphs 1 and 4, of the Kyoto Protocol."[42] If the Central and Eastern European countries met these requirements they would qualify for the JI 1st track, which essentially leaves the whole project procedure to the discretion of the host country. Otherwise projects would have to be carried out according to the 2nd track which will entail an international procedure under the yet to be established JI Supervisory Committee and will thus be more cumbersome.[43] Since the details for both tracks are still to be worked out, it is at the moment not possible to estimate the transaction costs JI will entail and to what extent they will further reduce the market potential.

2.3 AAU Supply from the New EU Member States and the EU Accession Countries

During their transition to a market economy, the gross domestic product (GDP) in Central and Eastern European countries sharply declined, which in most countries was accompanied by a significant drop in GHG emissions. Table 23 provides data regarding the Kyoto targets, the historic emission surpluses, as well as the projected surpluses during the first commitment period. Unless otherwise stated, all fig-

[42] Paragraph 5 of Draft decision -/CMP.1 (Mechanisms), Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol.
[43] Annex of Decision 16/CP.7, Guidelines for the implementation of Article 6 of the Kyoto Protocol.

ures were drawn from the Third National Communications (NCs) of each country and are expressed in Mt CO_2e.

Among the non-EU Accession Central and Eastern European countries, only Croatia, the Russian Federation and the Ukraine are Annex B Countries and could therefore be potential suppliers of AAUs. Croatia has yet to ratify the Kyoto Protocol and will therefore not be included in this paper. The situation in the Ukraine and the Russian Federation will be discussed in the following section.

Although reliable data concerning projections for GHG emissions in 2010 is not available for all countries, it seems safe to say that all new EU Member States and EU Accession Countries, except for Hungary and Slovenia, will not only meet their Kyoto commitments but will indeed be below, in some cases far below, their GHG emission target.

The accumulated surpluses of all countries amount to 151.6 Mt CO_2e annually in the scenarios with existing measures, but one has to note that data is available for only nine countries. In the scenarios with additional measures, the total surplus amounts to 227.5 Mt CO_2e, taking into consideration that data is available for only eight countries.

It has to be noted that the criteria for eligibility to participate in the Kyoto mechanisms mentioned in the preceding section also apply here. Moreover, the Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol list further eligibility requirements to transfer and / or acquire Kyoto Units. These relate especially to putting in place a national system for the estimation of anthropogenic emissions by sources and removals by sinks of GHGs, submitting an annual inventory of GHGs and supplying additional information on the assigned amount.[44] It remains to be seen in how far the Central and Eastern European countries will be able to meet these requirements.

[44] Paragraph 2 of the Annex to Decision 18/CP.7, Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol.

	Bul-garia	Czech Repu-blic	Estonia	Hunga-ry	Lat-via	Lithuania [a]	Po-land	Romania [b]	Slova-kia	Slove-nia
Base year	1998	1990	1990	Avg. 1985-1987	1990	1990	1988	1989	1990	1986
Base year emissions	157.1	186.3	37.2	101.6	31.1	51.1	460.0	286.1[c]	72.5	20.2
Com-mitment	-8	-8	-8	-6	-8	-8	-6	-8	-8	-8
Assigned Amount	144.5	172.5	34.2	95.5	28.6	47.4	433.6	264.9[c]	66.7	18.6
Historic emission surpluses										
1991	41.3	16.0	3.8	13.7	6.2	n.a.	21.8	85.5	8.6	0.9
1992	53.4	31.1	15.1	22.5	10.6	n.a.	20.2	57.8	13.4	1.1
1993	54.3	37.2	23.4	22.6	14.3	n.a.	29.4	67.7	17.5	0.5
1994	64.5	42.9	20.3	24.4	15.7	n.a.	20.4	74.4	20.5	0.4
	59.0	43.5	22.7	23.6	17.7	n.a.	42.7	52.5	18.8	-0.4
1996	62.4	36.1	23.4	22.4	18.4	n.a.	22.8	57.9	19.0	-1.2
1997	67.3	34.5	22.6	24.7	19.1	n.a.	33.1	63.7	19.0	n.a.
1998	75.7	41.5	24.2	17.9	19.0	23.9	56.7	85.7	21.1	n.a.
1999	79.4	48.6	25.6	15.0	19.7	n.a.	n.a.	n.a.	20.1	n.a.
2000	n.a.	n.a.	n.a.	n.a.	20.1	n.a.	n.a.	n.a.	n.a.	n.a.
Projected surpluses in 2010										
With measures	10.8	30.8	25.5	-4.8	15.8[a]	n.a.	39.4[d]	17	15.3	-2.5
With additio-nal measures	19.0	37.3	28.1	-2.2	n.a.	n.a.	61.6[d]	55.8	20.7	-1.5

[a] Source: EEA 2004

[b] Source: Second National Communication

[c] Source: http://www.unfccc.int

[d] Figures only refer to energy-related emissions, Source: EEA 2004

n.a. – not available

Table 23: GHG emissions in EU Accession Countries, Source: Compilation from Third National Communications

2.4 JI and AAU Supply from Russia and the Ukraine

The Russian Federation and the Ukraine are committed to stabilising their GHG emissions at the 1990 level. Like in most other Central and Eastern European countries, the GHG emissions from these two countries have declined sharply due to the economic collapse in the 1990s. Table 24 provides relevant data for the period from 1990 to 1999 for the Russian Federation and from 1990 to 1997 for the Ukraine.

	The Russian Federation		**The Ukraine**	
	1990	**1999**	**1990**	**1997**
GHG emissions (Mt CO_2e)	3,048	1,877	932	336
GDP (in%)	100	64	100	42
GHG emissions per GDP (kg CO_2e/$)	2.27	2.30	n.a.	n.a.
Population (million)	148.29	146.31	60.99	51.69
Total Primary Energy Supply (TPES in Mtoe)	868	603	262	150
TPES by source	Gas 42% Oil 30% Coal 21% Nuclear 4% Renewables 3%	Gas 52% Oil 21% Coal 18% Nuclear 5% Renewables 4%	Gas 36% Oil 24% Coal 32% Nuclear 8% Renewables 0%	Gas 44% Oil 12% Coal 29% Nuclear 14% Renewables 1%
Final Energy Consumption (Mtoe)	566	410	220	76.8

Table 24: General economic data for Russia and the Ukraine in the 90´s, Source: Russian Federation 2002; Ukraine 1998.

The following part provides details for the GHG emission reduction and JI potential, if available, by sector for each country individually.

2.4.1 Russian Federation

2.4.1.1 Emission projections

The Russian Federation has so far submitted three National Communications, the most recent in November 2002. GHG emission projections in NC3 are mainly based on one positive and one unfavourable scenario. In detail, the assumptions for the period 2001 to 2020 are (Russian Federation 2002: 73):

- Annual GDP growth of 5-5.2% in the positive scenario and 3.3 in the unfavourable scenario,
- Decrease of energy intensity by 3.7% or by 2.5-2.6% annually,
- Energy consumption grows by 1.5% or 0.7-0.8%.

Additionally, a third scenario is provided, estimating the GDP growth at 4,5% annually, the energy intensity decrease at 2.0% annually and the increase of final energy consumption at 2.5% annually (Russian Federation 2002: 73).

The Russian Federation states that a baseline or business-as-usual scenario would not make too much sense regarding the given conditions of the Russian Federation as a country in transition to a market economy, where naturally projections of economic growth are uncertain. (Russian Federation 2002: 71)

Explicit projections are only given for carbon dioxide in percentage of the 1990 level (Russian Federation 2002: 73f):

- The positive scenario sees CO_2 emissions in 2008 at 78%, in 2010 at 80.4% and in 2012 at 82.8% of the 1990 level. This indicates that for the whole commitment period there would be a surplus of at least 524.26 Mt CO_2.
- The unfavourable scenario shows CO_2 emissions in 2008 at 73.8%, in 2010 at 75.04% and in 2012 at 76.2% of the 1990 level, which equals a surplus of 725.42 Mt CO_2.
- The additional scenario forecasts CO_2 emissions in 2008 at 84.5%, in 2010 at 88.9% and in 2012 at 93.4% of the 1990 level, which would result in a minimum surplus of 201.16 Mt CO_2.

2.4.1.2 Reduction Potential by Sector

2.4.1.2.1 Conventional Energy Supply and Industry

The Russian Federation has a high percentage of the world´s energy reserves on its territory (Russian Federation 2002: 25):

- 12% of world oil reserves,
- 34% of world natural gas reserves,
- 20% of world hard coal reserves,
- 32% of world brown coal reserves.

The policy measures to reduce GHG emissions outlined in NC3 mainly focus on CO_2 emissions from combusting fossil fuels (Russia 2002: 55). Here, two main programmes need to be mentioned:

- The Basic Provision for the Energy Strategy for Russia for the period to 2020,
- The Energy Efficient Economy.

The general aims of these programmes are:

- Efficient use of natural resources,
- Increase of energy use efficiency,
- Replacing GHG intensive energy production capacity with less GHG intensive capacity such as renewable energies and nuclear power,
- Structural optimisation of power generating facilities,
- Decrease losses in energy transportation system.

Divided by sector, the measures in the two programmes are supposed to eventually result in the following reductions of energy consumption (Russian Federation 2002: 61f):

- Energy intensive industries 1,465 – 1,583 PJ,
- Agriculture: 176 – 205 PJ,
- Rural Area: 1,114 PJ,

- Transport: 272 - 307 PJ, of which 147 PJ from railway transport,
- Federal Institutions: 243PJ,
- Energy branches: 1,2879PJ.

Implementation would yield annual emission reductions of 330 Mt CO_2e by 2010 (Russian Federation 2002: 61). The total investment needs for the programme until the year 2020 are estimated at 550-700 billion USD (UNFCCC 2004: 23).

There is also potential in CH_4 mitigation from coal mining since 68% of CH_4 emissions are related to fugitive emissions from coalmines. The government plans to switch from underground mining to open pit mining, which should include 75% of all mines in the future. A decrease of underground mining by 1% reduces methane emissions by 2.1%. Further potential lies in utilising the methane extracted by degassing and vent systems for energy purposes (Russia 2002: 65f).

Excursus: JI potential in the Russian gas industry

The Russian Federation, with proven gas reserves of 47 trillion m^3, is the world's largest producer (580 billion m^3/a) of natural gas and the main natural gas supplier to the EU (115 billion m^3/a) (BP 2004) The market leader Gazprom, which is partly state-owned, operates one of the largest long-distance gas networks in the world with about 153,000 km of gas mains that have been installed mainly during the 1970's, 80's and 1990's.

Recent results on the volume of greenhouse gas emissions

Due to leakages and accidents but also during regular operation significant amounts of natural gas (consisting mainly of the potent greenhouse gas CH_4) are released to the atmosphere at production and processing sites as well as during transport and distribution. Results of an intensive measurement campaign in Russia carried out in 2003 by the Wuppertal Institute and the Max Planck Institute indicate an overall loss during transport within Russia of 0.7% of gas delivered, with a range of 0.4-1.6% (Lelieveld et al. 2005; Lechtenböhmer et al. 2005). For gas spills at the wells (for which only little information is available) the same leakage as in the USA, i.e. about 30% of overall emissions, with a large uncertainty range of 0.2-1.0% was assumed (Lelieveld et al. 2005). In absolute terms this means that during production, processing and long distance transport of Russian natural gas between 3.5 and 15 billion m^3 of natural gas are emitted to the atmosphere per year, representing an economic value of about 350 to 1,500 million EUR and greenhouse gas emissions ranging from 50 to 225 Mt CO_2e.

Due to the high energy needs of the pipeline system the CO_2 emissions from compressor drives amount to about 68 to 81 Mt CO_2 annually (estimate based on Lechtenböhmer et al. 2005).

Estimates on JI Potential

In spite of improvements made by Gazprom in the past decade there are still great possibilities to reduce CH_4 emissions from the Russian natural gas system. Robinson, Fernandez and Kantamaneni (2003) list quite a number of technical measures that could be implemented in Russia. The measures cover the production and the transportation segment of the natural gas industry and are derived from US experience with the extensive Natural Gas Star program. They include the installation of flare systems and green completions at wells, replacement of high bleed pneumatics with low bleed systems, introduction of directed inspection & maintenance at compressor stations, retrofitting of fuel gas recovery for blowdown valves and composite wrap repairs for pipeline tubes. Robinson, Fernandez and Kantamaneni estimate that more than 30 % of the CH_4 emissions could be mitigated at costs below 10 US-$/t CO_2e. Experiences of the Rusagas Carbon Offset Project between TransCanada and Gazprom who carried out directed inspection & maintenance at two Russian compressor stations as a test for possible JI projects confirm the existence of significant and cost efficient CH_4 mitigation potentials (Venugopal 2003).

Regarding the CO_2 emissions from energy use Ruhrgas and Gazprom have carried out a JI pilot project where they attained 1.5 bln kWh reduction of gas consumption for turbines by computer-based load optimisation. They are currently planning to expand the project to the whole Gazprom system, with expected emission reductions of about 4.5 Mt of CO_2.

Conclusion

There is significant potential to reduce greenhouse gas emissions in the Russian gas industry. Especially for CH_4 there are cost efficient mitigation options available that have not been fully implemented by Gazprom. A conservative estimate arrives at 15 Mt tons of CO_2e annually that can be mitigated at costs below 10 US-$ per ton, most of it at even much lower prices. Drive energy reduction and the huge distribution system offer further large mitigation potentials.

These facts and the long-term need by Gazprom to secure funds for maintenance and re-investment of its huge operating system are probably the main reasons why Gazprom has been among the early supporters of the ratification of the Kyoto Protocol (cf. Grubb / Safonov 2003).

2.4.1.2.2 Renewable Energy

Concerning renewable energies, large hydro electricity production is supposed to increase from 175.1 TWh in 2001 to 181 TWh in 2010. Non-traditional renewables, i.e. biomass, wind, solar and geothermal energy and small hydro, are also to be further developed. In total, renewables are supposed to contribute 3-5 Mtoe to energy supply in 2010 (Russian Federation 2002: 61).

2.4.1.2.3 District Heating and Residential Sector

NC3 gives little detail regarding the residential sector, only some information on energy efficiency plans up to 2005. Measures such as energy controls and regulating devices, efficient light bulbs, automation of heating devices and replacement of boilers are supposed to have yielded emission reductions of 40 Mt CO_2e per year (Russian Federation 2002: 63).

2.4.1.2.4 Transport

As for the transport sector, fuel consumption could be reduced by up to 40% by modernising the vehicle fleet, introducing modern oil additives and high-octane petrol (Russian Federation 2002: 65).

2.4.1.2.5 Waste Management

Concerning waste management, NC3 only refers to waste in the construction industry which is of little climate relevance (Russian Federation 2002: 70).

2.4.1.2.6 Overall JI Potential

It is not clear which part of the reduction potential mentioned could be tapped by JI. But given the financial and administrative difficulties of the Russian state it is unclear which part of the government programmes mentioned will actually be realised. Projects therefore stand a good chance of being additional and the theoretical JI potential could range in the hundreds of Mt CO_2e per year. Moreover, Russia is interested in early trading based on AAUs so that certificates could already be generated pre-2008 (World Bank 1999: 34).

2.4.2 The Ukraine

2.4.2.1 Emission projections

The Ukraine handed in the first NC in 1998. In this NC, the Ukraine provided data according to a baseline scenario, an optimistic scenario and a pessimistic scenario. The underlying assumptions are not transparently presented for all parameters in NC1 but were further clarified by the UNFCCC in-depth review (Ukraine 1998: 1-5; UNFCCC 2000: 20f) :

- GDP level compared to 1990: in 2005 –20.1%; in 2010 +14.2%; in 2015 +32%,
- The GDP for the optimistic scenario in 2010 would be +24.7 and for the pessimistic scenario -9.1% compared to the 1990 level,
- The amount of fuel combustion is expected to remain below the 1990 level until 2015,
- Population will start to increase in the new millennium and reach the 1990 level in 2015, after a sharp decline at the beginning of the 1990´s,
- Final energy consumption in 2015 would be 205 Mtoe according to the baseline scenario, 235 Mtoe according to the optimistic scenario and 180 Mtoe according to the pessimistic scenario.

In all scenarios GHG emissions are projected to remain below the 1990 level. In the baseline scenario 2015 emissions are about 15.7% below the 1990 level, in the pessimistic one 27% and in the optimistic scenario 10.7% (Ukraine 1998: 6-40 – 6-41). The main difference, besides economic growth, between the pessimistic and the optimistic scenario is the volume of energy savings. In the optimistic scenario, energy savings are expected to be 10-12% higher than in the baseline scenario, whereas in the pessimistic scenario they are assumed to be 25-30% lower (Ukraine 1998: 1-5). Only the baseline scenario provides a figure for the year 2010, with GHG emissions being 18% lower than in 1990, which would mean a surplus of 168 Mt CO_2e annually, i.e. 840 Mt CO_2e for the whole commitment period (Ukraine 1998: 6-40).

However, all projections in these scenarios are based on the assumption of economic growth from 1995, whereas in fact the Ukrainian economy only started to grow from the year 2000 onwards. Due to this delay in economic growth the GHG emission figures mentioned above might also be reached five years later if the economy grows with the same velocity as predicted. So the actual emission surplus for the first commitment period is very likely to be higher than stated in NC1. The UNFCCC in-depth review also argued that the GDP estimates in the baseline scenario might be too high (UNFCCC 2000: 20). Indeed, the National Strategy for Joint Implementation and Emissions Trading expects an annual surplus of 300 Mt CO_2e (Ukraine 2003: 13).

2.4.2.2 Reduction potential by Sector

2.4.2.2.1 Conventional Energy Supply and Industry

Since most of the energy and industrial infrastructure is rather deteriorated, there is great potential for energy efficiency. This sector is also considered to be the one where measures could be realised with least costs. Relatively straightforward energy efficiency measures alone could yield annual reductions of 27 Mt CO_2e (Point Carbon/ Vertis 2003).

The total available reduction potential from energy efficiency measures is probably much higher. NC1 provides a list of 28 measures which would lead to annual GHG emission reductions of 377 Mt CO_2e by 2015 (Ukraine 1998: 5-24 – 5-29). The implementation of these measures is estimated to require around 29-32 billion USD and therefore depends on acquiring the necessary funding (Ukraine 1998: 1-5).

2.4.2.2.2 Renewables

The Ukraine offers quite some potential regarding renewables, especially for biomass and wind energy. For the latter, the Ukraine aims to achieve an installed capacity of 200 MW by 2010 and has passed legislation on the purchase of electricity from renewables. Currently around 40 MW are being installed. Although the biomass sector is rather negligible at the moment, it is supposed to contain a large potential for growth. Concrete figures on the related emission reduction potential, however, were not provided (Point Carbon/Vertis 2003).

The potential of hydropower on the other hand has already been developed to a large degree with an installed capacity of 4,700 MW (UNFCCC 2000: 11f)

2.4.2.2.3 District Heating and Residential Sector

There are thousands of boilers for central heat supply which could be upgraded to combined heat and power systems. Concrete figures regarding the emission reduction potential were not available (UNFCCC 2000: 12).

2.4.2.2.4 Waste Management

Waste is another sector with a large reduction potential. By the end of the last millennium over 90% of waste was deposited in about 700 landfills, none of which had a collection system for landfill gas. The rest of the waste was incinerated in 4 incineration plants. Large investments need to be undertaken since all equipment is rather obsolete. The Ukrainian goal in waste policy is an equal share of waste to be incinerated and waste to be disposed of in landfills by 2015 (UNFCCC 2000: 18).

2.4.2.2.5 Transport

Not many measures are mentioned in NC1 concerning the transport sector. GHG emission reductions are considered to be very costly in this sector. Since energy intensity in transport is expected to increase by 10-30% in the coming years, there seems to be a high theoretical potential for reducing emission. Possible measures include upgrading the electric vehicle fleet in public transport (UNFCCC 2000: 16).

2.4.2.3 Overall JI Potential

The Ukraine has a high potential for further GHG emission reduction measures. Energy efficiency measures which are viable for JI could yield an annual 100 Mt CO_2e. The total potential of all measures which are viable for JI have been estimated at 150 Mt per year, i.e. 750 Mt CO_2e for the whole commitment period.[45]

Since financing these measures seems to be a major problem, most of these projects would probably be additional. As a matter of fact, the UNFCCC review team noted in its report that most measures planned by the government could be postponed or even completely cancelled due to these financial problems (UNFCCC 2000: 22-24).

2.4.3 Overall Supply from Russia and the Ukraine

Russia and the Ukraine dispose of vast emission surpluses; even at a conservative estimate the combined total easily exceeds 500 Mt CO_2e per year. Moreover, emission reductions through JI could theoretically yield another 500 Mt CO_2e. However, several caveats have to be mentioned.

First, both countries are not considered to be the best address concerning foreign direct investment. A good business environment depends, inter alia, on the integrity of public and private agents, the absence of crime and corruption, political and economic stability, as well as an effective infrastructure and a well-functioning financial sector. Russia and the Ukraine, however, feature for instance a weak judiciary which can render foreign companies unable to enforce contracts, corruption which often reaches to the highest levels of government and a poorly developed capital market offering only limited access to finance (Point Carbon/Vertis 2003; Fankhauser/Lavric 2003: 15-17).

Secondly, the necessary institutional infrastructure for the implementation of JI projects is also sorely lacking. The Ukraine did not even host any projects during Activities Implemented Jointly (AIJ) pilot phase (Fankhauser/Lavric 2003: 12). The Russian Federation participated actively in the AIJ pilot phase and established the Interagency Commission of the Russian Federation on Climate Change Problems to facilitate projects (World Bank 1999: 40-42). But the JI infrastructure still leaves a lot to be desired (Point Carbon 2005: 4f).

Finally, Russia and the Ukraine will need to fulfill the eligibility criteria for participating in the Kyoto mechanism outlined in the previous sections. It remains to be seen in how far they will be able to do so.

Due to the generally poor investment climate and JI-specific institutional shortcomings, Point Carbon (2005: 7-9) estimates that the combined amount of ERUs from both countries will probably not exceed 30 million per year. They are also sceptical as to which part of their AAU surplus will actually reach the market. First, they will have to meet the eligibility criteria for participating in Art. 17 emissions trading. Even if they manage to qualify, Russia might limit sales to 2-3% of its surplus and the Ukraine to 30%. Given the estimates outlined above, this might mean an annual supply of about 100 million AAUs.

[45] Ukraine (2005): Canada-Ukraine Environmental Cooperation Program, Joint Implementation Project Database: http://www.ji.org.ua/ [18.02.2005].

2.5 CDM Supply

2.5.1 Methodology

The size of the CDM market depends on a number of factors. On the supply side these are:

- implementation costs,
- transaction costs,
- baseline setting,
- additionality criteria,
- specific situation in the host country concerning investment climate and CDM infrastructure.

On the demand side these are mainly:

- the gap between Kyoto targets and actual GHG emissions in Annex B countries,
- the amount of hot air supply,
- the amount of ERU supply.

Based on these factors, several studies have estimated the potential size of the CDM market. The estimates range from 67 to 723 Mt CO_2e annually. (Criqui / Kitous 2003; Ellis / Corfee-Morlot / Winkler 2004; Haites 2004; Jotzo / Michaelowa 2002; Zhang 2000; Zhang 2003).

However, most studies used different parameters for their scenarios, for example, concerning inclusion of the USA, different regional splitting, different figures for the factors mentioned above or also inclusion of countries that have not yet ratified the Kyoto Protocol.

We therefore recalculated these studies according to the following parameters and took the average of the resulting figures.

For the expected compliance gaps or overcompliance of the individual countries, we took the figures established in this paper:

- Given current emission trends in the Annex B buyer countries, we followed the scenarios with existing measures, which yield a potential annual demand from Annex B countries of 748.4 Mt CO_2e.
- Conversely, the 520.76 Mt CO_2e of total emissions surpluses in the new EU Member States, Russia and the Ukraine projected in the scenarios with existing measures are the result of a very pessimistic forecast, combining relatively high economic growth with very small improvements in energy efficiency. In fact, hot air supply should in theory be more than sufficient to fully cover any demand. However, as outlined above Russia and the Ukraine might in practice sell only a small part of their surplus on the market. Besides, the EU but also other countries might establish (unofficial) rules to cap or to totally ban the purchase of hot air (Laroui / Tellegen / Tourilova 2004: 905). We therefore disregarded the potential hot air supply for our calculation.

Moreover, we again assumed a market price of 5 EUR per certificate. Finally, we only included countries that ratified the KP up to February 2005.

Recalculating the studies mentioned above according to these parameters, the average of the results from these recalculations is a total annual CDM supply of 423.85 Mt CO_2e. The shares of this overall market potential for the different regions will be outlined in the following section.

2.5.2 CDM Potential by Region

We divided the countries into regions mainly according to the continent they belong to but made one exception in the case of Asia, where we established three categories which are rather political than geographical: Middle East, Former Soviet Union and Asia.

North and Central America	**Africa**	**South-Pacific**	**Asia**
Antigua and Barbuda	Benin	Fiji	Bangladesh
Bahamas	Botswana	Marshall Islands	Bhutan
Belize	Burundi	Cook islands	Cambodia
Costa Rica	Cameroon	Kiribati	China
Cuba	Djibouti	Micronesia	India
Dominican Republic	Equatorial Guinea	Nauru	Laos
El Salvador	Gambia	Niue	Malaysia
Grenada	Ghana	Palau	Maldives
Guatemala	Guinea	Papua New Guinea	Mongolia
Honduras	Lesotho	Samoa	Myanmar
Jamaica	Liberia	Seychelles	Philippines
Nicaragua	Madagascar	Solomon Islands	Republic of Korea
Panama	Malawi	Tuvalu	Sri Lanka
Saint Lucia	Mali	Vanuatu	Thailand
Saint Vincent and the Grenadines	Mauritius		Vietnam
Trinidad and Tobago	Morocco	**Middle East**	
	Mozambique	Israel	**Former Soviet Union**
South America	Namibia	Jordan	Armenia
Argentina	Niger	Oman	Azerbaijan
Bolivia	Nigeria	Qatar	Georgia
Brazil	Rwanda	Saudi Arabia	Kyrgyzstan
Chile	Senegal	United Arabian Emirates	Moldova
Colombia	South Africa	Yemen	Turkmenistan
Ecuador	Sudan		Uzbekistan
Guyana	Togo	**Europe**	
Paraguay	Tunisia	Cyprus	
Peru	Uganda	Macedonia, FYR	
Uruguay	Tanzania	Malta	

Table 25: Non-Annex B Countries having ratified the Kyoto Protocol by February 2005b, Source: http://unfccc.int/essential_background/kyoto_protocol/status_of_ratification/items/2613.php [17.02.2005]

2.5.2.1 Africa

Recalculating the studies mentioned yields an annual potential of 36.2 Mt CO_2e. Of these, South Africa is expected to supply the largest share of about 5.81 Mt CO_2e (1.37% of global CDM supply), followed by Egypt with 2.54 Mt CO_2e (0.6%).

However, this potential might fail to actually be realised due to institutional inadequacies. At the time of writing only six of the 29 countries listed above had officially notified a Designated National Authority (DNA) to the UNFCCC: Egypt, Madagascar, Mali, Mauritius, Morocco and Niger.[46] One reason may be that 19 of these countries belong to the category of least developed countries as defined by the UN, as a result of which they may not dispose of the necessary technical and financial capacity.

2.5.2.2 Asia

Asia hosts the three countries that are expected to supply the largest shares of the worldwide CDM market.

- China with an estimated volume of 204.46Mt CO_2e (48.24%),
- India with an estimated volume of 52.09 MtCO_2e (12.29%),
- Indonesia with an estimated volume of 12.93 MtCO_2e (3.05%).

Other Asian countries are estimated to contribute 43.36 MtCO_2e (10.23%) annually of the global CDM supply. Among these, the Republic of Korea is expected to gain a share of 4.83 Mt CO_2e (1.14%).

All countries from this region except for Indonesia and Pakistan have already notified a DNA to the UNFCCC.[47]

2.5.2.3 South Pacific

The countries in the South Pacific region are without exception rather small islands. Among these countries, only Fiji has so far established an official DNA. Specific studies on these countries are not available, and since they will most probably not supply large amounts of CERs, they will not be further analysed here.

2.5.2.4 Europe

The Non-Annex B Parties in Europe are Cyprus, Malta and the Former Yugoslav Republic of Macedonia. However, all are relatively small states. Recalculating the studies mentioned yields an estimated CDM potential of 2.25 Mt CO_2e, equal to 0.53% of global supply.

2.5.2.5 Former Soviet Union (without Russia and Ukraine)

What was written regarding Russia and the Ukraine regarding reduction potentials to a lesser extent also counts for these countries. Kazakhstan as the largest country has not yet ratified the Kyoto Protocol.

[46] CDM: Designated National Authorities (DNA): http://cdm.unfccc.int/DNA [17.02.2005].
[47] Ibid.

Recalculating the studies mentioned yields an estimated potential CDM supply of 15.81 Mt CO_2e, equal to 3.73% of global CER supply. If Kazakhstan were to be included, the amount would rise up to around 17.58 Mt CO_2e.

2.5.2.6 North and Central America

With the notable exception of Mexico, which is in theory supposed to become the most important host country in North and Central America, this region has so far been quite active concerning the CDM. During the AIJ phase there have been numerous projects, mostly in Costa Rica, Honduras, Guatemala and Nicaragua. These countries also have a relatively high share of the CDM projects which are currently being planned. This large share, however, refers to the absolute number of projects. The share expressed in reduction of GHGs is relatively small due to the rather small size of these countries (Ellis / Corfee-Morlot / Winkler 2004: 19-22; 40-45).

According to the recalculation of the studies mentioned, Mexico will supply 12.16 Mt CO_2e, equal to 2.87% of global supply. The supply from the rest of the North and Central American countries amounts to 7.12 Mt CO_2e, equal to 1.68%.

2.5.2.7 Middle East

Until the end of 2004 only three countries from this region had ratified the Kyoto Protocol: Israel, Jordan and Yemen. Most recently another four countries also decided to ratify. Given this situation we estimate the potential from this region to be 15.43 Mt CO_2e, equal to 3.64% of global supply.

2.5.2.8 South America

Brazil is expected to supply the largest contribution from this region to the global CER supply, namely 8.82 Mt CO_2e (2.08%)

As for the other countries, our recalculation puts their CER supply at 8.39 Mt CO_2e, or 1.98% of global supply.

2.5.3 Overall CDM Supply

Table 26 gives an overview of the findings, ranking the countries and regions in alphabetical order.

It bears noticing that at the time of writing only two CDM projects had been officially registered. The elaborate CDM project cycle could thus turn out to be a significant bottleneck factor, not only concerning the Executive Board but also concerning the establishment and functioning of the DNAs and the approval procedures in the parties involved. Many countries, especially host countries, still have to establish their national institutions and regulations. Lack of capacity might thus prove a serious obstacle to speedy project approval.

Region/ Country	CDM Supply	
	in Mt CO_2e	in %
Africa		
Egypt	2.54	0.60
South Africa	5.81	1.37
Rest of Africa	27.85	6.57
Asia		
China	204.46	48.24
India	52.09	12.29
Indonesia	12.93	3.05
Republic of Korea	4.83	1.14
Rest of Asia	43.36	10.23
Europe	**2.25**	**0.53**
Former Soviet Union	**15.81**	**3.73**
Middle East	**15.43**	**3.64**
North and Central America		
Mexico	12.16	2.87
Rest of North and Central America	7.12	1.68
South America		
Brazil	8.82	2.08
Rest of South America	8.39	1.98
Total	**423.85**	**100**

Table 26: CDM supply by country and region

Ellis, Corfee-Morlot / Winkler (2004: 40-45) provide a list of 145 projects which were in the pipeline at the time of writing of their study. The average size of these projects is a little above 0.2 Mt CO_2e annually, which means that more than 2000 projects would be necessary to cover the estimated potential CER supply. At the moment it seems as if the CDM infrastructure will at best be able to process a fraction of this number.

Given the figures in Table 26, it seems probable that the CDM will concentrate on a small number of host countries such as China, India, Brazil and South Africa which contain a very substantial emission reduction potential and can also provide a relatively friendly investment environment.

2.6 Overall Supply

Table 27 summarises the figures established in this paper for the potential supply on the global market for emission certificates. However, it bears repeating the caveats mentioned earlier.

As already pointed out, the estimates for the emission surpluses in the Central and Eastern European Countries vary widely. Moreover, it is unclear whether these countries will meet the eligibility criteria for participating in Art. 17 emissions trading, especially in the cases of Russia and the Ukraine. Even if they did, they may decide to bank the major part of their surpluses for the second commitment period.

JI supply from the new EU Member States and EU Accession countries is also a rather hypothetical figure since the literature surveyed for Paper 2 was very vague on concrete figures. The theoretical JI potential in Russia and the Ukraine is massive, but in practice it is severely curtailed by the unfavourable business environment.

The same probably also holds for the CDM. In all likelihood the theoretical potential of 423.85 Mt CO_2e we established in this paper will only be partially realised due to insufficient capacity at the national level as well as at the CDM Executive Board.

Annual Supply (Mt CO_2e)	**Lower Estimate**	**Upper Estimate**
Hot Air from New EU Member States and EU Accession Countries	151.6	227.5
Hot Air from Russia	201.16	725.42
Hot Air from the Ukraine	168	300
JI in the New EU Member States and EU Accession Countries	n.a.	130
JI in Russia and the Ukraine	30	500
CDM	n.a.	423.85
Total	**550.76**	**2306.77**

Table 27: Summary of supply estimates

Conclusions

Tables 28 and 29 summarise the projected deficits in the Annex B buyer countries as well as the potential supply as established in this paper.

Deficits in 2010 (Mt CO_2e)	With existing PAMs	With additional PAMs	EU Supplementarity
EU-15	322,1	64.1	185
Other Annex B buyer countries	426.3	179.5	
Total	**748.4**	**243.6**	

Table 28: Summary of estimates of total deficits in Annex B buyer countries

Annual Supply in 2010 (Mt CO_2e)	Lower Estimate	Upper Estimate
Hot Air from New EU Member States and EU Accession Countries	151.6	227.5
Hot Air from Russia	201.16	725.42
Hot Air from the Ukraine	168	300
JI in the New EU Member States and EU Accession Countries	n.a.	130
JI in Russia and the Ukraine	30	500
CDM	n.a.	423.85
Total	**550.76**	**2306.77**

Table 29: Summary of supply estimates

Comparing the totals of the two tables quickly shows that in theory, supply exceeds demand by far. Taking a closer look at the underlying issues at hand, however, makes it apparent that the situation on the global market for emission certificates is much more complex. As mentioned throughout the paper, several concerns regarding both supply and demand remain unresolved and only further decision-making in the respective countries will determine which way the balance between demand and supply will move.

The main uncertainties regarding our research results are threefold and all point to a lower supply estimate than stated in Table 29. Firstly, international policy development indicates that hot air supply may not be forthcoming or only to a small degree for reasons discussed above. Moreover, several buyer countries, especially the EU-15 countries, may find it politically unfeasible to use hot air for their compliance. They might succumb to public pressure to use this public spending on projects that directly reduce emissions across the world. This would mean that a certain process has to be established that indicates which source an emission certificate has originated from.

Secondly, our results indicating JI supply from the new EU Member States and EU Accession Countries was taken directly from Paper 2, where it is noted that the literature surveyed rather lacked concrete figures.

Thirdly, as discussed earlier, our research that yielded the CDM figure in Table 29 indicates a maximum available potential, whereas the actual CDM supply will probably be only a fraction of this. Lack of funding of the CDM process as well as uncertainty surrounding the determination of additionality, sustainable development value and transaction costs among other concerns are proving to mount considerable barriers to CDM planning and implementation.

It can therefore be concluded that, in practice, supply will most likely be able to cover only a fraction of the demand that will arise if the buyer countries do not rein in their emissions. One should also note that supply will probably concentrate on very few countries. If they qualify for Art. 17 emissions trading, Russia and the Ukraine will dispose of about more than two thirds of available hot air supply, whereas the CDM is likely to be dominated by the large developing countries such as China and India. This could put the sellers into a very favourable position, and ever more so the nearer the end of the first commitment period comes and the more the buyer countries fail to rein in their emissions.

Just like other buyer countries, the Japanese government should therefore consider implementing further measures to reduce emissions domestically so as to reduce its dependence on the international market.

As for buying certificates, given the uncertainties regarding the potential supply on the one hand and the enormous potential demand on the other, the Japanese government would be well advised to quickly move to secure the amounts it needs. The following aspects can be noted for the individual supply sources:

Art. 17 emission trading currently seems to be the most unreliable source. Seller countries will first have to fulfil the eligibility criteria for participating in international emissions trading. Even if they succeed at qualifying, they may well prefer to bank a major part of their surpluses for the second commitment period.

Russia and the Ukraine offer a vast potential for cost-efficient emission reduction projects but a poor business environment. Still, JI opportunities should be further explored.

Conversely, the new EU Member States and the EU Accession Countries provide a relatively good business environment and substantial potential for cost-effective emission reductions. Projects without linkage to the EU ETS, such as projects in the district heating sector, are still possible without further complications. Projects with indirect or direct linkage to the EU ETS are also still possible but will probably entail increased transaction costs due to the necessity to avoid double counting.

As for the CDM, the first projects are finally being registered and supply is constantly increasing. The CDM has the advantage of being internationally regulated, which offers a degree of certainty and reliability, and provides a significant theoretical emission reduction potential. On the downside, at least at the moment the process is still very cumbersome and many host countries offer only a poor business environment. The easiest route seems to be to focus on the large host countries with large emission reduction potentials and a good investment climate. However, focussing on less attractive countries and providing them with the necessary capacity building within the framework of a formalised cooperation could possibly have the advantage of being able to realise the reduction potentials in these countries without too much competition from other countries.

Besides these "established" mechanisms which have been examined in this paper, there are also more novel instruments which warrant further study: Green Investment Schemes (GIS) and the linking of domestic emission trading systems. Whereas the former could be a means to endow the purchase of AAUs with actual environmental benefits, the latter could be a means to access the emission reduction potentials in the Central and Eastern European energy and industry sectors, which seem to have been removed from JI by the EU ETS, as elaborated in Paper 2. These instruments will be examined more closely in Paper 4.

To sum up, it seems advisable for a buyer country such as Japan to reduce dependence on the international market by implementing further domestic action. As for covering remaining deficits via purchases, all opportunities provided by the project-based mechanisms should be used in order to diversify risk and secure the amounts needed as early as possible. Being well prepared and establishing a sound Kyoto strategy will also serve to avoid a last-minute rush for AAUs which would allow the sellers to dictate the terms.

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