

Background Paper 2

March 2005

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

Wolfgang Sterk, Maïke Bunse, Jutta Volmer and Stefan Lechtenböhmer

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. They 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 CO₂ 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 Wettstad (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 Commission'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.

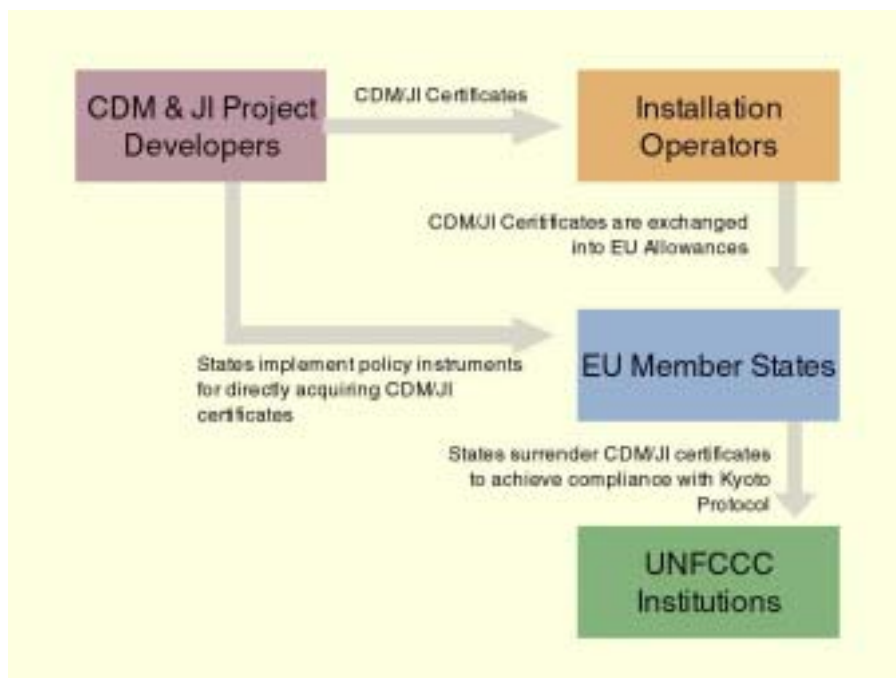


Figure 1: Means for EU Member States to Acquire CDM/JI Certificates

2.3 The Supplimentarity 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 CO₂e (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 conver-

sion 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 supplementary 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 refurbishing 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 not 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 about EUR 15.¹ 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.

¹ 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 SO₂ 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 Directive	Plant
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 CO₂ 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 ₂ e		Mt CO ₂ e	Mt CO ₂ e	Mt CO ₂ e	
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 CO₂

3) Second National Communication

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 CO₂e 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 CO₂e 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). There-

fore, 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 insolation 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 CO₂e 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 CO₂e. 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 CO₂e 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 CO₂e 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 bio-energy 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 CO₂e with marginal abatement costs in the range from 2 to 8.6 USD/t CO₂e. 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 CO₂e. 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 CO₂e. 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 CO₂e.

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 CO₂ reduction potential of about 3 Mt per year with marginal abatement costs of 2 USD/t of CO₂e. In total, the possible measures in the residential and tertiary sectors with marginal abatement costs below 30 USD/t of CO₂e 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 CO₂e. 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 CO₂e.

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 CO₂e, 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 CO₂e (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 CO₂ 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 CO₂e 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 CO₂e 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 CO₂ (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 CO₂ emissions from fossil fuel combustion in the energy sector amounted to 60.16 Mt, CO₂ 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 CO₂ 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 CO₂e 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 CO₂e 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 CO₂e 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 CO₂e. 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 CO₂e 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 Művek (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 po-

tential 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 CO₂e 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 CO₂e 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 processes. 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), CO₂ emissions from the activities covered by the EU ETS amounted to 30.52 Mt in 2002. According to Hungary's inventory for 2002, CO₂ emissions from fossil fuel combustion in the energy sector amounted to 19.68 Mt, CO₂ 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 CO₂ 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 ₂ e 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 CO₂e 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 CO₂ 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 CO₂e 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 SO₂ 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 CO₂e, 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 CO₂e. 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 CO₂e (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 CO₂e 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 CO₂e 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 CO₂e 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 bio-fuel 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 CO₂ (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 CO₂e 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 CO₂e 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 CO₂e 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 CO₂ 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. CO₂ emissions from the installations covered by the EU ETS make up 68% of the total national CO₂ 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 too 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 ₂ e 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 renewable 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 mobility, 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 CO₂e (Slovakia 2001: 95), so that the target amounts to 66,728 Mt and thus a total amount of 333.638 Mt CO₂e 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 CO₂e (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 CH₄ emissions would be reduced by 0.155 Mt CO₂e and energy-related N₂O emissions by 0.25 Mt CO₂e 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: CO₂ emissions from coal combustion fell from 5.93 Mt in 1993 to 4.34 Mt in 2001, while CO₂ 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 Elektrárne 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 is 550 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 Elektrárne 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 CO₂e. 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 CO₂e, 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 CO₂e. 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 CO₂e 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 CO₂e. 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 CO₂e. Combined cycles in public CHP could reduce emissions by 520 kt at 26-28 USD/t CO₂e. 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 CO₂e 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 CO₂e p.a. while the technical potential is above 50 Mt CO₂e 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 CO₂e p.a.

According to the draft NAP (Slovakia 2004: 7), CO₂ 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, CO₂ emissions from fossil fuel combustion in the energy sector amounted to 12.8 Mt, CO₂ emissions from fossil fuel combustion in industry to 14.23 Mt, amounting to a total of 27.03 Mt. CO₂ 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-CO₂ 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-CO₂ 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 CO₂e 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 CO₂e for the whole commitment period (Bulgaria 2002: 57, 97).

Bulgaria's annual emission surplus is about 11 Mt CO₂e in the "with measures" and 19 Mt CO₂e 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 CO₂e 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 CO₂e, 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 CO₂e 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 CO₂e/MWh, it is supposed to reduce emissions by 61 kt CO₂e in the former and 119 kt CO₂e 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 m³ 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 CO₂e 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 hydro-power 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 CO₂e 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 CO₂e 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 CO₂e.

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 CO₂e (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 CO₂e 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 CO₂e 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 CO₂e 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 CH₄ 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 CO₂e 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 CO₂e 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 CO₂e 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 transmission 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 ₂ e 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
Biomass, 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 CO₂e (Romania 1998: 34), leading to an average annual target of 251.88 Mt and thus a total amount of 1,259.42 Mt CO₂e 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 CO₂e 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 CO₂e 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 m² of solar collectors by 2005, producing 1 TWh thermal energy and reducing emissions by 1 Mt CO₂e. 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 CO₂e 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 CO₂e 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 CO₂, 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 CO₂e per year. Another Swiss project intends to upgrade the distribution system in Bucharest with the result of 67 kt to 70 kt CO₂e 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 CO₂e 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 CO₂e 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 CO₂e 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 CO₂e. 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 CO₂e (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 CO₂ for the first commitment period.

A PCF project aims to reforest 6,728 hectares, resulting in a sequestration of about 1 Mt CO₂ 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 CO₂e 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 CO₂e.
 - 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 CO₂ 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 CO₂e 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 photo-voltaics 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 x 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%	No 4)	No

	1)		
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 Directive)
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 refurbishing 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**, CO₂ 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 CO₂e 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 CO₂e. Conversely, about 100 Mt CO₂e 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.

This paper is a contribution by Wolfgang Sterk, Maïke Bunse, Stefan Lechtenböhmer (all Wuppertal Institute for Climate, Environment and Energy) and Jutta Volmer (Independent Consultant). The authors would like to express their gratitude to Rie Watanabe (Climate Policy Project of Institute for Global Environmental Strategies (IGES)) and Thomas Langrock (Deutsche Emissionshandelsstelle (DEHSt)) for their comments. Any remaining errors are the sole responsibility of the authors.

References

- Akermanis, A. 2004. Towards Local Energy Systems: Revitalizing District Heating and Co-Generation in Central and Eastern Europe, Strategy for the Development of District Heating in Bulgaria for 2000 – 2005. Sofia: Ministry of Energy and Energy Resources.
- Bojadgieva, K., H. Hristov, V. Hristov, and A. Benderev. 2000. “Status of Geothermal Energy in Bulgaria”. In: Proceedings World Geothermal Congress 2000, Kyushu-Tohoku, Japan, May 28-June 10, 2000, 93-98.
- Bulgaria. 2002. Third National Communication on Climate Change, United Nations Framework on Climate Change. Sofia.
- Bulgarian Ministry of Environment and Water (MoEW). 2004. JI Projects in Bulgaria: http://www2.moew.government.bg/index_e.html [28.11.2004].
- Burden-Sharing Agreement: Agreement Between the European Community and Its Member States Under Article 4 of the Kyoto Protocol. FCCC/CP/2002/2, 12.06.2002.
- Christiansen, A.C. 2004. “The Role of Flexibility Mechanisms in EU Climate Strategy: Lessons Learned and Future Challenges”. In: International Environmental Agreements: Politics, Law and Economics, Vol. 4, No. 1:27-46.
- _____, and J. Wettestad. 2003. “The EU as a frontrunner on greenhouse gas emissions trading: how did it happen and will the EU succeed?” In: Climate Policy, 3:3-18.
- Czech Republic. 2001. The Czech Republic’s Third National Communication on the UN Framework Convention on Climate Change. Prague: Ministry of the Environment of the Czech Republic / Czech Hydrometeorological Institute.
- _____. 2004. National Allocation Plan of the Czech Republic 2005 to 2007, Compromise Draft of the Deputy Prime Minister for Economy, MZP and MPO, 29.9.2004.
- Decision 280/2004/EC: Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring community greenhouse gas emissions and for implementing the Kyoto Protocol. Official Journal of the European Union L 49/1, 19.02.2004.
- Energy Centre Bratislava (ECB), European Renewable Energy Council (EREC).2004. Renewable Energy Policy Review, Slovakia, May 2004. Bratislava, Brussels: ECB / EREC.
- EC Baltic Renewable Energy Centre (EC BREC), European Renewable Energy Council (EREC). 2004. Renewable Energy Policy Review, Poland. Brussels: EC BREC / EREC.
- European Climate Change Programme (ECCP). 2001. Long Report, June 2001.
- Energy Charter Secretariat. 2002. In-depth review of energy efficiency policies and programmes of Romania. Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects. Brussels: Energy Charter Secretariat.
- ET Directive: Directive 2003/87/EC of the European Parliament and of the Council of 13 October establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. Official Journal of the European Union, L 275/32, 25.10.2003.

-
- ET Proposal: 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. COM (2001) 581 final, Brussels, 23.10.2001.
- EU Commission. 1998. Communication from the Commission to the Council and the European Parliament, Climate Change – Towards an EU Post-Kyoto Strategy. COM (98)353, 3.06.1998.
- _____. 1999. Preparing for Implementation of the Kyoto Protocol. Commission Communication to the Council and the Parliament. COM(1999) 230 final, 19.05.1999.
- _____. 2000a. Communication from the Commission to the Council and the European Parliament on EU policies and measures to reduce greenhouse gas emissions: Towards a European Climate Change Programme (ECCP). COM(2000) 88 final, Brussels, 08.03.2000.
- _____. 2000b. Green Paper on greenhouse gas emissions trading within the European Union (presented by the Commission). COM(2000) 87 final, Brussels, 08.03.2000.
- _____. 2003a. 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 (internal document).
- _____. 2003b. Commission Staff Working Paper, Extended Impact Assessment on the Directive of the European Parliament and of the Council amending Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. SEC(2003) 785, Brussels, 23.07.2003.
- _____. 2004a. 2004 Regular Report on Bulgaria's progress towards accession. SEC(2004) 1199, Brussels, 6.10.2004.
- _____. 2004b. 2004 Regular Report on Romania's progress towards accession. SEC(2004) 1200, Brussels, 6.10.2004.
- EU Council. 2003. Report from Permanent Representatives Committee to Council, Subject: Proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms – Policy Debate. 16135/03, Brussels, 17.12.2003.
- _____. 2004a. Note from General Secretariat to Delegations, Subject: Proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms – Policy Debate. 5243/04, Brussels, 13.01.2004.
- _____. 2004b. Meeting Document, Subject: Proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. DS 228/04, Brussels, 22.03.2004.
- EU Parliament. 2002. Report on the proposal for a European Parliament and Council directive establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, Unofficial final Version after 1st reading in plenary, 10.10.2002.
- _____. 2004a. Draft report on the proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, 27.01.2004.
- _____. 2004b. Amendment 1, Draft report (PE 340.779) Alexander de Roo, A scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, Proposal for a directive (COM(2003) 403 – C5-0355/2003 – 2003/0173(COD) – amending act), PE 340.779/CONS.1, 11.03.2004.

-
- _____. 2004c. Report on the proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms (COM(2003) 403 – C5-0355/2003 – 2003/0173(COD)), Final, A5-0154/2004, 17.03.2004.
- Energieverwertungsagentur - the Austrian Energy Agency (EVA). 2004a. Czech Republic, Energy Demand:
<http://www.eva.ac.at/enercee/cz/demand.htm> [23.11.2004].
- _____. 2004b. Czech Republic, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/cz/supplybycarrier.htm> [23.11.2004].
- _____. 2004c. Hungary, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/hu/supplybycarrier.htm> [02.11.2004].
- _____. 2004d. Poland, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/pl/supplybycarrier.htm> [03.11.2004].
- _____. 2004e. Slovakia, Energy Market Actors:
[http://www.eva.ac.at/\(en\)/enercee/sk/energymarketactors.htm](http://www.eva.ac.at/(en)/enercee/sk/energymarketactors.htm) [19.11.2004].
- _____. 2004f. Slovakia, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/sk/supplybycarrier.htm> [19.11.2004].
- _____. 2004g. Bulgaria, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/bg/supplybycarrier.htm> [23.11.2004].
- _____. 2004h. Romania, Supply: Energy Sources:
<http://www.eva.ac.at/enercee/ro/supplybycarrier.htm> [03.11.2004]
- Polish Foundation for Energy Efficiency (FEWE). 2004. Polish Energy Efficiency Report. Katowice: FEWE.
- Government of Japan. 2003. Comments on Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/.../EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. 14.11.2003.
- Hungary. 2002. Third National Communication for the UNFCCC. Systemexpert Consulting Ltd.
- _____. 2004. Draft National Allocation Plan of Hungary.
- International Energy Agency (IEA). 2002. Energy Policies of IEA Countries, 2002 Review. Paris: OECD/IEA.
- _____. 2003. Energy Efficiency Update Hungary:
http://www.iea.org/dbtw-wpd/textbase/newsletters/eneff/effi_updates_all.pdf [28.11.2004].
- _____. 2004). Energy Efficiency Update Czech Republic: http://www.iea.org/dbtw-wpd/textbase/newsletters/eneff/effi_updates_all.pdf [28.11.2004].
- IPPC Directive: Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control. Official Journal of the European Union, L 257, 10.10.1996.
- Kolar, S., E. Levina, E. Williams, and K. Lawson. 2001. Multi-Project Baselines for Joint Implementation Projects in Poland. Centre for Clean Air Policy.
- Lako, P., H. Eder, H., M. de Noord, and H. Reisinger. 2003. Hydropower Development with a Focus on Asia and Western Europe, Overview in the framework of VLEEM 2. Verbundplan, Energy Research Centre of the Netherlands.
- Landfill Directive: Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste. Official Journal of the European Union, L 182, 16.7.1999:1-19.

-
- Langrock, T., and W. Sterk. 2004. Linking CDM and JI with EU Emission Allowance Trading, Policy Brief for the EP Environment Committee. EP/IV/A/2003/09/01, Brussels: Institute for European Environmental Policy.
- _____, and C. Arens. 2004. Die projektbasierten Mechanismen CDM & JI, Einführung und praktische Beispiele. Berlin: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.
- LCP Directive: Directive 2001/80/EC of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from large combustion plants. Official Journal of the European Union, L 309, 27.11.2001:1-21).
- Linking Directive: Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 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. Official Journal of the European Union, L 338/18, 13.11.2004.
- Linking Proposal: Proposal for a Directive of the European Parliament and of the Council amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. COM (2003) 403 final, Brussels, 23.07.2003.
- Luhmann, J. 2003. "Europas Ökosteuererhöhung, Ecofin-Rat hat nicht mehr 'gescheut', er ist gesprungen". In: Wuppertal Bulletin, Jg. 6 (2003), Nr. 2, S.:20-23.
- Maly, M., J. Jakubes, J. Jílková, and E. Snajdrová. 2002a. Country Profile – Czech Republic, Review of Status of Emissions Trading Activities in CG11 Countries, working version for CG11 workshop in Zagreb, Croatia, 28. – 29. May 2002: http://r0.unctad.org/ghg/sitecurrent/projects/cg11/country_p/Czech_Republic_Country_Profile.doc [22.11.2004].
- _____. 2002b. Country Profile – Hungary, Review of Status of Emissions Trading Activities in CG11 Countries, working version for CG11 workshop in Zagreb, Croatia, 28. – 29. May 2002: http://r0.unctad.org/ghg/sitecurrent/projects/cg11/country_p/Hungary_Country_Profile.doc [22.11.2004].
- _____. 2002c. Country Profile – Poland, Review of Status of Emissions Trading Activities in CG11 Countries, working version for CG11 workshop in Zagreb, Croatia, 28. – 29. May 2002: http://r0.unctad.org/ghg/sitecurrent/projects/cg11/country_p/Poland_Country_Profile.doc [12.11.2004].
- _____. 2002d. Country Profile – Slovak Republic. Review of Status of Emissions Trading Activities in CG11 Countries. Working version for CG11 workshop in Zagreb, Croatia, 28. – 29. May 2002: http://r0.unctad.org/ghg/sitecurrent/projects/cg11/country_p/Slovakia_Country_Profile.doc&e=7634 [12.11.2004].
- Marias, M. 2003. Renewable Energy Policy of the Slovak Republic. Presentation, Budapest 13th October 2003: <http://www.iea.org/dbtw-wpd/textbase/work/2003/budapest/marias.pdf> [17.11.2004].
- Ministry of Economic Affairs of the Netherlands (MOEA). 2004. Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines, Version 2.3, May 2004.
- Nondek, L., M. Maly, V. Splitek, and J. Pretel. 2001. Joint Implementation in the Context of European Union Accession. The Case of the Czech Republic. PCFplus Report 7.
- Oberthür, S., and H. Ott. 1999. The Kyoto Protocol, International Climate Policy for the 21st Century. Berlin, Heidelberg, New York: Springer.

-
- Prototype Carbon Fund (PCF). 2002. Stargard Geothermal District Heating, Project Design Document, Final Draft, 26.05.2002:
http://carbonfinance.org/pcf/router.cfm?Page=RecentDocs&DateToUse=&Sort_Order=4&Start=101&MaxRows=100 [04.11.2004].
- Prototype Carbon Fund (PCF). 2004. District Heating Project:
<http://web.worldbank.org/external/projects/main?pagePK=104231&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P008314> [09.11.2004].
- Poland. 2001. Third National Communication to the Conference of the Parties to the United Nations Framework Convention on Climate Change. Warsaw: Institute of Environmental Protection.
- _____. 2004. National Allocation Plan for CO₂ Emission Allowances. 2005 -2007 Trading Period. Warsaw: Ministry of the Environment.
- The Regional Environmental Center for Central and Eastern Europe (REC). 2004. Assessment of JI Potential in Central and Eastern European Countries, Final Report.
- Romania.1998. Second National Communication to the United Nations Framework on Climate Change. Bukarest: Ministry of Waters, Forests and Environmental Protection.
- Swedish Energy Agency (SEA). 2002. Joint Implementation: Case Study.
- _____. 2004a. Carboncredits.nl, ERU04/35, Landfill gas recovery Konin, Poland. Available on the internet at: <http://www.senter.nl/asp/page.asp?alias=erupt&id=i001614> [03.11.2004].
- _____. 2004b. Carboncredits.nl ERU03/29, Reduction of greenhouse gases by gasification, Bulgaria: <http://www.senter.nl/asp/page.asp?alias=erupt&id=i001510> [12.11.2004].
- Slovakia. 2001. The Third National Communication on Climate Change. Bratislava: The Ministry of Environment of the Slovak Republic.
- _____. 2004. National Allocation Plan for 2005 – 2007. Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, Draft.
- United Nations Framework Convention on Climate Change (UNFCCC). 2000. Romania. Report on the in-depth review of the second national communication of Romania. FCCC/IDR.2/ROM, 13.12.2000.
- _____. 2002. Decision 16/CP.7, Guidelines for the implementation of Article 6 of the Kyoto Protocol, Annex, in: Report of the Conference of the Parties on its Seventeenth Session, Held at Marrakesh from 29 October to 10 November 2001, Addendum, Part Two: Action Taken by the Conference of the Parties, Volume II. FCCC/CP/2001/13/Add. 2, 21.01.2002:5-19.
- _____. 2003. Poland. Report on the in-depth review of the third national communication of Poland. FCCC/IDR.3/POL, 28.11.2003.
- _____. 2004a. Hungary. Report on the in-depth review of the third national communication of Hungary. FCCC/IDR.3/HUN, 11.06.2004.
- _____. 2004b. Information on national greenhouse gas inventory data from Parties included in Annex I to the Convention for the period 1990-2002, including the status of reporting, Note by secretariat. FCCC/CP/2004/5, 14.10.2004, Bonn: UNFCCC Secretariat.
- United States Department of Energy (US DOE). 2004a. An Energy Overview of the Czech Republic: <http://www.fossil.energy.gov/international/CentralEastern%20Europe/czekover.html> [12.11.2004].
- _____. 2004b. An Energy Overview of Hungary:
<http://www.fossil.energy.gov/international/CentralEastern%20Europe/hungover.html> [12.11.2004].

-
- _____. 2004c. An Energy Overview of Slovak Republic:
<http://www.fossil.energy.gov/international/CentralEastern%20Europe/slvkover.html> [12.11.2004].
- _____. 2004d. An Energy Overview of the Republic of Bulgaria:
<http://www.fe.doe.gov/international/CentralEastern%20Europe/bulgover.html> [12.11.2004].
- _____. 2004e. An Energy Overview of Romania:
<http://www.fossil.energy.gov/international/CentralEastern%20Europe/romnover.html> [12.11.2004].
- Wisniewski, G. 2004. Poland's strategy and Poland's Market for Renewable Energy Sources. Presentation of EC Baltic Renewable Energy Centre, Conference of the Federal Environmental Ministry, Berlin, 13.-14. February:
http://www.bmu.de/files/wisniewski_renewables1.pdf [04.11.2004].
- World Bank. 2001. Bulgaria Energy – Environment Review, A World Bank Country Study. Washington, DC: World Bank.
- Wynne, J., R. Pletka, J. Abiecunas, C. Helberg, N. Lindstrom, P. Oggero, R. Patel, D. Salour, and S. Scupham. 2003. Strategic Assessment of the Potential for Renewable Energy in the EBRD Countries of Operation, Stage 1. London: European Bank for Reconstruction and Development.
- Zapfel, P., and M. Vainio. 2002. Pathways to European Greenhouse Gas Emissions Trading, History and Misconceptions, Fondazione Enrico Mattei (Nota die Lavoro 85.2002).
- Zito, A. 2002. "Integrating the Environment into the European Union: The History of the Controversial Carbon Tax". In: Jordan, Andrew (ed.): Environmental Policy in the European Union. Actors, Institutions and Processes. London: Sterling, VA: Earthscan Publications Ltd., 241-255.