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research article

Kyoto flexibility mechanisms in EU accession countries: will they make a difference?

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What potential effect do flexible mechanisms under the Kyoto Protocol have on energy efficiency, fuel switching and the development of renewable energy sources for the eight post-communist EU Member States that accessed in 2004? These countries are chief candidates for hosting Joint Implementation (JI) projects and for participating in international emission trading, which may assist the implementation and financing of projects in these target areas. The potentials and barriers to Joint Implementation are reviewed, as well as the conditions under which international emission trading can influence the energy use of the selling country. Different strategies adopted by the host countries towards the application of these instruments, and their impact on sustainable energy development, are examined. The article concludes that the Kyoto flexibility mechanisms may play a positive, but rather limited, role in the sustainable energy development of the region, but the barriers to Joint Implementation may shift the emphasis towards transactions under the framework of international emission trading. If innovative mechanisms are tied to sustainable development goals, this may mobilize the energy-efficiency potentials of these countries. An attractive opportunity exists to achieve energy efficiency and emission reductions, utilizing the revenues from allowance sales through 'green investment' schemes.

Keywords: Kyoto flexibility mechanisms; energy efficiency; green investment schemes; international emissions trading; renewable energy; Joint Implementation; new Member States

*Quel est l'impact potentiel des mécanismes de flexibilité définis par Kyoto sur l'efficacité énergétique, le changement de combustibles et le développement des énergies renouvelables pour les huit états ex-communistes ayant adhéré à l'Union européenne en 2004? Ces pays sont de très bons candidats pour accueillir des projets de mise en œuvre conjointe et participer au marché international d'échanges de droits d'émissions, ce qui pourrait avancer la mise en œuvre et le financement de projets dans les secteurs clés. Les obstacles possibles à la mise en œuvre conjointe sont revus, ainsi que les conditions dans lesquelles les mécanismes internationaux d'échange de droits d'émissions pourraient avoir une influence sur la consommation d'énergie des pays fournisseurs. Différentes stratégies ont été employées par les pays hôtes dans la mise en œuvre de ces instruments, et leur impact sur le développement énergétique durable est examiné. L'article conclut que les mécanismes de flexibilité auraient un rôle positif mais assez limité dans la région pour le développement énergétique, mais que les obstacles à la mise en œuvre conjointe pourraient en fait favoriser le mécanisme d'échange international de droits d'émissions. Si des mécanismes innovateurs sont liés à un objectif de durabilité, le potentiel en efficacité énergétique de ces pays pourrait être mobilisé. L'application des revenus à l'efficacité énergétique et à la réduction des émissions dans le cadre de "*green investment schemes*" serait une opportunité intéressante.*

Mots clés: mécanismes de flexibilité, "*green investment schemes*", marché international d'échanges de droits d'émissions, énergies renouvelables, mise en œuvre conjointe, nouveaux pays membres,.

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1. Introduction

The communist era left behind the most energy-intensive economies in the region of Central and Eastern Europe (CEE). Although economic, political and social restructuring and the transition to a market economy have removed many of the socialist legacies contributing to the high energy intensities (Ürge-Vorsatz et al., 2003a), and joining the European Union (EU) has aligned economic and energy policies with those of some of the most developed and efficient economies of the world, the energy intensity gap between East and West in Europe has not yet closed (Ürge-Vorsatz et al., 2003b, 2006; Froggatt and Canzi, 2004), and there are still significant cost-effective energy-efficiency potentials in this region waiting to be captured. Given the heavy burden of higher energy bills resulting from the removal of subsidies, as well as compromised economic efficiency and high energy dependence, energy-efficiency improvement in CEE may result in even more important social and economic gains than in the old EU Member States. It is also important, however, to recognize that the majority of these countries suffer from serious budget deficits, and generally lack the financial resources that may be necessary to support energy-efficiency policy instruments. In addition, taxes are typically already among the highest in Europe, and energy prices have been raised to such an extent that moderating tariff increases represent one of the most important promises in election campaigns. It is unlikely, therefore, that any of the new EU Member States (NEU-8) or other countries in CEE would be able to allocate generous funds or introduce new taxes or earmarked levies on top of energy prices to widely subsidize efficiency improvements or support policy instruments in the short term.

As a result, innovative policy instruments and financing, and market-based solutions to capture the remaining cost-effective efficiency potentials, are fundamental in the CEE countries, even more so than in the old market economies. One of the opportunities for financing energy-efficiency and renewable energy projects in the region which has raised high hopes at the turn of the millennium is Joint Implementation (JI). Designed to be targeted towards cost-effective greenhouse gas (GHG) emission reduction projects, the JI mechanism of the Kyoto Protocol (KP) was expected to bring numerical co-benefits, such as external financing, expertise and know-how, to energy-efficiency investments and, even more importantly, new incentives and initiatives to identify projects with favourable financial returns and large GHG-saving potentials, along with expertise and a mutually beneficial goal to overcome administrative and other barriers to implementation. The international emission trading (IET) instrument of the KP, as originally envisaged, was another opportunity which had the potential to leverage cost-effective GHG emission reductions, resulting in improvements in energy efficiency or the spread of renewable energy investments.

- Will the Kyoto flexible mechanisms deliver their promise?
- How much energy efficiency can they supply?
- Will they be able to capture a large share of the remaining cost-effective potentials housed in the new Member States and shake up the energy-efficiency market?
- Is EU enlargement influencing the prospects?
- What role will IET play in this respect?

This article examines these questions and explores the effect that flexible mechanisms under the KP may have on energy efficiency, fuel switching, and the development of renewable energy sources (RES) in the eight post-communist new EU Member States (NEU-8), and what impact EU enlargement has had on the scope of these instruments. All eight countries studied are Annex-I Parties that have ratified the KP. These are the chief candidates in the EU for hosting JI projects and for selling allowances under IET, which can promote the implementation of energy efficiency,

renewable energy, and fuel switching projects. This work reviews the potential of and barriers to JI, and the conditions under which IET can influence the energy use of the selling country. Since the European Union Emission Trading Scheme (EU ETS) and its implications have been widely studied, the present research covers the EU ETS only to the extent to which it influences the possibilities for JI projects. JI is still at a very early stage and the EU ETS entered into force only in 2005, and thus the evaluation of their future impact is difficult. However, the available evidence suggests that JI may play a fairly limited role in the sustainable energy development of the region, and that, if certain important conditions are fulfilled, IET may have greater scope to make a positive contribution.

The article is divided into two main parts. The first considers the basic potential for the Kyoto flexible mechanisms in the region, reviewing the opportunities provided by the NEU-8's combination of 'carbon surpluses' and high energy intensities, and considering the types of projects in the energy field which appear to have the greatest cost-effective potential for GHG emission reduction. The second part of the article considers what the realistic prospects for JI and IET are in the region, given the various specific practical barriers and opportunities confronting the NEU-8 at the present time. We find that the realization of JI's potential largely depends on institutional capacity; investment climate and business environment; and international, EU and national policies influencing baselines and additionality. After concluding that JI is likely to play a positive, but limited, role in the region, we examine whether IET can facilitate the capturing of energy efficiency or renewable energy potentials. We highlight Green Investment Schemes (GIS) as a promising architecture to utilize 'hot air' or other emission surpluses for sustainable (energy) development.

The important contribution to knowledge of the article is a qualitative evaluation of the impact of the Kyoto flexibility mechanisms on energy efficiency in the NEU-8. Numerical studies and papers have already investigated various aspects of the mechanisms and discussed their importance; however, to the best of our knowledge, no paper has yet provided an analysis of the progress of the mechanisms in these countries. The conclusions of this article are that the present state of mechanisms will not deliver a significant contribution to energy-efficiency improvement, and therefore the associated hopes of policy-makers are in vain unless JI becomes more flexible, and GIS is designed as a credible alternative.

2. The potential for the Kyoto flexible mechanisms

The combination of a significant drop in GHG emissions in the region in the early 1990s and relatively high energy intensities means that both IET and JI activities look potentially attractive options in the region. All the NEU-8 countries experienced a significant drop in GHG emissions in the early 1990s due to the severe economic recession in the region. With the exception of Slovenia they have remained below their Kyoto base-year levels since then (Figure 1). As Markovič-Hribernik and Murks (2007) explain, Slovenia is likely to face difficulties in meeting its 2008–2012 Kyoto target; the country aims to reduce its Kyoto compliance costs through such policy tools as, for instance, a CO_2 tax and participation in the EU ETS. The rest of the countries, most notably the Baltic States, can expect to have significant GHG emissions surpluses (Table 1). According to Gassan-zade's (2006) estimates, the overall compliance gap of Annex-I countries over 2008–2012 will be about 5.6 billion tCO_2e. Taking into account the expected global supply of JI and CDM credits over the same period of 2.0 billion tCO_2e (Reece et al., 2006), the need for about 3.6 billion tonnes of emission credits is to be covered by surplus AAUs of economies in transition. Thus the GHG emissions surplus for at least seven new Member States provides an opportunity to participate in IET as sellers.

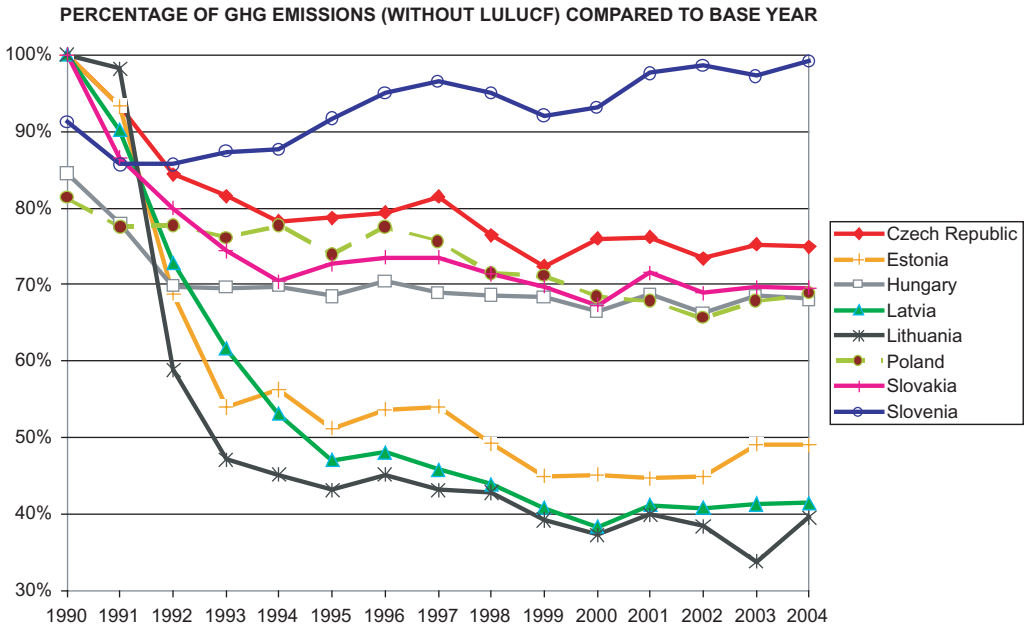

FIGURE 1 GHG emissions of the eight accession countries between 1990 and 2004 compared to the base year. Base year 1990, except for Hungary (average of 1985–1987), Poland (1988) and Slovenia (1986).

Source: UNFCCC (2006) except for GHG emissions of Lithuania in 1991–1997 and 1999–2000 for which the source is the European Environmental Agency (2006).

Despite the sharp declines in GHG emissions, carbon intensities (C/GDP) for some of these countries are still high in comparison with those of the EU-15 countries. Figure 2 illustrates that CO_2 intensities (GDP at purchasing power parities (PPP) rates) of NEU-8 except Latvia and Lithuania exceeded those of the EU-15 by 1.2–2.8 times.

TABLE 1 GHG emissions in 2004 and its projection for 2010 compared to the Kyoto target

Country	Change from base year to 2004 (%)	2010 projections with existing policies and measures: difference from target (in % of emission limit)	2010 projections with additional policies and measures: difference from target (in % of emission limit)
Czech Republic	–25%	–18%	–20%
Estonia	–51%	–53%	–57%
Hungary	–32%	–24%	–24%
Latvia	–58%	–41%	–44%
Lithuania	–60%	–46%	–46%
Poland	–31%	–6%	–6%
Slovakia	–30%	–16%	–18%
Slovenia	–1%	14%	7%

Source: UNFCCC (2006), Commission of the European Communities (2006).

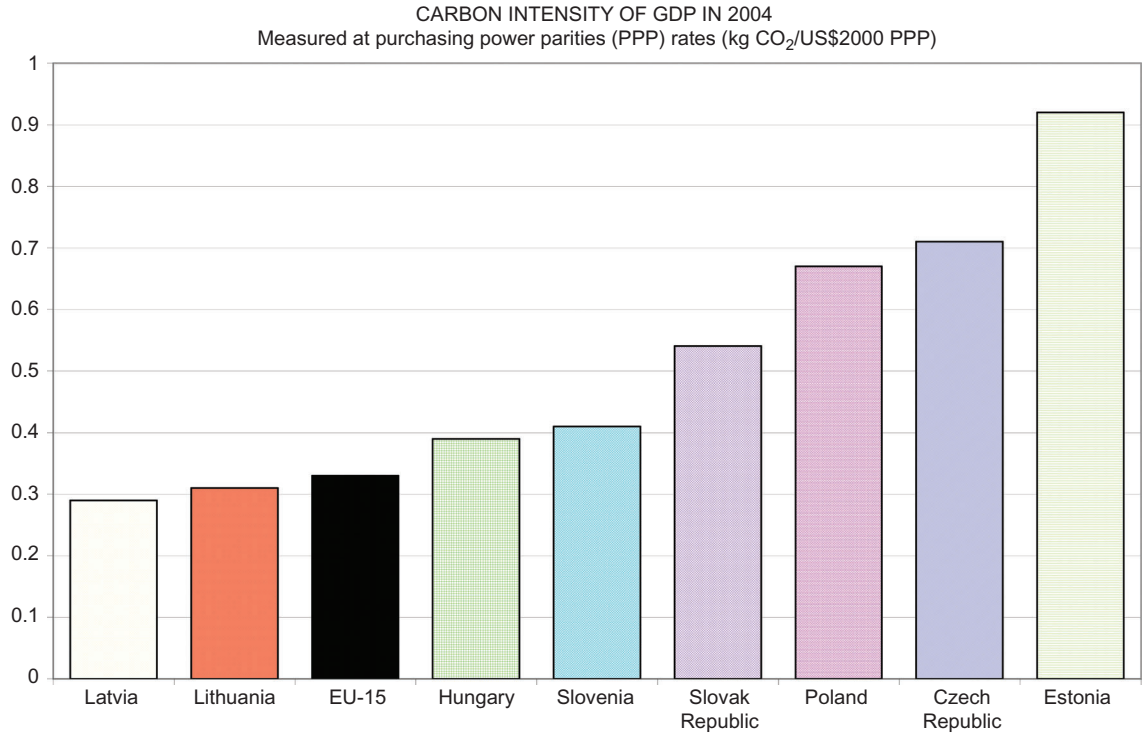

FIGURE 2 Carbon intensity of GDP in 2004 measured in purchasing power parities (PPP) rates (CO_2/2000 US$ PPP).

Source: International Energy Agency (2006).

According to Bertoldi et al. (2004), one of the most cost-effective options to reduce CO_2 emissions is through end-use energy-efficiency improvements, which in many cases can be reached at negative or low costs. For instance, Ürge-Vorsatz and Novikova (2006) reviewed a number of studies estimating the potentials and costs of energy conservation and CO_2 reduction in residential buildings of different countries around the world, and calculated that economies in transition have an abundance of such 'low-hanging fruits', while developed countries have already been capturing low-cost opportunities due to the progressive policies in place or in the pipeline. The economic potential for such reductions may be substantial; for example, in Poland, the Czech Republic and Slovakia, it is estimated to be about 20% (Ürge-Vorsatz et al., 2003b). Thus this is one of the main rationales for investing in JI projects: for the EU-15 and other high-income OECD countries, GHG mitigation opportunities at affordable costs are much more abundant in transition economies than domestically.

3. Most promising options for greenhouse emission reductions

Given the generally good potential for the Kyoto mechanisms in the NEU-8, what specific areas are likely to be the focus of efforts at GHG reduction? JI projects are financially viable if their unit GHG emission reduction costs do not exceed the price of emission reduction unit on the carbon market. According to Capoor and Ambrosi (2007), the weighted average of price of emission reduction unit in 2006 was €6.7/tCO_2e. Figure 3, which presents the results of an assessment performed within the framework of the Fourth IPCC Assessment Report (IPCC, 2007), with a focus on economies in transition, demonstrates that there are significant savings of GHG available

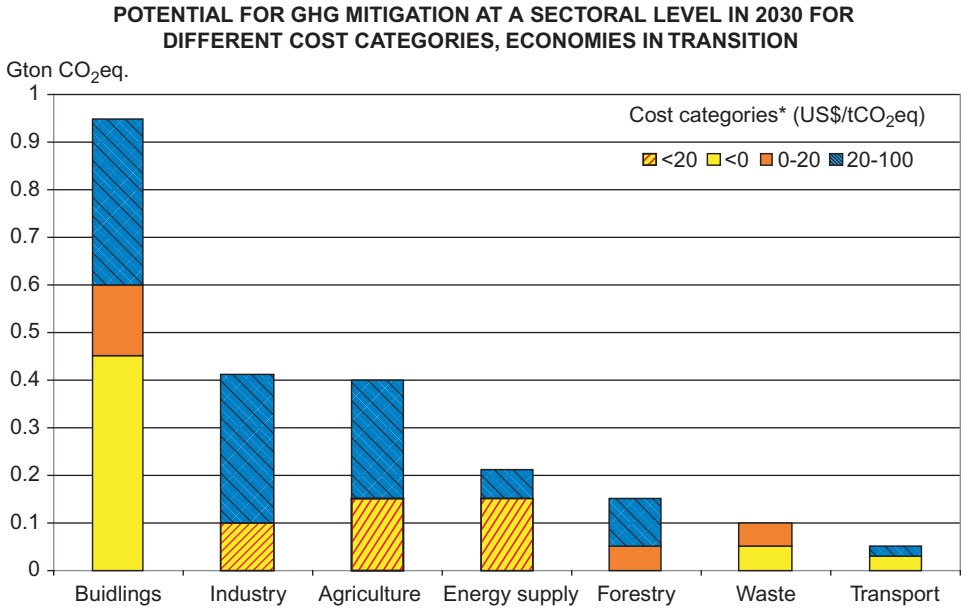

FIGURE 3 Estimated potential for GHG mitigation at a sectoral level in 2030 for different cost categories in economies in transition.

Source: Constructed based on Chapter 11, IPCC (2007).

at zero (net benefit) or low costs. The most promising options capable of delivering these savings are energy-efficiency measures in buildings and industry, renewable sources applications and, especially, biomass for electricity and heat and landfill gas recovery, fuel-switch technologies, as well as realization of combined heating and power generation (CHP) and improvements in district heating (DH) from the supply-side options. Each of these is discussed briefly below.

Demand-side energy efficiency (DSEE) measures enjoy primary attention in the climate policy of most countries. This is especially true for the NEU, as shown in the previous section as well as in Ürge-Vorsatz et al. (2003b). The highest energy-efficiency potentials in the NEU-8 are concentrated in residential and commercial buildings, and the lowest are in industrial processes. Since the largest energy consumption in dwellings is for space and water heating (80%), followed by lighting and various kinds of appliances (13%), energy-efficiency measures considered under JI could make the largest overall contribution to sustainable energy development.

The renewable potential in the NEU-8 is very diverse. According to Black and Veatch (2003), biomass is the most abundant and promising source in all the countries covered. Wind and solar energy can be produced in the Czech Republic under attractive feed-in tariffs, and the wind-energy potential in the Baltic States and Poland is also very good due to their favourable geographical location. Hydro energy appears to be one of the best opportunities for Slovakia and Slovenia, while geothermal sources can play a (subsidiary) role in Hungary and Slovakia. An indication of the relative costs of the different renewable sources in the region is provided by calculations made for the Czech Republic, where reduction costs related to biomass projects varied from €1.5 to 6.6/t CO_2 in comparison with hydro energy at €6.9–8.5/tCO_2, wind energy at €16.2–26.2/tCO_2, and solar and geothermal energy options at more than €23.1/tCO_2 costs (Econoler, 2003).

The most cost-effective forms of energy-efficiency improvement in district heat (DH) generation and distribution are the application of efficient boilers and fuel switching, reduction of losses in heat distribution, combined heat and power generation (CHP) and the introduction of highly efficient heaters (Econoler, 2003). The first option includes the replacement of coal-fired boilers by more efficient ones, with the greatest GHG reductions available in switching from coal- to biomass-fired boilers for space and water heating in the residential and commercial sectors; an option which is most attractive in Poland, the Czech Republic and Slovakia – where coal is the main fuel for DH/CHP (Lensu and Alakangas, 2004).

Natural gas is the main fuel for DH and CHP in Hungary, Lithuania and Slovenia. Although these countries have some biomass-fired plants and CHP installations at industrial plants, their capacities are far from their full technical and economic potential (Lensu and Alakangas, 2004). The development of DH/CHP and fuel switching in these technologies is inhibited both by a number of general factors (discussed below) and by some country-specific obstacles. In Hungary, for example, the process of renewable sources application and fuel switching is slowed by the tax on forest maintenance when burning woody biomass, and the lack of support for energy-forest plantations (Lensu and Alakangas, 2004).

4. Practical prospects for the Kyoto flexible mechanisms

In the second half of the article we move from considering the theoretical potential for the Kyoto flexible mechanisms in the NEU-8 to a more practical analysis of their prospects in the current political, economic and regulatory climate. We consider JI and IET separately, and conclude that while both have a role to play in the region, the role of JI may be less significant and the role of IET more significant than has previously been thought.

5. Assessment of JI: barriers and opportunities

5.1. Experience from the AIJ phase

The obvious starting point for an assessment of the practical prospects for JI in the region is a look at the experience of the pilot Activities Implemented Jointly (AIJ) phase. As Table 2 indicates, a good number of projects were implemented, particularly in the Baltic States, with a particular focus on energy efficiency and boiler conversion to biomass projects.

Experience gained from these early actions in the pilot phase before 2008, when emission reductions from JI projects could first be accrued, revealed a number of challenges facing JI projects. Despite the relatively high success of AIJ projects in Eastern Europe and the great potential for DSEE, it is unlikely that many JI projects of this type will be introduced (Evans, 2001). According to analyses of the 70 AIJ from the energy sector in countries in transition, although DSEE projects are usually cost-effective by themselves, high transaction costs, the disconnection between end users' energy savings and the emissions associated with energy production, along with the difficulties of tapping the benefits of energy savings by external investors, all hinder implementation (Evans, 2001).

The largest barrier to the implementation of JI projects is the high transaction costs. As Table 3 shows, this is a more serious issue for smaller-scale projects and, taking into account the threshold for economically feasible projects mentioned above, Michaelowa et al. (2004) conclude that projects below 20,000 emission reduction units (ERU) per year are not attractive without additional incentives to invest (for example, subsidies). This factor hinders the implementation of small-scale projects, which are the majority among potential JI projects.

TABLE 2 Inventory of AIJ projects in CEE countries

Country	Afforestation, forest preservation or restoration	Agriculture fugitive gas capture	Energy efficiency DH	Fuel switching Other	Renewable energy	Total		
						Boiler conversion	Other	
Hungary	0	0	0	2	2	0	0	4
Poland	0	0	0	2	1	0	0	3
Czech Republic	1	0	0	1	2	0	0	4
Slovakia	0	0	0	1	2	1	0	4
Latvia	0	0	4	7	1	12	1	25
Estonia	0	0	8	6	0	7	0	21
Lithuania	0	0	1	1	0	7	0	9
Slovenia	0	0	0	0	0	0	0	0
Total	1	0	13	20	8	27	1	70

Source: Constructed on the basis of UNFCCC 2002.

The evident option for meeting this challenge is bundling projects where possible. This would reduce the high transaction cost per unit GHG mitigated and, therefore, make the bundle of projects more economically feasible. A few 'bundled' JI projects have been implemented in the region, for instance in 2001–2004 the Czech Republic implemented a JI project consisting of a portfolio of nine biomass projects (replacing old combustion technologies and fuel switching) under a contract with SenterNovem (2005, information from the official site of Senter International). Another example is a Hungarian project to improve the energy efficiency of the Hungarian State Railways (MÁV) through renovating railway stations (J. Feiler, personal communication). However, not very many projects can exploit this opportunity in reality. To be bundled effectively, projects

TABLE 3 Project size, type and indicative specific transaction costs

Size	Type	Certified emission reduction (tCO_2/year)	Transaction costs (€/tCO_2)
Very large	Large hydro, gas power plants, large combined heat-power (CHP) plants, geothermal, landfill/pipeline methane capture, cement plant efficiency, large-scale afforestation	>2,000,000	0.1
Large	Wind power, solar thermal, energy efficiency in large industry	20,000–200,000	1
Small	Boiler conversion, demand-side management, small hydro	2,000–20,000	10
Mini	Energy efficiency in housing and small and medium enterprises, mini hydro	200–2,000	100
Micro	Photovoltaics	<200	1,000

Source: Michaelowa et al. (2004).

should be of the same type, within the same geographical area, at the same stage of development, and be bundled by one organization.

There are two additional important challenges which investors intending to implement JI projects face. Firstly, there is a shortage of time available for these projects to become operational. The project development usually has a time lag of 3–7 years for institutional procedures and construction; so for a project to contribute its CO_2 emission reductions in 2008–2012, the time to start procedures is no later than 2006. Secondly, it may be difficult to secure the necessary support from financial institutions, which usually have a minimum threshold of US$100–200 million before they will even consider project financing. Since the projects currently on the carbon market are typically smaller than this (Lecocq, 2004), they are unlikely to attract funding unless bundled together.

A case study of the Czech Republic reviewing the AIJ pilot phase (Econoler, 2003) showed that a country may also face a number of specific difficulties. Among those identified in the Czech case were insufficient transparent criteria and complicated procedures for the planning and implementation of AIJ projects, leading to controversies; for example, over the identification of additionality or over how to share the emission reduction credits (Econoler, 2003). Such controversies have led to a generally negative perception of JI and mistrust between the Czech Government and stakeholders, and ultimately resulted in even higher transaction costs.

Thus, the AIJ phase showed that there are opportunities for low-cost DSEE projects, but due to the difficult administrative procedures in track-2 JI, the transaction costs are too high for the small projects constituting the majority of cases. The possibility that these costs may exceed the revenues from the investment and the difficulty in satisfying conditions of additionality discourage potential investors in the JI market. Moreover, the AIJ phase showed the importance of having a single unit responsible for the solicitation and approval of projects to help avoid controversy among ministries. Such controversies have already broken out in Eastern Europe and have led to an increase in transaction costs for developers (Michaelowa et al., 2004).

A new impetus for JI activities was expected from the Decisions made at the first Conference of the Parties serving as the meeting of the KP (Montreal, December 2005). The Decisions requested the JI Supervisory Committee to develop the special provisions for small-scale projects among the other guidelines for the JI and allows transferring methodologies and experience of designing documents for small-scale CDM projects to JI activities. The guidance with regard to JI implementation is presently under development. At the same time, the transfer of CDM experience and monitoring methodologies to JI projects may not play a significant role because JI project proponents are generally unfamiliar with the available CDM methodologies.

Until provisions open the window to low-cost procedures for the JI projects, one of the key concerns about JI arising from the AIJ phase remains the issue of transaction costs for small projects, and whether project bundling can work. While bundling has been successfully achieved in a few cases, the limited conditions under which it can work mean that it is unlikely to provide a comprehensive solution to the problem of transaction costs, and this is supported by the experience with AIJ, JI and CDM projects to date.

5.2. The impact of EU enlargement on JI potential

With EU accession and the enforcement of the environmental standards of the *acquis communautaire*, the scope for JI activities is inevitably reduced in the accession countries and the new Member States. Project baselines and eligibility are more stringent, and thus feasibility is decreased, as part of the abatement is mandatory. However, the extent of this reduction varies depending on transitional arrangements: a country's emission baseline decreases when environmental standards become obligatory (Probase, 2002). Other factors influencing the scope

of this reduction are the strictness of the best-available-technology determination (Armenteros and Michaelowa, 2002), early actions (van der Gaast, 2001), and eligibility for track-1 JI. For instance, Nondek et al. (2001) have calculated that the true JI potential of the Czech Republic in 2010, taking into account accession, will be only about 4% of the 'technical' potential that they estimated from emission reduction measures adopted between 1995 and 2000. Czech officials are thus understandably sceptical about the prospects for JI, deeming it 'questionable' in the new Member States (Chmelik, 2005).

The EU ETS and the Directive 2004/101/EC (often referred as the 'linking' Directive) adopted in October 2004, connecting JI and ET mechanisms and introducing double-counting provisions, seemed to provide a new boost to JI opportunities. However, in practice the linking Directive placed the EU ETS and JI projects in direct competition for emission reduction financing (Sterk et al., 2005), as well as significantly narrowing the scope of JI activities in the NEU-8. Although it is too early to judge the overall impact of the EU ETS on JI in the NEU-8, it is likely that few new JI projects in these countries will be spawned by the compliance efforts with the EU ETS due to the high administrative complexity of the JI procedures.

5.3. Ongoing and planned JI activities

This section explores the current and planned JI activities and constraints preventing their expansion on the carbon market. At the moment, only a few buyers are active in Central and Eastern Europe, mainly the Prototype Carbon Fund (PCF) of the World Bank and the Governments of the Netherlands, Denmark and Austria, and only a few JI projects have been fully approved. There is a lack of reliable and comprehensive information on ongoing and accepted projects, but we summarize some of the available information on approved JI activities and provide a list of JI projects in Table 4 (information is valid as of February 2007).

The number of participating buyers in the NEU-8 is limited mainly to representatives from three countries and the World Bank. For the majority of the NEU-8, the current projects are those delivering the largest emission reductions at the lowest costs among the whole amount of potential JI projects (Chmelik, 2005; J. Feiler, personal communication).

5.4. The limits of JI in the region

As concluded above, JI activities are limited because of a number of barriers, such as the particularly complicated administrative procedures and consequently high transaction costs, and the track-1 JI project requirements are difficult and expensive to comply with. From the other side, track-2 JI is likely to be substituted by either project-based emission trading, which is discussed in detail in the next section, or other, more flexible, approaches allowed by IET, if countries are able to fulfil their eligibility criteria for it. Additionally, EU Member States have to meet requirements under the EU ETS which are similar to JI track-1 requirements, in this case the question is whether all projects within the EU will be eligible for development under track-1. Our view that the JI mechanism has low potential in the region is supported by Michaelowa et al. (2004), who estimated that the share of the world annual demand for emission reductions captured by JI activities in 2008–2012 will be only 5%. According to the projections of these authors, CDM can capture about 33% of this demand. Thus, the compliance gap of 62% of the world annual demand for emission reductions in the 2008–2012 period will need to be covered by IET. The World Bank's (2004) projection that most activities on the global carbon market will be connected with IET in the near future is likely to hold true for the CEE region as well, especially since some countries in CEE, such as Slovakia, actually prioritize IET over JI (Point Carbon and Vertis Environmental Finance, 2003).

TABLE 4 Ongoing JI activities in CEE region

Buying organization/ country → Host country ↓	SenterNovem/ Netherlands	Austria	Danish Agency of Environmental Protection (DEFA)	Prototype Carbon Fund/World Bank	Others	References
Hungary: 15 projects	3 projects on shift to biomass 1 project on collection of CH_4 from landfills 1 project on cogeneration from biomass to energy and heat	**Exim-Invest Biogáz Kft:** 1 project on CH_4 recovery from landfill wastes **Pálhalmai Agrospeciál Kft:** 1 project on CH_4 from agricultural wastes **E. ON Hungaria Rt:** 2 wind energy projects **Pannónia Szlél Kft:** 1 wind project		1 shift to biomass	**Mitsubishi/Japan:** 1 energy efficiency improvement project 1 project on using CH_4 from geothermal sources **Nitogénmüvek Rt.É:** 1 project on reducing N_2O at the acid factory **Liget Bioenergia Müvek Kft:** 1 cogeneration project: biomass to energy and heat	J. Feiler, pers. comm., 2006
Romania: 15 projects	2 Projects of modernization of hydro units 1 cement plant 1 project on municipal cogeneration 1 project on landfill gas recovery in four cities	n.a.	1 project on sawdust 1 project on geothermal energy use in DH systems 1 project on landfill gas recovery 1 project on energy efficiency in DH 1 project on biomass utilization 1 project on boiler improvement	1 project on afforestation of degraded agricultural soils	**Switzerland:** 1 project on rehabilitation of a CHP unit **Norway:** 1 project on development of heating systems in municipality **EBRD (Netherlands):** 1 modernization of CHP unit	Ministry of Environment and Water Management of Romania, 2006; DEFA, 2006
Estonia: 6 projects	1 wind energy project	n.a.	1 windmill project	n.a.	**Finish government:** 3 DH projects 1 wind energy project	SenterNovem, 2005; DEFA, 2006; Finnish Ministry for Foreign Affairs Development Cooperation; Point Carbon and Vertis Environmental Finance, 2006

TABLE 4 Ongoing JI activities in CEE region *(Cont'd)*

Buying organization/ country → Host country ↓	SenterNovem/ Netherlands	Austria	Danish Agency of Environmental Protection (DEFA)	Prototype Carbon Fund/World Bank	Others	References
Latvia: 1 project	n.a.	n.a.	n.a.	1 Solid waste project	n.a.	Prototype Carbon Fund, 2005
Lithuania: 3 projects	n.a.	n.a.	n.a.	n.a.	**Unknown Company:** 2 energy conversion projects 1 project on CH_4 collection from landfill	R. Bubniene, pers. comm., 2006
Poland: 7 projects	1 project on utilization of biomass for heating 1 landfill gas recovery	n.a.	1 project on recovery and utilization of CH_4 from landfill	1 geothermal heating plant	**Canada**: 1 project on construction of small hydropower plants **Denmark:** 1 wind power project 1 project on degassing of municipal landfill	DEFA, 2006; Prototype Carbon Fund, 2005; Paczosa, 2005
Czech Republic: 39 projects (small-scale projects counted separately)	9 biomass energy projects bundled into one portfolio	1 landfill gas utilization from four sites	1 project on N_2O reduction in technical process 1 biomass processing project 4 biomass central-heating projects	16 small hydro projects bundled into portfolios 4 DH projects 1 waste dump project 1 hydrogen boiler project	**Unknown Company:** 1 small hydropower plant	P. Zámyslický, pers. comm., 2006; SenterNovem, 2005; Austrian JI/CDM Programme, 2007

TABLE 4 Ongoing JI activities in CEE region *(Cont'd)*

Buying organization/ country → Host country ↓	SenterNovem/ Netherlands	Austria	Danish Agency of Environmental Protection (DEFA)	Prototype Carbon Fund/World Bank	Others	References
Bulgaria: 16 projects	1 glassification project in three towns 3 cogeneration projects 1 biomass and energy efficiency project 2 gasification projects in municipalities 1 energy efficiency project	**Kommunalkredit Public Consulting**: 2 hydropower cascades 1 industrial energy and cogeneration	1 Agropolychim N_2O reduction project 1 new cogeneration power station for CHP in DH	1 biomass utilization 2 projects for rehabilitation of DH system	n.a.	Ministry of Environment and Water of Bulgaria, 2007
Slovakia: 3 projects	1 landfill gas recovery project	1 green energy project for wind and hydropower	1 geothermal project	n.a.	n.a.	Ministry of Environment of the Slovak Republic, 2005; DEFA, 2006; Platts Emissions Daily, 2006

6. Potential for promoting sustainable energy through emissions trading

Unless the transfer of AAUs under Article 17 is tied to some criteria corresponding to the goals of Kyoto, policies prioritizing IET over JI will weaken the environmental integrity of the Protocol and, more importantly for the topic of this article, fail to deliver energy efficiency or other carbon mitigation in CEE, which is a significant lost opportunity to bring investment into this area. Thus the analysis of IET which follows, considers not only whether it is a viable option for the region, but also whether it is a desirable option given the risk of 'hot air' trading.

In theory, the trading of AAUs should facilitate more cost-effective global compliance with the planet's GHG reduction target. When marginal abatement costs are high in a particular country, it has an opportunity to purchase AAUs from another country where the saving of these AAUs are associated with lower marginal costs. Thus, when emission trading works as originally intended, the host country receives carbon financing for GHG mitigation efforts, making more sustainable energy projects financially viable.

Given the relatively low marginal project costs in CEE, the NEU-8 should be prime candidates for selling AAUs resulting from GHG abatement activities. However, as already shown, after the economic recession and decline in CO_2 emissions, many of the countries are likely to have surplus emission 'allowances'. Therefore, when AAUs are sold by a CEE country, they will most probably not be the result of additional emission reduction efforts, but rather the selling of these surplus AAUs (often referred to as 'hot air'). It is thus unlikely that IET will directly foster sustainable-energy developments in CEE, unless revenues from IET are earmarked for such a purpose.

As estimated above, about 3.6 billion tonnes of emission credits worth of surplus AAUs of economies in transition will be needed to close the compliance gap, taking into account available JI and CDM credits. Thus, it is likely that emission trading for the surplus AAUs will pick up speed in CEE as the end of the first commitment period approaches. However, the population of many AAU buying countries may not find it acceptable to meet their Kyoto targets through the purchase of 'hot air' (i.e. no real emission reduction), which undermines the integrity of the KP. The majority of the EU-15 countries and Japan, for instance, have indicated that they are only interested in IET if it will lead to real reductions (Carbon Finance at the World Bank, 2006; Gorina, 2006; Henkemans, 2006; J. Feiler, personal communication).

Green Investment Schemes (GIS) can support sustainable energy development through providing earmarked funds generated from the sale of emission allowances, and can provide a more flexible mechanism for institutional requirements (monitoring, reporting, and others) (Tangen et al., 2002). GIS brings reductions in emissions using the revenues from AAU sales (Blyth and Baron, 2003). Thus, such a scheme is similar to track-1 JI, but the greater flexibility offered by this alternative may make it more attractive for investors and hosts than JI track-2, which has high transaction costs due to institutional barriers and the small scale of most eligible projects. Not least, GIS can support activities with time frames wider than the 2008–2012 period and accept projects with CO_2 emission reductions that are more difficult to verify than those of JI projects requiring compliance with additionality (World Bank, 2004). Being a result of policies and investments directed to emission reductions ('greening'), AAU sales based on GIS contributing to the development of sustainable energy are more palatable to public opinion. The realization of GIS will tap additional (private) financial resources, and these funds can be used to support the seller's co-financing obligations under government financing schemes (World Bank, 2004). Despite this, such 'greening' can be 'neutral', resulting in the inclusion of emission reduction options difficult to measure or demonstrate (such as educational campaigns or R&D spending) (World Bank, 2004).

The feasibility of GIS is currently being explored in CEE. For instance, various organizations have been working on designing the options for GIS implementation in Bulgaria, Romania,

Hungary, Ukraine and Russia (World Bank, 2004; Lavinia et al., 2006; Point Carbon, 2007; Ürge-Vorsatz et al., 2007; J. Paschenko, personal communication). The first GIS cooperation took place in May 2006, when Romania and the Netherlands signed a letter of intent (Point Carbon, 2006a). Since then Ukraine has concluded a contract with the Netherlands (Point Carbon, 2006b), while Bulgaria, the Czech Republic and Latvia have reported that they are in detailed negotiations with several potential buyers from the EU-15 (Point Carbon, 2006c). It is vitally important that these and further GIS initiatives are based on transparent, targeted and simple but credible schemes to satisfy the expectations of potential buyers and to avoid repetition of the JI shortcomings. If these conditions are realized, the GIS could potentially play a larger role than either JI or CDM as these latter tools can supply less than half of the Kyoto compliance gap of the Annex-I countries.

In summary, while 'plain' IET of surplus AAUs in CEE is liable to undermine the environmental integrity of the KP and may not contribute to the development of energy efficiency, fuel switching or renewables directly in the region, there is an architecture through which IET can be turned into a useful and flexible instrument, which can bring substantial benefits to the CEE region in the field of sustainable energy. IET is expected to be the main player on the global carbon market in the longer run and we have shown that it will probably play an important role also in several NEU-8 countries, but its real contribution to sustainable energy development will depend on the actual architecture through which it is applied. Potentially it can create new opportunities to tap additional financing sources for 'green' (emission reduction) activities, and is more flexible and efficient in comparison with JI, so it may replace JI in the longer term even in the absence of surplus AAUs.

7. Conclusions

This article has shown that while the technical and economic potential in energy efficiency and RES is large in the NEU-8, the Kyoto flexible mechanisms are expected to play only a limited role in mobilizing this potential. The experiences from the Activities Implemented Jointly (AIJ) phase showed that the procedures with Joint Implementation (JI) are complicated, and therefore track-2 JI may give way to project-based emission trading instead. The AIJ phase has also indicated that despite significant cost-effective potential in demand-side energy efficiency, the financial viability of small projects is limited under JI without project bundling, which in practice is difficult to implement. Experience so far shows that whereas DSEE projects may promise the lowest unit mitigation costs, most JI projects are targeted to fuel switching, especially boiler conversion to biomass, and other small-scale renewable investments, mainly biomass. Therefore, JI is unlikely to contribute to the mobilization of the no-regret potential on the demand-side to a significant extent, although a limited amount of activity will probably take place in this area. While EU accession has reduced the scope for JI through mandating some measures otherwise eligible to JI, national policies and concrete implementation approaches to EU Directives on the country level have proven to be as important to determine baselines and thus the overall potential for flexibility mechanisms. The enthusiasm of governments and environmental ministries for JI clearly varies across the region, with some governments clearly prioritizing IET over JI. Since most countries in the NEU-8 may have emission surpluses for sale in 2008–2012, IET transactions are unlikely to deliver any energy efficiency or renewable energy unless surplus AAUs can be 'greened' through Green Investment Schemes (GIS). Given the difficulties associated with track-2 JI, GIS which is similar to but more flexible than track-1 JI offers more flexibility to implement carbon mitigation activities, and is more promising in tapping the DSEE potential. As a result, emission trading under Article 17 may also unlock the sustainable energy potentials in CEE through these new innovative mechanisms in the pipeline. However, to realize these hopes, these instruments have to be simple, transparent, credible and flexible.

To sum up, the Kyoto flexibility mechanisms are expected to play a positive but limited role in mobilizing the economic potential in energy efficiency and renewable energy in Central and Eastern Europe. Their success now depends on the viability and acceptance of the new mechanism under Article 17, namely the Green Investment Schemes. As far as JI is concerned, its potential can be maximized by more countries becoming eligible for track-1 JI and by successful approaches to project bundling. Due to the undisputed benefits of additional revenues for energy-efficiency projects from carbon finance, it is certainly advisable for the countries in CEE to explore the options offered by the flexible mechanisms to help capture DSEE and RES potentials.

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