The chances for end-use energy efficiency projects under Joint Implementation and CDM: bleak or sunny?

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1. HYPERLINKSYNOPSIS

The paper addresses the chances of end-use energy efficiency projects in JI and CDM in competition with other project types, particularly energy supply projects. These chances are at the moment not favourable.

2. ABSTRACT

Joint Implementation JI and the Clean Development Mechanism CDM promote greenhouse gas emission (GHG) reduction projects because the sale of emission reduction credits provides an additional financing source. In current JI and CDM schemes, projects in energy production and conversion are preferred, although projects to improve end-use (or demand-side) energy efficiency could also be a technically and economically feasible alternative for GHG emission abatement. The chances of end-use energy efficiency projects under the JI and CDM mechanism are investigated by addressing the following questions:

1. What are the potential and incremental costs for GHG emission reduction of end-use energy efficiency projects in comparison to energy supply and conversion?
2. Are end-use energy efficiency projects more expensive, leading to relatively high costs for the emission reduction credits compared to supply projects? What are the transaction costs for implementing these projects under a JI/CDM scheme, particularly for validation, monitoring and verification?
3. Do difficulties in project development and financing put energy efficiency projects at a disadvantage?
4. Are the chances of energy efficiency projects in CDM better than in JI given the additional criteria for project selection in CDM, such as the contribution to sustainable development?

In answering these questions, the paper combines theoretical analysis as well as empirical evidence from the existing JI and CDM initiatives. The paper concludes on the chances of end-use energy efficiency projects in JI and CDM under the international regulatory framework after CoP6 in competition with other project types, particularly energy supply projects. These chances are at the moment not favourable. Recommendations are given on the possibilities of designing JI and CDM tenders in such a way that these chances are improved.

3. INTRODUCTION

Joint Implementation (JI) and the Clean Development Mechanism (CDM) promote greenhouse gas emission (GHG) reduction projects because the sale of emission reduction credits provides an additional financing source for the projects. End-use (or demand-side) energy efficiency projects could be a technically and economically attractive option for GHG emission abatement for the following reasons:

1. In JI/CDM host countries the technical potential for GHG emission reduction by improving end-use energy efficiency is large. Many studies have also identified a large (nearly) economic potential (see section 4).
2. Securing financing is often a key barrier for project development, for which the additional income by selling of ERUs/CERs could prove a solution.
3. In many host countries, improving energy efficiency has high priority.

The road to a successfully implemented JI/CDM project however is long. We distinguish the following steps:

1. A substantial potential of energy efficiency projects within the competitive range of marginal costs for GHG emission reduction must be available.

2. The project must be successfully developed up to the stage that the project can be submitted to a JI/CDM tender or other scheme. Therefore, the conditions for developing projects in the host country (institutional, legal framework, business climate, financing, etc.) for end-use energy efficiency projects must be good.
3. The project must win a contract in JI/CDM schemes in competition with other projects with respect to quantity and price of the ERU/CERs generated as well as the projects risks. The project emission reduction must be monitored and verified.

We will investigate the chances of end-use energy efficiency projects under the JI and CDM mechanism by addressing the following questions:

1. What are the potential and incremental costs for GHG emission reduction through end-use energy efficiency projects in comparison to energy supply and conversion?
2. Are end-use energy efficiency projects more expensive, leading to relatively high costs for the emission reduction credits compared to supply projects? What are the transaction costs for implementing these projects under a JI/CDM scheme, particularly for validation, monitoring and verification?
3. Do difficulties in project development and financing put energy efficiency projects at a disadvantage?
4. Are the chances of energy efficiency projects in CDM better than in JI given the additional criteria for project selection in CDM, such as the contribution to sustainable development?

We will first specify which type of GHG emission reduction projects we consider. This is important because end-use energy efficiency projects strongly differ in technical characteristics, economics, and project development, all of which influence the chances in JI/CDM schemes. In this paper, end-use energy efficiency projects include the following project categories:

1. Improvement of building envelope,
2. Efficient electric appliances, particularly through market transformation programmes,
3. Energy efficiency measures in transport,
4. Energy efficiency in industry production processes,
5. Heating systems in buildings (efficient boilers and fuel switch),
6. Small-scale CHP in buildings.

We are not able in this paper to fully consider the differences between these project types, but will focus instead on the analysis of the differences between end-use energy efficiency projects on the one hand, and energy supply and conversion projects on the other hand.

In answering these questions the paper will combine both theoretical analysis as well as empirical evidence from the existing JI and CDM initiatives. In AIJ programmes a significant number of these projects has been implemented. However, in the few existing “real” JI and CDM schemes very few end-use energy efficiency projects occur in contrast to energy production and conversion projects. In this paper, we use the Dutch ERU-PT as an example. By identifying the competitive factors, we will draft recommendations in what way JI and CDM guidelines could be developed to increase the competitive position of end-use energy efficiency projects in an optimal way. The paper concludes on the chances of end-use energy efficiency projects in JI and CDM under the international regulatory framework after CoP 6 as well as on the possibilities of designing JI and CDM tenders in such a way that the competitiveness of these projects is increased.

4. POTENTIAL AND COSTS OF MITIGATION OPTIONS

The mitigation potential and the costs per unit of GHG abated (usually expressed in US$ per tonne CO_2 equivalent) are major factors in the competition of end-use efficiency projects versus other projects. An assessment has been made of the potential and costs of CDM options in the energy sector of non-Annex I countries as part of a joint ECN-AED-SEI research project.[1] This project has resulted in two different databases and, subsequently, two different abatement cost curves expressing potentials and costs of mitigation options in CDM host countries. The first database refers to mitigation options identified in national / sectoral abatement costing studies of 24 major non-Annex I countries (accounting for about two-thirds of all non-Annex I GHG emissions in 1995). The second database concerns information obtained from projects carried out within the framework of either the programme of Activities Implemented Jointly (AIJ) or the Global Environmental Facility (GEF).

In each database, GHG reduction options have been classified according to three main categories:

- Non Power Supply (NPS), including activities related to mining of coal, oil and gas; distribution of gas, but also the provision of biogas and landfill gas.
- Power Supply (PS), including all renewable power generation options (also small-scale), cogeneration and energy efficiency improvements in existing power infrastructure.
- Demand Side (DS), including options such as energy efficiency measures in households, commercial buildings, industry and transport.

Each category has been further divided into three sub-categories: Energy Efficiency (EE), Renewable Energy (RE) and Fuel Substitution (FS). Table 1 shows the allocation of abatement options and projects over the main categories and sub-categories.

Table 1. Breakdown of mitigation options over various categories

Category	AIJ/GEF projects	Abatement options
Non Power Supply (NPS)	2	12
Energy Efficiency (EE)	2	5
Renewable Energy (RE)		4
Fuel Substitution (FS)		3
Power Supply (PS)	37	84
Energy Efficiency (EE)	2	29
Renewable Energy (RE)	34	39
Fuel Substitution (FS)	1	16
Demand Side (DS)	21	151
Energy Efficiency (EE)	21	133
Renewable Energy (RE)		5
Fuel Substitution (FS)		13
TOTAL	60	247

The total GHG reduction potential of the 247 mitigation options identified in 24 non-Annex I country abatement studies is estimated at almost 1.1 billion tonnes CO_2 equivalent (Table 2). Figure 1 shows the distribution of this potential over the technologies DS-EE (Demand Side Energy Efficiency), DS-FS/RE (Demand Side Fuel Switch/Renewable Energy), NPS (Non Power Supply), PS-FS (Power Supply Fuel Switch), PS-RE (Power Supply Renewable Energy) and PS-EE (Power Supply Energy Efficiency).

Figure 1 clearly identifies two types of activities that account for the largest abatement potential, i.e. energy efficiency measures in the power sector and demand side energy efficiency measures (together 66%). The share of renewable energy is limited to 14% of the estimated abatement potential, whereas the contribution of fuel switch options (oil and coal to natural gas) at both the demand and supply side of the energy sector is 17%.

Figure 1. Distribution of abatement potential over technologies based on non-Annex I country abatement studies

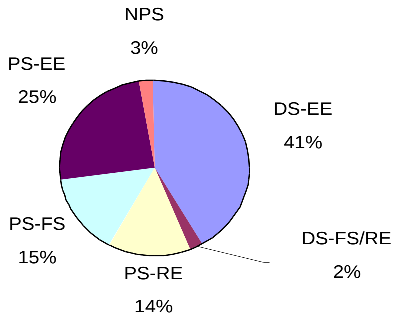


Figure 2 provides a comparable picture of the distribution of GHG savings over different types of technology options, based on information derived from AIJ/GEF projects. It shows that DS-EE projects account for the major part of the estimated GHG savings (60%), followed by renewable energy supply projects (31%). Comparing Figure 2 with Figure 1 shows that especially the share of energy efficiency projects in the power sector (part of miscellaneous) is lower for AIJ/GEF projects implemented to date, whereas the share of renewable energy projects is much higher for the implemented projects. Also, the share of projects involving a fuel switch (also part of miscellaneous) is smaller for implemented projects.

Figure 2. Distribution of GHG Savings over technologies based on AIJ/GEF project information

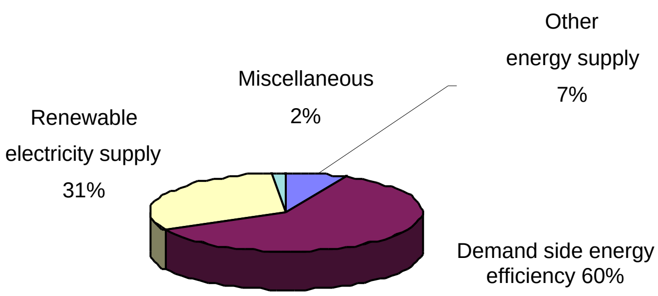


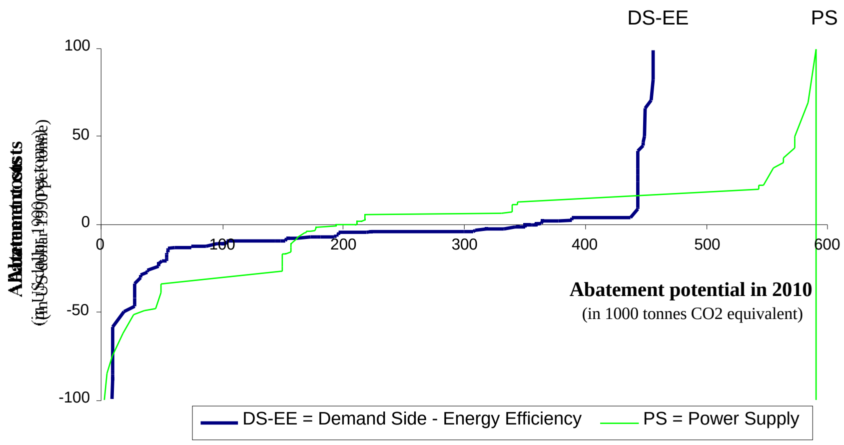
Table 2 provides some additional information on the potential and costs of abatement options over different categories of mitigation technologies. Depending on the abatement technology considered, the average mitigation costs per tonne CO_2 equivalent varies widely from –17 US$ for Demand Side Renewable Energy (DS-RE) technologies to 254 US$ for Non-Power Supply Fuel Substitution (NPS-FS) options. These average figures, however, should be interpreted cautiously, as they are sometimes based on a small number of mitigation options identified in the sample of 24 non-Annex I country abatement studies. The average abatement costs of Demand Side Energy Efficiency (DS-EE) technologies in non-Annex I countries is estimated at –8 US$ per tonne CO_2 equivalent compared to 3 US$ for all Power Supply (PS) options considered. This implies that in non-Annex I countries (i) DS-EE technologies are, on average, cheaper than PS options, and (ii) DS-EE technologies can, on average, be regarded as 'no-regret options' (i.e. abatement opportunities with negative costs). The last column of Table 2 shows that even 78 % of the abatement potential of DS-EE mitigation options can be classified as 'no-regrets' compared to 33 % for all PS technologies and only 2% of all Non-Power Supply (NPS) options.

Table 2. Potential and cost of abatement options over various categories

Category	Number of options	Potential (in mln tonnes CO_2 eq.)	Average costs (in US$ per tonne)	No-regret options as % of total identified abatement potential
Non Power Supply (NPS)	*12*	*28*	*53*	*2*
Energy Efficiency (EE)	5	22	45	2
Renewable Energy (RE)	4	5	56	0
Fuel Substitution (FS)	3	1	254	0
Power Supply (PS)	*84*	*591*	*3*	*33*
Energy Efficiency (EE)	29	275	6	22
Renewable Energy (RE)	39	153	-13	74
Fuel Substitution (FS)	16	162	12	13
Demand Side (DS)	*151*	*480*	*-8*	*79*
Energy Efficiency (EE)	133	458	-8	78
Renewable Energy (RE)	5	2	-17	91
Fuel Substitution (FS)	13	20	-12	91
TOTAL	*247*	*1099*	*-1*	*52*

Finally, Figure 3 summarises the major findings with regard to the abatement potential and costs of DS-EE versus NPS mitigation technologies by providing cost curves for these two main categories of GHG reduction options. The table shows that, up to 100 US$ per tonne CO_2 equivalent, the total abatement potential of PS options is larger than for DS-EE technologies, but that the share of no-regrets – i.e. the abatement potential below the X-axis – is significantly smaller for PS technologies compared to DS-EE options. However, although the relative abatement costs of PS versus DS-EE technologies vary depending on the interval of abatement potentials considered (see Figure 3), the average abatement costs of the total identified abatement potential is significantly lower for DS-EE options than for PS technologies (as indicated in Table 2).

Figure 3. Abatement cost curves for different mitigation technology options



The above results, however, should be treated with due care as they are subject to several analytical limitations.[2] For instance, the cost figures involved refer only to direct project cost (including investments, maintenance, fuel and other operational costs), but exclude cost categories such as implementation costs and other, indirect (macroeconomic) costs. Notably the implementation costs – including administrative, transaction and other institutional costs at both the local and national level – may vary significantly over different technology options. Most likely, these costs are much higher for DS-EE projects than other projects, leading to a deterioration of the competitive advantage of the former against the latter options. In addition, a variety of other criteria besides abatement costs are important in the choice between different mitigation technology options such as the socio-political acceptance of these options.

5. EXPERIENCE IN AIJ PROJECTS

The Activities Implemented Jointly (AIJ) programmes, established by CoP 1 in 1995, are used to gain experience with JI and CDM. Since then, several Parties to the Climate Change Convention have set up national supporting programmes for AIJ. By June 2000, at the UNFCCC Secretariat, information was available on a total of 149 AIJ projects, of which 60% are implemented in Central and Eastern Europe. The distribution by project type is as follows [3]:

- Energy efficiency: 58
- Fuel switch: 9
- Renewable energy: 49
- Fugitive gas capture: 7
- Forestry: 16

The energy efficiency projects can be broken down as follows:

- Improvement of municipal/district heating systems and CHP: 28
- Power sector: 5
- Industrial processes: 6
- Horticulture and agriculture: 2
- Appliances, lighting and buildings: 8
- Other: 9

One can observe that, AIJ projects are not spread equally among project categories. Of all energy related AIJ projects, by far the majority is implemented in energy supply and conversion, particularly in renewable energy and improvement of municipal/district heating systems and CHP. The number of end-use energy efficiency projects is small. No projects have been implemented in the transport sector. Another observation is that more than 10 % of the AIJ projects are related to forestry, resulting in sometimes high potential reductions, and the majority of these projects are realised in developing countries, which would classify them as potential CDM projects.

One should be aware of the differences between AIJ projects and future JI projects. First, in many cases, financing schemes and conditions are in most cases different than for future JI projects. For instance, in the Dutch AIJ programme, the Dutch Government has financed 100% of the initial investment costs. Also, on average, AIJ projects are smaller than future JI projects, and transaction costs are therefore relatively higher (compare ERU-PT, Chapter 7). Finally, the role of the private project developers/investors will be much larger in JI than has been the case in AIJ.

Although AIJ projects have been developed for some years now, there remains a lack of consistency, comparability and completeness in the reporting of the activities and the estimated or obtained emission reductions. Because the emission reductions resulting from AIJ projects can not be claimed by the investor, less attention given to validation, monitoring and verification of the project's baseline and performance. The reporting requirements for AIJ projects are often not complied with, resulting in different levels of completeness, transparency and comparability of the project reports.

6. THE CURRENT STATUS OF INTERNATIONAL NEGOTIATIONS

The Kyoto Protocol formally allows countries to jointly implement emission reduction projects. Firstly, it allows through Art. 6 of the Protocol, an Annex I "buying" country to purchase ERUs (Emission Reduction Units) resulting from projects realised in another Annex I "host" country. This mechanism is known as Joint Implementation. Furthermore, Art. 12 of the Protocol gives Annex I countries the opportunity - through the

Clean Development Mechanism - to implement projects in non-Annex I countries. The operating rules for the two systems are still under negotiation. It is expected that the Parties will solve the loose ends during CoP6^{bis}. In this section, only those characteristics of JI and CDM are listed that could influence the chances of end-use efficiency projects under the Mechanisms:

1. International guidelines put neither restrictions nor preferences on the type of projects under JI.
2. Project eligibility plays an important role in the discussion on CDM. End-use energy efficiency projects will be included in the so-called 'positive' list.
3. The additional requirement of Kyoto Protocol Art. 12 to achieve sustainable development and the 'adaptation levy' on CDM reduce the competitive advantage of CDM compared to JI projects.
4. The guidelines within UNFCCC are currently directly linked to those of CDM where additionality is a much more preponderant criteria than for JI. The risk of leakage in non-Annex I countries is namely much higher compared to countries with a binding target.
5. The weak emission registration and monitoring system in developing countries causes an extra burden on the establishment of a reliable baseline for CDM projects and the set up of monitoring plans. This results in higher transaction costs.

Although experience with project based emission reduction has been gained in the AIJ programmes, no single set of rules and guidelines for JI exists at the moment. In the FCCC negotiations following CoP3, where JI was established as mechanism to reduce emissions, the three mechanisms are to a very large extent treated as a whole (packet), meaning that none of them can become active without agreement on the others. The link between JI and CDM has now become very strong and Parties are not willing to separate them very easily, although they aim for different categories of host countries and, hence, have other conditions. At CoP6 there was no agreement on the level of supplementary of CDM projects compared to the baseline scenario, while the discussion on a “ceiling” or “cap” for all three mechanisms is still not closed. With regard to the latter issue, the major opponents are the EU/CEE and the Umbrella group (US, Canada, Japan, Australia, New Zealand, Norway, Russia and Ukraine). The ultimate attempt by the British deputy Prime Minister John Prescott to strike a deal at CoP6 failed. This was due to the European refusal to accept unlimited domestic carbon sinks, even in the situation that the US were prepared to give up the idea of unlimited carbon sinks through JI and certainly through CDM as an emission reduction option. The position of carbon sinks in the negotiations on project based emission reduction abroad can remain a difficult issue, even though the IPCC has recently finalised its special report on land use change and forestry to support the FCCC in its decision-marking with regard to this controversial topic.

The failure of CoP6 and especially the postponement to a CoP6^{bis} in July 2001 was a serious disappointment on the future entry into force of the Protocol. The postponement could lead to intense procedural discussions about the legality and status of such a meeting, the chances are quite high that everything will be postponed further till CoP7. The recent news that the US president, in contrast to his election campaign message, does not regard climate change a priority item, causes further doubts and fears about a positive outcome of the next negotiations, which had good perspectives from earlier contacts this year between the major players (US, EU, China, and others). The protest and efforts from the others may perhaps alter the US point of view but, given the current situation and position, this might be wishful thinking.

7. A TEST CASE: THE DUTCH JI TENDER ERU-PT

The Dutch Emission Reduction Unit Procurement Tender (ERU-PT) was the first national JI tender to be implemented[4]. In the near future, the tender will also be opened for CDM projects in developing countries. In this section we will present the results of the first tender, which was opened for Expressions of Interest (EoI) in July 2000, to see 1) what type of projects are submitted and 2) whether the specific tender guidelines put certain project types at a (dis-)advantage.

26 EoI were submitted, notably with regard to the following types of projects: CHP in district heating, renewables (wind, hydro), biomass, and landfill biogas utilisation. No end-use energy efficiency proposals were submitted. The nine shortlisted projects included CHP in district heating, renewable electricity production (hydro, wind), biomass, afforestation and landfill gas extraction. These projects are to be implemented in Romania, Poland, the Czech Republic, Latvia and the UK. February 2001, the project developers submitted a full proposal that should include:

1. A validated baseline study.
2. A detailed technical and financial description of the project.
3. A Letter of Approval of the host country (including the number or share of ERUs to be transferred).
4. A quote for a specified number of ERUs and the price. The number of ERUs is a function of 1) the total number generated by the project as determined by the validated baseline study and 2) the share of ERUs that could be transferred (as stated in the Letter of Approval). Only ERUs produced in the first commitment period can be purchased. In absence of an international market for ERUs and lack of competition, the price was mainly determined on the basis of the gap in financing of the project that needed to be covered. Senter has indicated a target price for an ERU of 5-10 $/t CO2eq. It is expected that for projects in energy conversion (like CHP in district heating) about 20 % of the investment costs could be covered by the ERU revenues.

In April 2001, the Dutch Government contracted five projects for a total number of ERUs of 4 Mtons CO_2 eq. at a total price of EUR 36 million. These projects are: a 60 MW wind-power park in Poland, a portfolio of biomass-fuelled boilers in the Czech Republic, a hydro-power plant, and two district heating CHP projects in Rumania.

The following tender guidelines of ERU-PT have an impact on the type of project, particularly with regard to the energy production and conversion versus end-use energy efficiency. They are listed in decreasing order of importance:
1. The sole objective of ERU-PT is to buy ERUs at a low price and acceptable risk. Senter, the organisation that manages the ERU-PT for the Dutch Government, therefore assesses primarily price and project risk and does not have a preference for specific project types.
2. Transaction costs for JI/CDM schemes are a concern to both buying and selling countries. The transaction costs encompass those costs made in preparing and implementing the JI/CDM schemes (including development of guidelines, communication and negotiations, evaluation and contracting etc.). The transaction costs carried by the project developer are not considered here because they should be included in the price. The ERU-PT procedure foresees a fee for project developers to enable them to prepare and validate the baseline study. In ERU-PT the transaction costs are reduced by defining a minimum number of ERUs that can be offered (500.000 ERUs over the first commitment period). This corresponds to projects that reduce on average 100.000 tCO2eq a year assuming that 100 % of the ERUs can be transferred. These are big projects. However it is possible to submit portfolios of smaller projects of the same type that in total meet the minimum number of ERU to be contracted.
3. The guidelines suggest the following project lifetimes: good housekeeping: 5 years, refurbishment projects: 10 years, and green field projects: 15 years.
4. The tender has a very tight schedule: about 10 months between opening and contracting; effectively three months for preparation of the full proposal, baseline study validation and Letter of Approval. It was virtually impossible to complete the procedure for “fresh” projects that were not already in the pipeline.
5. The host countries have the opportunity to evaluate the compliance of the proposed projects with national policies and priorities.
6. The whole procedure is confidential. There was no participation of the public or other public benefit interest groups (like e.g. NGOs). However (some parts of) the validation reports will be accessible for a broader public. In the host countries, only few governmental organisations were involved in the implementation of ERU-PT.

No end-use energy efficiency projects have been submitted in the first ERU-PT tender[5]. In addition to the tender specifications listed above, this can be explained as follows:
1. The level of awareness on JI/ERU-PT in the end-use sectors (e.g. industry, public building sector, transport) is much lower than in the energy sector, where most of the projects originate. This is caused by the commercial and strategic interest in these sectors of Dutch and other Western companies, which are at the moment the main initiators of JI projects. Furthermore, the energy supply sector has been a key sector for GHG emission reduction in the past.
2. The host countries did not express any preference for end-use energy efficiency projects.
3. Market competition or market opening (liberalisation) plays a major role for projects in the power sector (energy supply) and acts as a strong motivation for West European power companies, which look for an enlargement of their market share.
4. Present and future ownership of the energy efficiency projects and the technologies installed may not be clear. The projects are often spread over a larger group of different sites compared to energy supply and conversion projects. Latter projects are often set up in only one location with a clear perspective on (future)

ownership. Also, in end-use energy efficiency projects, the project developer or investor has less control over or impact on the behaviour of the end-user, although the former remains responsible for the emission reduction achievement.

8. VALIDATION, MONITORING AND VERIFICATION

Different barriers hinder the development of greenhouse gas reduction projects. One category of barriers relates to the UNFCCC requirements, such as the validation, monitoring, verification and certification procedures. These requirements lead to higher transaction costs and consequently to less net project benefits. The question here is whether these transaction costs are different for end-use energy efficiency projects in comparison to the competing project types, particularly energy supply projects.

At the moment, it is not clear what the requirements of JI projects will be. A two-track approach for JI is being discussed, *i.e.* there could be two different project life cycles. In the case the Annex I host country comply with Articles 5 and 7 of the Protocol (dealing with Parties' reporting and inventory commitments), there is no need for strict procedures on verification of the emission reduction of JI projects ('fast track'). If not, a full scrutiny is necessary, like in CDM (baseline validation, monitoring, verification of emission reduction and certification by an independent body).

In the first 'fast track' case, we don't expect significant different transaction costs between end-use energy efficiency projects and other project types. In the second case however the following differences should be considered:

1. End-use energy efficiency projects in general are smaller, and the relative transaction costs relatively higher.
2. In end-use energy efficiency projects, the increase of energy efficiency often coincides with an increase of the level of energy services. For instance, when improving the envelope of residential buildings, the level of comfort (temperature) often increases. In industrial processes, in most cases, the increase of productivity is the main motivation for investments, with the increase of energy efficiency as an additional benefit. It is often difficult to separate productivity increases and efficiency improvements in validation and monitoring. This problem doesn't occur with energy supply projects.
3. Energy efficiency projects related to end use demand may have more problems in setting up a baseline and may be very difficult to monitor due to a higher risk of rebound/spill-over effects.

9. DIFFERENCES BETWEEN JI AND CDM

Some differences between JI and CDM could influence the competitive position of energy efficiency versus energy supply and conversion projects:

1. Regarding the eligibility of projects, the Note by the President at CoP 6 [6] proposed that Non-Annex I parties will have the discretion to evaluate the extent to which a CDM project contributes to achieving sustainable development. This will certainly include energy efficiency projects. Also, a positive list of project categories is proposed, including end-use energy efficiency.
2. CDM projects always need to be fully scrutinised (validation, verification, certification), while if the two-track approach is accepted, the JI project life-cycle could be more simple (see chapter 8).
3. Some requirements for eligibility for JI and transfer of ERUs for the JI host countries do not apply to CDM. The most difficult one is having a national emission inventory system and registration in place before the start of the commitment period. However, for CDM, a CDM board will decide on projects.
4. The potential of projects in CDM countries will be different than in JI host countries. For instance, in Central and Eastern Europe, a large potential exists for district heating projects (CHP), while in CDM host countries renewable energy (solar/hydro) is more important.
5. It is still not clear from which date on JI projects can generate emission credits. CDM projects can already start generating credits from 2000 on, assuming guidelines and rules are in place at that date. So probably eligible projects that are already implemented (e.g. as AIJ) that satisfy all the requirements could be recognised as CDM and result in early credits. Such a provision is not yet in place for JI, meaning they can only generate credits between 2008-2012. This means that projects with short lifetimes, although being

environmental beneficiary, are in disadvantage to JI projects with longer lifetimes (power supply, forestry) and to identical projects under CDM.

6. Economic growth forecasts for developing countries have a higher rate than those for industrialised (Eastern European) countries, especially for electricity use. This may favour projects that reduce emissions at the supply side because there is a larger potential of ERUs.
7. New projects (greenfield) or major modifications may be more cost effective if executed in developing countries than refurbishing or upgrading existing installations. The latter type of project is more relevant for economies in transition.
8. The awareness of energy efficiency is on average even less in developing countries compared than in economies in transition.

One can conclude that some factors lead to better chances for end-use energy efficiency projects in CDM. For others, the opposite is the case. No conclusion can therefore be drawn on the difference in chances of end-use energy efficiency projects in JI versus CDM.

10. CONCLUSIONS AND DISCUSSION

In chapter 3, the following three essential conditions for the successful development and implementation of JI/CDM projects were identified:

1. A substantial potential of energy efficiency projects within the competitive range of marginal costs for GHG emission reduction must be available.
2. The project must be successfully developed up to the stage that the project can be submitted to a JI/CDM tender or other scheme. Therefore, the conditions for developing projects in the host country (institutional, legal framework, business climate, financing, etc.) for end-use energy efficiency projects must be good.
3. The project must win a contract in JI/CDM schemes in competition with other projects with respect to quantity and price of the ERU/CERs generated as well as the projects risks. The project emission reduction must be monitored and verified.

In this chapter, the competitive position of two examples of end-use efficiency JI projects (building envelope and industrial processes) is compared in a tentative way with an example energy supply project, namely medium-sized CHP projects in district heating. The potential for CHP projects in Central and Eastern Europe is still very large (10-50 MWe). Many projects could become commercially viable with about 20% extra investment financing. The results of the first ERU-PT tender confirm this. These projects therefore can be regarded as strong competitors for end-use energy efficiency projects in future JI schemes.

We will structure the competitive factors according to the three conditions listed above. In the following table, we indicate the competitive factors for the three projects types in relative qualitative terms: “+” means “relative competitive advantage”; “-” implies “relative competitive disadvantage”; “0” is neutral.

Table 3. Relative competitive advantages and disadvantages for three example project types

	End-use energy efficiency projects		Energy supply projects
	Measures in building envelope	Energy efficiency improvements in industrial processes	CHP in district heating
1. Potential of projects with competitive marginal reduction costs	0	+	0/+
2. Developing the project			
Cost effectiveness (e.g. rate of return)	-	0/+	0/+
Project risks	0	0	0
Project development costs	+	0	0
Interest of investors/commercial interest	-	-/+	0/+
Strategic interest (foreign) investors/companies	-	-/+	0/+
Effective national priorities host countries	-	0/+	+
Reproducibility	+	-	+
Average project size	-	-/+	0/+
Possibility to develop portfolios	-	-	0
3. Winning a JI/CDM tender and generating verified ERU/CERs			
Price of ERU/CER	-	0	0
Risks of not delivering emission reduction	0	0	0
Transaction costs for validation, monitoring and verification	-	0	0

The results indicate that the overall competitive position of end-use energy efficiency projects in JI is weaker than energy supply projects (with industrial energy efficiency project at a better position than building envelope projects). By and large, this conclusion is valid for CDM as well. At the moment therefore, JI and CDM are certainly no catalyst for end-use energy efficiency projects. This is confirmed by the experiences in current JI schemes, like ERU-PT.

Engleryd and Cunha da Costa investigated the chances of market transformation projects under CDM (domestic refrigeration and service sector lighting) and came to similar conclusions[7]. Although the local and global benefits are obvious, the main barrier is the difficulty of attracting Annex I investors to market transformation projects. They recommend that the more strategic benefits of these market transformation projects, compared to clean electricity production, should be credited also. On the longer term this could change if the market grows. The host countries could then afford to state a preference for end-use energy efficiency projects because JI and CDM can contribute substantially to the transfer of environmental sound technologies to the host countries, which in a globalising competing market may mean the extra additional incentive for a more equitable society.

Some of the competitive factors could be improved on the short term by 1) improving the rules and guidelines for JI and CDM, and 2) a stronger involvement of the host countries:

1. Eligibility of small projects could be improved by accepting and facilitating practical portfolio approaches.
2. For small projects, transaction costs for baseline studies, monitoring and verification could be significantly decreased by for instance accepting more generic approaches. Furthermore, for some energy efficiency projects, like market transformation projects, specific guidelines for baseline determination and monitoring still need to be developed.
3. Although almost all host countries have stated energy efficiency as a key priority, effective support of such projects is small. Also, in actual JI schemes, no host country has in fact stated a preference for energy efficiency projects, e.g. compared to energy supply projects. Eligibility is an effective tool that host countries could use to select specific project types in favour of end-use energy efficiency projects and to limit for instance certain types of other projects (e.g. sinks). This is particularly the case in CDM where sustainable development is an important objective.

However, the main competitive disadvantage for end-use energy efficiency project, namely the relative low commercial and strategic interest of investors and foreign companies, cannot be resolved in this way. It is therefore difficult to predict in how far the measures identified above could in fact improve the currently rather bleak prospects of end-use energy efficiency projects in JI and CDM.

11. ENDNOTES

[1] The ECN-AED-SEI research project was carried jointly by the unit Policy Studies of the Netherlands Energy Research Foundation (ECN), the Alternative Energy Development, Inc. (AED; USA), and the Stockholm Environment Institute (SEI; USA). See Van der Linden, *et al.* (1999), Potential and Cost of Clean Development Mechanism Options in the Energy Sector, ECN-99-095, Petten.

[2] These data and methodological limitations are extensively discussed in Van der Linden et al. (1999) and Sijm *et al.* (2001), Cost Assessments of Mitigation Options in the Energy Sector – Conceptual and Methodological Issues, ECN, Petten.

[3] Activities Implemented Jointly under the Pilot Phase; Fourth synthesis report. Note by the Secretariate. FCCC/SB/2000/6.

[4] For information on ERU-PT, see www.senter.nl\erupt.

[5] Two other examples: 1) of the four JI/CDM project proposals currently being processed by the World Bank Prototype Carbon Fund, two concern renewable energy, one landfill gas recovery and one large industrial CHP. http://www.prototypecarbonfund.org/. 2) The International Climate Change Project Fund (ICCPF) may support a wide variety of climate change mitigation projects (including End Use Energy Efficiency & Demand-Side Management Actions). The list of projects approved by USIJI or under development however comprises only biomass power generation, hydro, forestry and gas-fired CHP projects (http://www.ji.org/index.htm, 4.1.2001)

[6] Note by the President. COP 6 (23.12.2000).

[7] Engleryd A., Cunha da Costa R. End-Use Energy Efficiency under the Clean Development Mechanism; an opportunity to simultaneously benefit the global and local environment. International UIE/EDP conference on electricity for a sustainable urban environment, Lisbon, Portugal, November 2000.