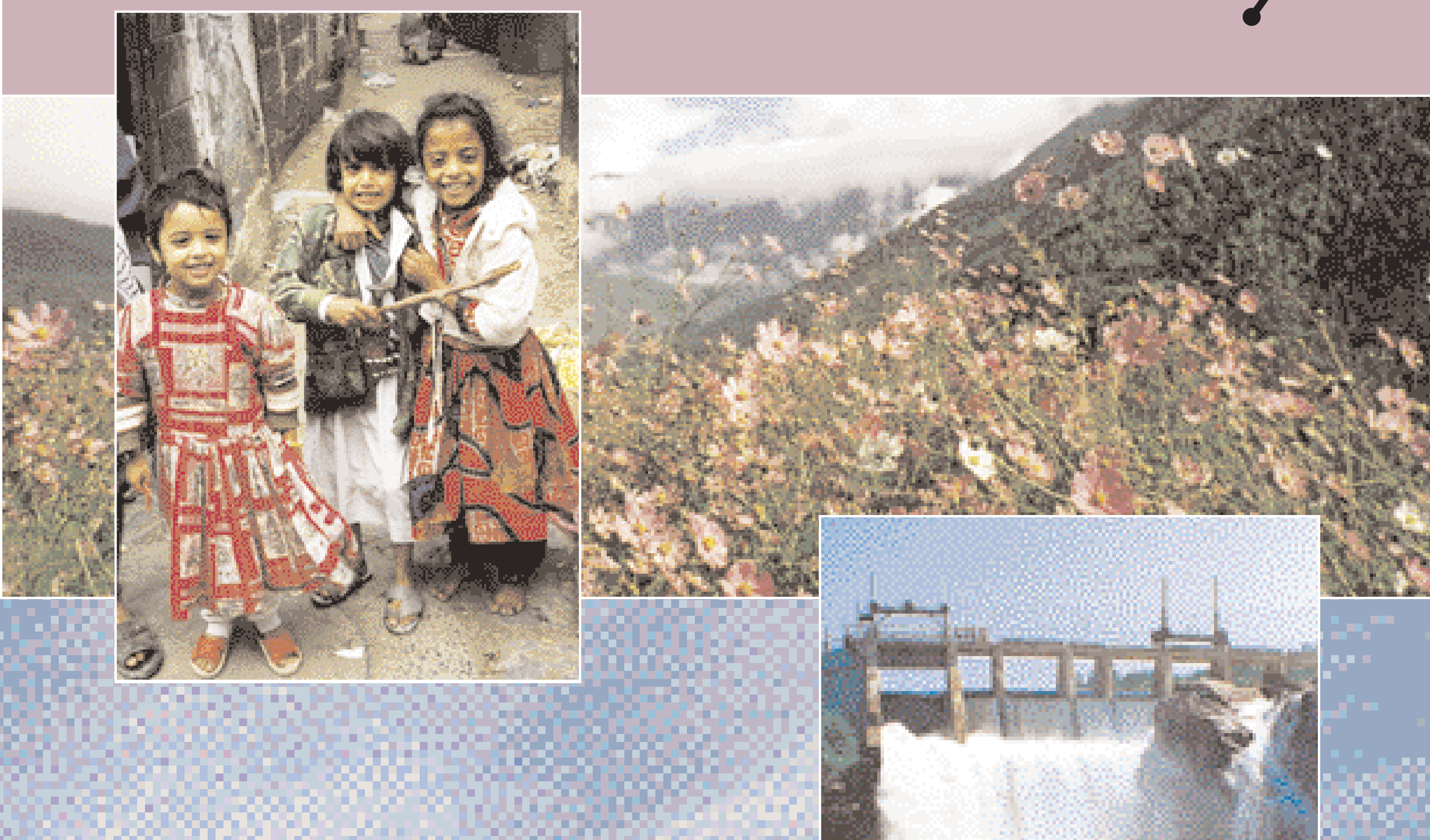
Position Paper on CDM and the Other Flexible Mechanisms

E7 and Its Partners from Around the World



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Introduction

The Fourth Conference of the Parties (COP4) to the UNFCCC decided on the Buenos Aires Action Plan, which included a work program to define the flexible mechanisms of the Kyoto Protocol. Further progress was made during COP5 at Bonn. The Conference of the Parties will likely make a decision on the flexible mechanisms at COP6 which is scheduled for November 13-24, 2000, in The Hague, Netherlands.

Climate Change is an important issue, but not the only issue on the global energy agenda. Massive flows of private capital as well as technical and organizational skills are needed to fulfill even the most basic energy demands in developing countries. Currently, two billion people do not have access to reliable and economically affordable electricity. The World Energy Council (WEC) estimates that during the next 20 years, 30 trillion dollars (US) will be required to meet only basic energy needs, a figure in excess of the annual global GNP. To fulfill these needs and supply energy in a reliable, environmentally friendly, and economically feasible way, private capital and resources must be mobilized.

Flexible mechanisms can promote cooperation between developed and developing countries, and entities therein, to undertake action to help meet energy demands through achieving sustainable energy development and managing greenhouse gas (GHG) emissions.

The E7 members and its partners[1] believe that in order for the flexible mechanisms to develop to their full potential, commitment and a high level of participation by private entities from both investing and *project site* countries are required.

1. *E7's partners include the State Power Corporation of China, PLN (Indonesia), CEGCO (Jordan), ESKOM (South Africa), EGAT (Thailand), and ZESA (Zimbabwe).*

To ensure the greatest participation, the operating rules for the mechanisms must be simple, well defined, transparent, globally consistent, and stable. Complicated, bureaucratic, discriminating, costly, or ambiguous procedures will discourage private investment in these promising instruments.

The E7 has three Activities Implemented Jointly (AIJ) underway in Indonesia, Jordan, and Zimbabwe to contribute practical experience to the AIJ initiative. The experience with these projects and a trade of CO_2 emissions reduction credits between two E7 member companies (Ontario *Power Generation* and *Edison International*) were the basis of an E7 paper presented at COP4.

E7's partner utilities bring experience to AIJ from the perspective of the project beneficiary. Moreover, as entities involved in the energy business of the potential host countries, partner utilities bring direct insight into the local needs and issues to be considered in the mechanism definition in order to facilitate local implementation of the CDM projects.

This paper goes beyond the E7 COP4 paper which presented recommendations for the practical implementation of the flexible mechanisms. It focuses on some of the key issues surrounding baselines, additionality, monitoring, and verification by presenting the views of some of the leading electricity companies from around the world. The paper incorporates the results of a workshop held on October 28 & 29, 1999, in connection with COP5, by the E7 and representatives from the State Power Corporation of China, PLN (Indonesia), CEGCO (Jordan), ESKOM (South Africa), EGAT (Thailand), and ZESA (Zimbabwe). The presentation of this paper for consideration at COP6 is in the hope that the flexible mechanisms can contribute to cost-effective and sustainable reductions of global greenhouse gas (GHG) emissions, as well as provide the means to fulfill some of the most basic demands of developing countries.

Background

(The Credit Creation Process)

Certification of GHG emission savings from the project-based Kyoto Mechanisms, the Clean Development Mechanism, and Joint Implementation, involves the following business-based chain of actions:

- Project Registration
- Project Implementation
- Monitoring
- Reporting
- Certification of Emission Reductions.

Each of these actions is briefly described below.

Project registration consists of the following steps:

- Defining the project—This is the basis of the decision-making process, which includes an assessment of the eligibility of a project in terms of GHG emissions, and economic, environmental, and social impacts.
- Establishing the project baseline—This is a critical link in the chain as the credibility of all subsequent steps depends upon the validity of the baseline.
- Validating (Certifying) the project—Validation is accomplished by having an independent third party (also known as an operational entity) verify that the project meets the CDM requirements and that the baseline definition and monitoring program are consistent with procedures. Project validation is needed to provide financial institutions with sufficient confidence to fund the project.

Project Implementation refers to the actual construction, start-up, and operation of the project.

The *Monitoring Program* includes the measurement of the energy savings, GHG emissions, or other information necessary to determine project performance. This allows for the calculation of emission reductions by sources or removal by sinks, as well as an analysis of the results.

Reporting is the presentation of the measurements from the monitoring program, preferably in a standardized format such as the UNFCCC format, in order to verify the emission reductions actually achieved against the baseline and to facilitate the comparison between projects.

Certification is the verification of the emission reductions by sources or enhancements of removals by sinks, actually achieved against the baselines.

The entire process has to be consistent, technically irreproachable, easily verifiable, simple, and transparent, as well as cost effective.

Baseline and GHG Emissions

An emissions baseline must be established in order to calculate reductions in GHG emissions. A system of monitoring, verifying, and certifying the achieved emission reductions must be developed to maintain credibility among all stakeholders, including project participants, communities, and countries involved, in order to increase acceptance and efficiency of the use of the project-based Kyoto Mechanisms, CDM, and JI.

The discussion on the steps and criteria presented below is most relevant to energy-sector based projects. However, all sector projects must be implemented with equal rigor to ensure fungibility of all credits.

Principles

The definition of the baseline and calculation of the actual GHG emission reductions should be based on the following suggested principles[2] in order to encourage CDM transactions by respecting local conditions and promoting investor confidence:

- Establishment of baselines should promote economic growth, which is one of the key elements of a sustainable, energy-development policy.
- Transaction costs should be low so as to encourage broad participation and increase the number of projects.
- Projects should achieve reductions or avoidances of GHG emissions or sequester GHGs that are additional to any that would otherwise occur in the absence of the project activity.
- Accuracy and reliability should be emphasized so as not to jeopardize the credibility of the Mechanisms.
- Rules should be clear and well defined to promote investor confidence, including the rule that baselines are not subject to change.
- Baseline definition and calculation of emission reductions should be based on local conditions.

Moreover, a project to be considered as CDM should also meet local environmental objectives and foster local social benefits.

An analysis of these principles is presented in Table 1 (see page 9).

2. *Most of the principles are already contained in the document "E7 Recommendations for the Design of Flexibility Mechanisms to Manage Greenhouse Gas Emissions" issued and presented at COP4.*

Reduction Calculations

Methodology

The methodology proposed for the calculation of baselines and emission reductions is based on five *criteria:* simplicity, objectivity, repeatability, measurability, and verifiability.

The baseline should be:

- Set and verified at the time of project registration
- Based on local conditions
- Valid for the technical duration of the project.

Discussion and Recommendations

It is recognized that no single baseline calculation methodology will apply in all cases. We believe that verifiable historic carbon intensity of the replaced local sources or the local energy system for the years immediately prior to the validation[3] should be applicable in most cases. However, there will be cases, particularly related to new sources, when another method should be considered (e.g. when a country or a company previously developed hydroelectricity but has reached their limit of economical hydro resource development potential). The local situation, including the most credible and verifiable method for calculating the baseline, should be considered in all cases. We address some of the key issues surrounding the baseline determination below:

Replacing Existing Generation

As stated above, the baseline for replacing existing sources should usually be based on a verifiable historic carbon intensity of the replaced local sources for the years immediately prior to project registration.

For replacement of grid-connected generation, this means that the baseline should be based on the carbon intensity of the generation plant being replaced. This would also apply to an existing generation plant where the efficiency is being improved or the fuel is being replaced with a lower carbon content fuel.

If the electricity is replacing non-electric sources (e.g. kerosene fuel for lighting) or dispersed generation (e.g. diesel fuel), the baseline should be based on the emissions of the previous fuel.

3. It is proposed to consider the average value of the last three years before project validation.

Adding New Generation

This applies to new electric generation necessary to expand existing energy services due to economic growth and/or to an improvement of the standard of living. In addition, some projects may have two components: 1) replacing existing emission sources and 2) providing additional energy to supply new services. For example, this is the case of the construction of some renewable plants (e.g. mini-hydro in Indonesia) where the electric output of these plants exceeds the value necessary to replace kerosene fuel for village houses. This additional output will be available to supply equipment for new commercial, agricultural and/or activities that will improve the local economy.

Baseline scenarios for new generation are discussed on the next page.

The method to be employed shall be based on local conditions and situations. It is anticipated that Method 3 will likely require a more careful assumption verification. Clear rules need to be employed during the registration phase in order to limit subjective evaluations, avoid overestimation of emission credits and maintain credibility of the mechanism, so as to be helpful in reducing costs.

Demand Side Management

The actual reduction of emissions by electric end uses will be calculated as the overall saved electricity consumption multiplied by specific CO_2 emissions of plants connected to the grid, including imports and considering line losses.

Constant Baseline

The project baseline should be assessed in the registration phase, kept constant, and not be subject to change during the life of the project. Any variable baseline based on projected "business as usual" scenarios for the country's emissions would be highly subjective, not verifiable, and lead to higher transaction costs. Therefore, variable baselines should be avoided. A constant baseline would encourage increased private sector participation by reducing uncertainty, increasing objectivity, and simplifying the process.

As stated previously, we recommend that the baseline for new projects be performed at the time of project registration and based on verifiable average historic data for the carbon intensity of plants connected to the grid, which would consider the contribution of the entire mix of plants, including older as well as recent generation plants. To satisfy uncertainties associated with future potential improvements of the technology independent from the greenhouse gas concern, while retaining a constant baseline, some organizations suggest employing a small reduction factor to establish a constant baseline for the life of the project. This reduction factor would be in effect from the time of the registration phase and would be identical for any worldwide project. However, although the criterion of simplicity would be maintained and any additional subjectivity would be avoided, it must be recognized that any small reduction factor would in itself be arbitrary and that future operations may actually result in more than projected emissions credit reductions.

Baseline for adding new off-grid electric generation

The baseline for off-grid generation supplying new services (in excess of the output necessary to replace existing non-electric sources) should be based on the carbon intensity of a standard diesel generator[4].

Baseline for adding new electric generation connected to grids

Three suggested methods for calculating the baseline are provided below:

Method 1 – Use average carbon intensity emitted from the generation plants already connected to the grid for the years immediately prior to project registration.

Method 2 – In situations where carbon emissions are already very low (e.g. large use of hydro), use as default a carbon intensity value of fossil standard technologies for the baseline taking into account local conditions and availability of fuel sources. This will help to continue supporting the use of CO_2 free plants or low CO_2 emission plants and to simplify the registration process.

Method 3 – In situations where the methods specified above would penalize solutions to reduce GHG (e.g. coal plant is demonstrated to be the least expensive local plant and other fuels are not economical to use), baselines should be structured so as to consider the next plant that would likely have been built had it not been for the climate change issue. This would allow for clean coal technologies to be CDM compared to the construction of a conventional coal plant.

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4. When reliability data are not available the specific emission of a standard diesel generator is assumed, for example a value of 0.9 kgCO_2/kWh of consumption if electricity is not accumulated and 1.1 kgCO_2/kWh of consumption, including battery charger loss, if electricity is accumulated.

Consideration of Other New Projects

Based on the agreement of the affected parties, the baseline for new projects may consider both the actual local emissions and the effect of other new projects in development that already achieved certified status at the moment of project registration. These projects could be:

- Already under implementation; or
- Awaiting implementation, but already registered as CDM or already formally approved by the local authority.

The existence of other formally approved non-CDM projects, which may affect the baseline of the new project under registration, should be signalled by the project site State when providing its approval for the new CDM project. Failure by the State to signal the existence of other domestic projects that may affect the baseline is equivalent to a concession by the State of the right of priority to the new project under the CDM registration process. In other words, once the baseline is approved by the appropriate agencies, it should not be affected by the introduction of other projects that were unknown to the CDM project participants at the time of project registration.

Table 2 (see page 20) presents, for reference, the parameters that impact the baseline and the calculation of emission reductions for most types of energy, sector-based projects (for projects adding new electric generation connected to grid, only Method 1 is reported in Table 2). The data should be obtained from actual measurements during the project validation phase, The baseline data is identified by subscript 1, and data collected after project implementation is identified by subscript 2 in the equations given in Table 2.

Joint Implementation

Credits obtained from JI projects must be equivalent to those credits accrued from CDM projects. All participants in the GHG emission marketplace must have the same level of confidence in credits from CDM or JI projects.

A top-down approach to baseline setting may be considered for a JI project since a project-by-project baseline, as described above, may be unnecessary. Total permitted emissions of Annex I countries remain constant whether or not credits are produced by JI projects because under the JI mechanism, a certain amount of emissions reduction credits are transferred to the investor country with that same amount of credits added to the total emissions of the host country. Thus, a JI project results in a zero sum gain concerning actual emissions between the investing country and the host country. Furthermore, the accuracy of the baseline does not affect global emissions. Nevertheless, we recommend that a general methodology for baselines be applied, to the fullest extent possible, in order to have a transparent, worldwide understanding of the rules. This will facilitate implementation of the mechanisms and, in the end, will minimize transaction costs.

Table 1 – Principles and Basis for the Methodology of Calculation of the Baseline and Emissions Reduction Credits

Principles	Basis for Methodology of Baseline Calculation	Notes
1) Sustainable Energy Development: Baseline shall include economic growth (Society should not be deprived of the benefits of electrification)	Baseline should refer to carbon intensity before the implementation of the project and not to the absolute values. The evaluation of emissions reduction credits should be based on the energy services of the new project.	Increase of the absolute emissions is allowed if it is due to the growth of the energy services, as a consequence of economic growth, provided that carbon intensity decreases.
2) Accuracy and reliability should be emphasized.	Baseline will be objective and measurable. Repeatability of the baseline calculation is necessary as well as its independent verification early in the project validation phase. Certification of actual credits based on verifiable monitored data is also necessary.	
3) Transaction costs shall be minimized to encourage greater participation.	Simplicity is the basis for keeping the costs of the analysis and the verification low, while increasing transparency and, hence, credibility.	
4) Baseline shall be defined in order to promote investor confidence.	Baseline of a specific project will remain the same and constant for the technical duration of the new project. Moreover, project validation and approval of the baseline in the early design phase is important for project financing.	
5) Baseline shall be based on local conditions and standards.	Baseline maybe based on the historical carbon intensity, actually measured for the local sources that are going to be replaced (e.g. average value of the last three years). Differences will be made between projects which are: • independent on the overall energy system (replacing a well identified equipment/plant) • dependent on the overall energy system (replacing an unidentified equipment/plant).	Examples: • For new power plant connected to the grid: Baseline may be based on the average carbon intensity of all national power connected to the grid. • For fuel change in a specific plant: Baseline may be based on the carbon intensity before project implementation.

Monitoring

The Monitoring Program is specific to a project or project type and should be established at the time of Project Registration. The Program consists of a complete set of measurements required to ascertain the reduction of GHG, according to the emissions reduction evaluation of the specific project type (Table 2 provides examples of parameters to be monitored and evaluated in the different project type–see page 20). Monitoring should be jointly evaluated by the investor and the beneficiary.

Monitoring needs to be evaluated in terms of cost, accuracy, and transparency for the life of the project. Also, consideration should be given to using ISO to help design the monitoring function.

To illustrate, a Demand-Side Management (DSM) project based on Low Consumption Bulbs will have a quite different monitoring system than that required for the rehabilitation or re-powering of an existing coal powered station.

For both examples, the monitoring programs are based on measurement: the electricity metered before and after for the first project, and the quantity of fossil fuel consumed for a given generation of electricity for the second. The CO_2 savings are based on the electricity savings or the fuel savings.

Finally, depending upon the project, periodic verification may be required. During such checks, it might be necessary to refine the design of the monitoring program given the results of earlier audits.

Verification

Verification is a necessary step to validate, at the beginning of the project, the existence of potential credits and to certify the actual emission reductions during the life of the project. As previously mentioned, validation is done during the project registration phase.

Project Certification (validation)

Certification is performed by an independent third party to assure that a project satisfies the relevant requirements to be classified as a CDM or a JI project. These requirements may include verifying the following:

- Rights of the countries to participate
- The countries' approval of the project
- Participation of legal entities in the project
- Baseline definition
- Additional GHG emission reductions of the project
- Monitoring procedures.

Credits Certification

The Certification of emissions reduction is the verification of these reductions by sources or enhancement of removals by sinks, actually achieved by the validated project against the baseline. The certification also verifies that project participants maintain the right to participate, as assessed during the project validation.

The task of certification of credits should be designed in a simple and less costly manner. This will enhance participation of private entities by providing sufficient safeguards to maintain the credibility of the mechanism, while, at the same time, avoiding an expensive annual and systematic inspection by a Certifier of the data on the project site.

In order to make the certification process simpler, introducing a tax, audit-like system may be a solution. For organizations having a well organized, internal control-system, whose validity is verified during the initial project validation phase, the certification system could be like the income tax declaration process with a detailed audit for credibility performed on a random basis.

In this case the verification process uses a conventional, Internal Control based on the measurement scheme defined and proposed on the basis of the "standardized registration form." This form will be submitted for CDM to a registered Certifier whose responsibility is to review the appropriateness of the information and to audit in detail when necessary.

The Certifier (Verifier) in charge of detailed assessment of the validity of the CO_2 reduction or avoidance, may request any information such as on-line measurement tests, access to records, and on-site inspections.

Thus, it is of paramount importance to design the measurement scheme with the same concern for detail and precision as for the project itself.

Appropriate measures need to be taken to maintain system credibility.

Additionality

In general, additionality refers to the difference between “without project” emission levels and “with project” emission levels. Projects need to demonstrate additionality prior to becoming CDM/JI projects.

Some argue that a “real” JI or CDM project may not have any commercial value at all, whereas others propose that the value of emissions reduction credits shall bring about a positive return on investment, where it would have otherwise been negative. In addition, project risks, country risks, and other uncertainties make it impossible to define a fiscal threshold by which to separate projects into JI and non-JI, and CDM and non-CDM categories.

This debate needs to be resolved in a manner that encourages investments in Joint Implementation and the Clean Development Mechanism. We believe that any project that brings about real and measurable GHG reductions, as well as other environmental and social benefits should be regarded as a possible JI or CDM project, be it a pure donation or a highly profitable private investment.

Fungibility/ Supplementarity

Fungibility

Of key importance when addressing the flexible mechanisms are the links between the three instruments, especially in terms of fungibility. The links need to allow for their units of reduction or credits to be treated as a commodity on the secondary market. The fungibility issue is critical as it will increase the size of the market for "ton equivalent of CO_2 emission reductions" substantially, therefore, leading to increased liquidity and efficiency in the market.

The market needs to be assured that units of reduction or credits from any of the market mechanisms are interchangeable. The three instruments have three distinct types of greenhouse gas emission reduction units defined with different characteristics: CDM (CER) and JI (ERU) are project-based where emissions trading can be based on pre-assigned allowances or project-based reductions. There are other important differences among the three instruments, such as the obligations of the project site party, applicability (2008-2012, early start), as well as bankability—differences that must be recognized in making them fungible. To eliminate this uncertainty, it is recommended that after certification, credits from any of the mechanisms have equal value. In addition, any project risks associated with the reduction unit or credit should be covered by insurance policies and/or the price paid for the credit.

Supplementarity

Under the Kyoto Protocol, emissions trading is supplemental to domestic actions to achieve compliance. To promote GHG reductions to the greatest extent, it is recommended that there should be an unlimited use of any of the mechanisms to achieve compliance.

Emission Trading

In addition to CDM and JI, emissions trading can play a key role in reducing GHG emissions. Experience to date between some utilities of Annex B countries, shows that emissions trading can help meet emission objectives by lowering compliance costs and by giving a strong signal of the economic implications of an emissions objective through the cost of CO_2 permits (or CO_2 equivalent). Emissions trading can also help the players to make the right decisions and to select the best suitable investments favoring emissions reduction.

However, the definition of relevant principles, modalities, rules and guidelines, in particular for verification, reporting, and accountability for trading has to be defined in such-way that trading systems at all levels, national and international, must be compatible, transparent, open, credible, and at the lowest possible cost.

If properly designed, a national or international trading system will easily accommodate credits from other mechanisms, in particular those from JI and CDM as well as those deriving from carbon sequestration (see item on Fungibilty).

More specifically:

- Emission trading can be implemented in different ways: within a national industry sector, nationally involving some or all industrial sectors, and internationally. We suggest establishing as large an international trade mechanism as possible.
- International and domestic emissions trading systems should be compatible. Depending on local conditions, for instance, through interconnections or swaps, the international emissions trading system should be able to be combined with electricity agreements between utilities.
- If methodologies are to be designed for intersectorial trading, any market distortions should be avoided, and the benefits of a wider and wiser use of electricity must be recognized as a key contributing factor to compliance with the goals of the Climate Change Convention.
- Trading should be allowed at the company level, and the market should be ruled so as to develop as freely as possible, while being transparent and credible.

Other Important Items for Pra of the Flexible Mechanisms

In addition to the above-mentioned issues, baselines, additionality, monitoring, and verification, the E7 Initiative and its partners have gained experience with AIJ-projects and other activities, which highlight the following lessons:

- A stable political and economic outlook in the project site country facilitates project planning.
- Cooperation and collaboration with project site partners builds support for the mechanisms.
- All parties must agree with the methodology used to calculate the baselines and ensuing GHG reduction avoidances and credits.
- Visible understanding and support of the flexible instruments by all project partners, as shown by positions and activities at the COP, will facilitate the development of the required agreements.
- Commitment from all partners to all aspects of the project, including technical, financial and environmental, will facilitate the development of the required agreements.
- Close contacts between the investing party country and the project site country will facilitate project development.
- Projects should be adapted to local conditions; that is, project parameters, technology, etc. must be consistent with the skills, knowledge, and resource base as they exist in the project site country.
- Local development needs must be considered and facilitated.

actical Implementation

- Guidelines should provide for the registration and reporting of projects in situations where the projects are undertaken by international investors from more than one Annex I country.
- In the case of emissions reduction credit trading:
  - The source of emissions reduction credits (ERCs) must be acceptable to both the buyer and seller. Constraints as to the source of the ERCs may relate to the type of reductions producing the credits, e.g., energy efficiency initiatives, demand-side management, sequestration, etc., or the year of credit creation.
  - Ownership of the ERCs must be clear.
  - Currently, because of the small number of trades, the market price for ERCs is based on literature reviews and perceptions of a fair price. ERC price will reflect the risk associated with the trading process, the credibility of the reductions, the availability of documentation, etc.
- Certification of the ERCs is a key aspect to any trade and the certification requirements of both the buyer and seller should be defined well in advance of any trade.
- A simple and universal certification process will likely lower transaction costs and promote trades.
- Certification cost must be factored into the price of the ERCs. Small trades will have relatively higher transaction costs.
- Standardized contracts allow all parties to understand the terms of the sale in advance of the trade and can reduce transaction costs.
- Companies interested in participating in the ERC marketplace should have internal procedures to support the sale, purchase, and certification of ERCs.
- Well-adapted and simple institutional arrangements (such as certification auditor lists, or transaction management bodies) and procedures for tracking transactions should be implemented.

Conclusion

The E7 and its partners support the use of flexibility mechanisms to help reduce the emission of greenhouse gases. This paper has focused on the practical implementation of these mechanisms by proactively addressing some of the key issues surrounding them. We believe that the strength of the paper is bolstered by the fact that representatives from both developed and developing countries have joined together to endorse it. Our joint wish is that this paper will serve to further the progress toward implementing these mechanisms, adoption of which should occur at COP6, as envisioned by the Conference of Parties.

Table 2

Table 2 – Calculation of Baselines and GHG Emission Reductions for Energy Sector

Project Type	
A) Measures utilizing or replacing existing electric power or heat generation/transmission	• Fuel Change • Improvement of efficiency • Renewal of the facility (same output)
	• Reduction of loss of electric transmission or district heating network
B) Construction of new electric generating facility	Replacing a plant with another one of higher power and/or higher utilization factor
	Construction of new electric generating plant connected to the grid
	Construction of new power plants serving isolated villages (no grid connection)
	Cogeneration plant
C) Grid interconnection	Grid connection of isolated villages replacing local electric plant (e.g. diesel generators)

Projects

Parameters for Baseline/ Emissions Reduction Calculation	Notes
Baseline Parameters Carbon intensity before the implementation of the project **Emission Reduction** $(A_1 - A_2) \cdot C_2$ for electricity $(F_1 - F_2) \cdot H_2$ for heat	
Baseline Parameters Power transmission loss rate before the implementation of the project **Emission Reduction** $P_2 \cdot (T_1 - T_2) / (1 - T_1)$	
Baseline Parameters Carbon intensity of the replaced plant, average carbon intensity of all power plants on grid, generation output before the implementation of the project **Emission Reduction** $(A_1 - A_2) \cdot C_1 + (G_1 - A_2) \cdot (C_2 - C_1)$	Example: Combined Cycle gas turbine plant utilizing the steam turbine of the replaced oil/coal plant
Baseline Parameters Average carbon intensity of all power plants on grid before the implementation of the project **Emission Reduction** $(G_1 - A_2) \cdot C_2$	For a renewable plant with no emission $A_2 = 0$
Baseline Parameters Average carbon intensity of replaced fuel for basic services before project implementation **Emission Reduction** $1 \cdot N_2 + D \cdot (E_2 - B_2 \cdot N_2) - A_2 \cdot E_2$	The difference of consumption between the total value E_2, after project implementation, and the consumption $B_2 \cdot N_2$ (which would provide the equivalent basic service, such as lighting, of the replaced fuel) is for additional energy services as a consequence of economic development due to the electricity. For emissions reduction evaluation, these additional energy services would be treated if provided by a standard diesel system (oil fuel supplied) before the project's implementation.
Baseline Parameters Average carbon intensity of all power plants on grid and carbon intensity of the replaced boiler, before the implementation of the project **Emission Reduction** $(G_1 / (1 - T_2) - A_2) \cdot E_2 + (F_1 - F_2) \cdot H_2$	
Baseline Parameters Carbon intensity of local plant before the implementation of the project **Emission Reduction** $(A_1 - G_2 / (1 - T_2)) \cdot E_2$	

Table 2 (cont.) – Calculation of Baselines and GHG Emission Reductions for Energy

Project Type	
	Electrification through grid connection of non-electrified isolated villages
D) Use of untapped energy for heat production	• Geothermal • Flue gas heat recovery
E) Reduction of GHG leakage	• Reduction of leakage of gas transmission and distribution systems • Reduction of equipment leakage (e.g. SF6, HFC)
F) Measures on electrical end-uses	• Improvement of efficiency
G) Measures on thermal end-uses	• Reduction of heat demand (passive measures/ process improvement)
	• Replacing thermal end use with higher efficiency electrotechnologies
H) Afforestation, Reforestation, Deforestation (Forest Conservation), Land Use Change	

Sector Projects

Parameters for Baseline/ Emissions Reduction Calculation	Notes
Baseline Parameters Average carbon intensity of replaced fuel for basic services before project implementation **Emission Reduction** $I_1 \cdot N_2 + D \cdot (E_2 - B_2 \cdot N_2) - G_2 \cdot E_2 / (1 - T_2)$	
Baseline Parameters Carbon intensity of the replaced boiler before the implementation of the project **Emission Reduction** $(F_1 - F_2) \cdot H_2$	
Baseline Parameters GHG leakage before the implementation of the project **Emission Reduction** $L_1 - L_2$	
Baseline Parameters Annual electrical power consumption before the implementation of the project **Emission Reduction** $(E_1 - E_2) \cdot G_2 / (1 - T_2)$	The evaluation should consider the equivalence of service before and after the project implementation
Baseline Parameters Annual heat consumption before the implementation of the project **Emission Reduction** $(H_1 - H_2) \cdot F_2$	The evaluation should consider the equivalence of service before and after the project implementation The case of efficiency improvement of the boiler is provided in A)
Baseline Parameters Carbon intensity of the combustion process and annual heat consumption before the implementation of the project **Emission Reduction** $(H_1 \cdot F_1 - G_2 \cdot E_2 /(1 - T_2))$	The evaluation should consider the equivalence of service before and after the project implementation
Baseline Parameters CO_2 fixation due to Afforestation, Reforestation, Deforestation, Land Use Change-Measures **Emission Reduction** W2-W1	

Legend

A_1	Carbon intensity of the specific plant before project implementation (kg-C/kWh)
A_2	Carbon intensity of the plant after project implementation (kg-C/kWh)
B_2	Annual electric power consumption for each house after project implementation, in order to provide the equivalent basic services of F_1 fuel consumption (kWh/yr-house)
C_1	Annual electrical power generation of the specific plant before project implementation (kWh/yr)
C_2	Annual electrical power generation of the new project (kWh/yr)
D	Standard carbon intensity of a diesel (reference technology to be used for baseline evaluation for the electric output in excess of the basic services in isolated villages) (kg-C/kWh)
E_1	Annual electrical consumption of the end-use before project implementation (kWh)
E_2	Annual electrical consumption of the end-use after project implementation (kWh)
F_1	Carbon intensity of the specific heat plant before project implementation (kg-C/kJ)
F_2	Carbon intensity of heat plant after project implementation (kg-C/kJ)
G_1	Average carbon intensity of power plants on grid before project implementation, including import (kg-C/kWh)
G_2	Average carbon intensity of power plants on grid after project implementation, including import (kg-C/kWh)
H_1	Annual heat consumption before project implementation (kJ)
H_2	Annual heat consumption after project implementation (kJ)
I_1	Average carbon intensity for basic services of each house due to use of fossil fuel before project implementation (kg-C/yr-house)
L_1	Annual CO_2 equivalent emissions due to GHG leakage before project implementation (kg-C/yr)
L_2	Annual CO_2 equivalent emissions due to GHG leakage after project implementation (kg-C/yr)
N_2	Number of electrified houses after project implementation
P_2	Annual CO_2 emission of all plants connected to the grid after project implementation, including import (kg-C/yr)
T_1	Power transmission/distribution loss rate before project implementation (fraction, e.g. 0,06)
T_2	Power transmission/distribution loss rate after project implementation (fraction)
W1	Carbon fixation before project implementation (kg-C)
W2	Carbon fixation after project implementation (kg-C)

Type of monitoring system for carbon intensity of specific electric plant:

- fuel amount
- electrical output
- use standard value for carbon content of specific fuel provided by IPCC or in case of fuel which can change the characteristics, take periodical sampling and measurement of the content of carbon and its specific heat.

Type of monitoring system for carbon intensity of specific heat plant:

- fuel amount
- heat in output (flow and temperature difference)
- use standard value for carbon content of specific fuel provided by IPCC or in case of fuel which can change the characteristics, take periodical sampling and measurement of the content of carbon and its specific heat.

For further information please contact:

Secretariat
E7 Network of Expertise
for the Global Environment
1010 St. Catherine Street West
6th floor
Montréal (Québec) Canada
H3C 4S7

Tel.: (514) 392-8876
Fax: (514) 392-8900

Email: e7secretariat@hydro.qc.ca

Web: www.e7.org

4th quarter 2000