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Joint Implementation of Climate Change Measures

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Contents

1 Introduction

This paper discusses some of the issues that may arise in joint implementation of climate change measures under the United Nations Framework Convention for Climate Change (FCCC). The basic idea behind joint implementation is simple: one or more parties in one or more countries would contract with one or more parties in another country to implement a project (or, perhaps, modify a policy) for the purpose of reducing emissions of greenhouse gases (GHGs) in that country. The contracting parties would be able to seek credit for these emission reductions against their individual obligations for greenhouse gas emission reductions under the FCCC. The motivation or incentive for such contracting would be that the parties to the contract could lower their total costs of meeting these obligations by working together to take advantage of relatively low-cost abatement opportunities.

Most of the issues surrounding joint implementation have been aired extensively in recently prepared papers or papers now under preparation as background for the FCCC Conference of Parties' upcoming deliberations on, inter alia, criteria for joint implementation.[1] These papers examine the issues from a policy perspective. The present paper examines some of these issues from a "bottoms up", project-based perspective, based on experience gained under the pilot phase of the GEF. For this purpose, it draws heavily on experience with the preparation of two projects. Its objective is solely to illustrate, and thereby hopefully clarify, some project level considerations that may have implications for the choices between alternative policies governing joint implementation. Since these are project level issues, they also clearly arise in any other form of implementation as well. The paper considers, but does not propose or endorse specific solutions.

The plan of the paper is as follows. Section II briefly describes the two "case study" projects that provide a real context for subsequent discussion of the issues. One of these projects, ILUMEX, will demonstrate the use of high-efficiency lighting technology in two major Mexican cities. The other, Poland Coal-to-Gas Conversion, will demonstrate the establishment of institutional and financial mechanisms to encourage the conversion of coal fired boilers to gas in selected situations in which this would not otherwise be economical.

Section III examines four classes of issues that arise in the joint implementation context: (i) determination of the net abatement effect of a policy or project intervention; (ii) determination of prices of or compensation due for joint implementation projects; (iii) performance issues such as verification of abatement effects and handling of risk; and (iv) documentation and procedures. In examining these issues, the paper keeps in mind five criteria:[2]

- *efficiency:* whatever degree of abatement is obtained, good approaches to joint implementation should promote attainment of that degree of abatement at the lowest possible global expenditure of resources;
- *equity:* the distribution of gains from joint implementation should be fair;
- *effective:* joint implementation arrangements should be consonant with the attainment of agreed FCCC goals;

- *robust:* joint implementation arrangements should be sufficiently flexible to adjust as the provisions of the climate convention evolve;
- *practical:* joint implementation should be simple and transparent to arrange, administer, and monitor.

Section IV offers some concluding observations. It also raises some additional issues that do not arise in the projects examined in this paper but are nonetheless important joint implementation issues.

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[1] See, for example: H. Merkus, The Framework Convention on Climate Change: Some Thoughts on Joint Implementation, Ministry of Housing, Physical Planning and Environment, November 1992; and Tom Jones, Operational Criteria for Joint Implementation, Organization for Economic Cooperation and Development, OCDE/GD(93)88.

[2] The term "criteria" as used here is not to be confused with the term "criteria" as it is used in the FCCC. The FCCC contemplates operational criteria for joint implementation to be developed by the COP. As used here, the term means the general properties that a good system for joint implementation would possess.

2 A Brief Description of the Case Study Projects

Two projects, one in Mexico (ILUMEX) and one in Poland (Coal-to-Gas Conversion) provide a concrete context for examination of many of the issues that would arise in joint implementation projects. Both countries rank among the 15 largest GHG emitters in the world according to current estimates, due primarily to energy-system related emissions.[1] The energy systems in both are heavily dependent on fossil fuels. Over 98% of Mexico's commercial energy prodution is accounted for by fossil fuels, with oil accounting for over 80% of the total.[2] In Poland, fossil fuels account for over 99% of total commercial energy production, with coal acounting for over 96% of the total.[3] Estimated 1989 CO_2 emissions from industrial sources in Mexico and Poland (by far the predominant sources in both countries) were respectively about 320 million and 441 million tons.[4]

Mexico ILUMEX

ILUMEX will procure and place roughly 1.7 million compact fluorescent lamps over a two-year period in households in the cities of Guadalajara and Monterrey, two of Mexico's major urban areas. The procurement process will be based on a set of performance specifications developed specifically for the Mexican market that reflect the technical operating characteristics of the Mexican power system and the climates of the two demonstration cities. The procurement process will also involve testing of lamps against test specifications. The lamps will be distributed initially through the utility's existing network of local administrative offices. These are familiar to customers since the vast majority pay their electric bills in person at these locations.

CFL lamp sales stations will be established in each of the utility's local offices in the two project cities. Lamps will be offered at subsidized prices (efectively sharing some portion of the utility's projected savings with customers), promoted by an extensive advertizing and public education campaign. Customers will have the option to pay cash for the lamps, or pay over time, with their electricity bill, at a rate that is established to create a net positive cash flow to the customer. If these two options fail to generate enough demand for lamps, the utility stands ready to increase the subsidy to lamp purchases, and/or to pursue a neighborhood sales plan in which mobile sales vans would be sent to neighborhoods and a neighborhood sales force dispatched door-to-door.

A primary objective of the project, apart from demonstration of CFL technology, is to establish the capacity within the national utility to deliver demand side management resources over the long term. The project is structured to ensure that the original investment in the project will be recovered. This will enable the utility to extend demand side management programs to other regions and other technologies.

The total cost of the project is currently estimated at US$ 23.25 million, to be financed by a grant of US $ 10.0 million from the GET,

$10 million provided by the Government of Mexico, $ 3.0 million provided as joint cofinancing by the Kingdom of Norway, and $ 0.25 million of parallel cofinancing provided by USAID.

Poland Coal-to-Gas Conversion

The Poland Coal-to-Gas Conversion (CTG) Project is essentially an umbrella project. It has many features in common with development finance institution projects which establish lines of credit. GEF funds would be administered by the Polish Bank for Environmental Protection (Bank Ochrony Srodowiska, SA). The project has two components:

- *an investment component (US$43.5 million), covering the conversion to gas-firing of a number of coal-fired boiler houses.* The conversion technologies selected would include a possible mix of small-packaged gas-fired cogeneration schemes and gas-fired high efficiency condensing boilers. The final mix of conversion technologies will depend on Polish priorities. This mix will affect the number of individual subprojects because of the large differences in costs of the two technologies. Each individual project design will consider a number of elements: (i) supplementary end-user energy efficiency and conservation measures; (ii) connection to the fuel network; and (iii) intergrated monitoring systems; and
- a Technical Assistance Component (US$1.3 million), covering project administration, management, consultancy services, training, and monitoring system.

At the time of appraisal of the CTG project by the GEF, two pilot investment subprojects had been identified and associated engineering prefeasibility studies conducted. In one subproject, a local district heating company boiler in the old city center of Krakow will be replaced by a gas-fired condensing boiler. In the other, a new gas-fired boilerhouse will replace two coal fired boilerhouses, and will consist of a combination of one baseload cogeneration unit, steam boilers and several peaking hot water boiler units. The power generated will be sold to the grid.

The total cost of the overall project is estimated at US$ 44.8 million, financed by a GEF grant of US$ 25.0, US$ 18.8 million provided by Poland, and approximately US$ 1.0 million of grant cofinancing provided by the Kingdom of Norway. The two pilot investment sub-projects described in the preceding paragraph are estimated to cost US$ 415 thousand and US $ 5,296 thousand respectively, of which the GEF-financed amounts would be US$ 133 thousand and US$ 4,159 thousand respectively.

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[1] Ibid.
[2] World Resources, 1992-93, World Resources Institute (New York: Oxford University Press) 1992.
[3] Ibid.-
[4] Ibid.

3 Basic Joint Implementation Project Design and Measurement Issues

There are four classes of issues that arise in designing joint implementation projects: (i) determination of the net abatement effect; (ii) establishing the price or compensation due in payment for a joint implementation project; (iii) performance issues such as verification and the treatment of risk; and (iv) procedural issues, including the nature of contracts and records. These are discussed in the following paragraphs, drawing on experience gained through the ILUMEX and CTG projects.

Determination of the Net Abatement Effect

The science of global warming implies that global accumulations of GHGs are responsible for anthropogenic climate change. This has clear implications for the way in which the abatement effects of GHG interventions should be measured. Strictly speaking, what we would like to know is what effect each and every intervention (policy and/or project), individually and collectively, will have on future global emissions and accumulations of GHGs. If, for example, country x proposed to convert boilers from oil to gas based on imports of gas from country y, we would want to know not only about the reduced emissions due to fuel substitution in country x, but also about possible increased emissions due to increased fuel production and transport in country y. To consider another example, suppose that country z supported the placement of high efficiency light bulbs in its own country and used the resource savings generated by lower lighting demand to subsidize the purchase of power, we would want to know about the emissions generated by subsidized power prices as well as the emissions reductions associated with the use of more efficient lighting. We would also want to know whether the production and distribution of CFLs generated, directly or indirectly, significant additional GHG emissions.

The conceptual principles of proper determination of net abatement effect are thus absolutely clear: the net abatement effect of an intervention (policy or project) is the difference between the time path of global emissions with the project and the time path of global emissions without the project.

From the perspective of the FCCC, the relevant unit of analysis presumably is national emissions since that is the reporting/planning entity defined by the Convention. It has been suggested that net abatement effects should be measured against targets or baselines established in national studies/plans. This would require that plans contain emissions estimates/projections at the project intervention level of detail. To determine the net abatement effect of a proposed joint implementation project under this approach, the "without project" plans of all project participants' countries would have to be examined and the effect of the project on "without project" emission trajectories would have to be estimated.

As a practical matter, it is currently almost impossible to quantify baselines or emission reductions at very specific geographic, sectoral, technological or temporal levels. In

any event, data do not exist for Poland and Mexico which would allow us to define a meaningful detailed national baseline projection.

Another suggestion is that a somewhat less quantitative "rule of reason" standard be applied.[1] This approach would give credit for emissions reductions achieved by projects provided these projects were also believed to stand a "reasonable chance" of reducing global emissions. The reasonable chance standard would be defined in terms of certain criteria. For example, it could be stipulated that projects implemented in an otherwise favorable environment for GHG emissions abatement (e.g., no energy subsidies, demonstrated national commitment to solution of local environmental problems, emissions inventory and national plan that meets FCCC requirements) presumptively stand a reasonable chance of reducing global emissions. The amount of the net abatement due to the project, under this approach, would be based on calculations against a "reasonable" project-specific baseline. While materially simpler than estimating abatement effects against projected national emissions baselines, the task is still daunting.[2]

The difficulties are well-illustrated by the ILUMEX and CTG projects. The ILUMEX project demonstrates a technology which, provided that power tariffs are adjusted to and maintained at reasonable levels, could be expected to penetrate the Mexican market whether or not a demonstration project is mounted.[3] The project also provides for the creation of a revolving fund and institutional infrastructure that will be used to expand the reach (both geographic and technological) of Mexico's energy efficiency initiatives.

Viewed in these terms, the ILUMEX project will affect Mexico's future emissions path in a number of ways. First, it will, other things being equal, speed up the diffusion of efficient lighting technology. Lamps will be replaced not only based on lamp procured from utility-established sales outlets, but also as other households buy lamps through other channels. Lamps will be replaced not only in the two cities participating in the project, but in other cities as well, based on information and experience generated by the project. These "information effects" can be substantial. In what has been termed the "free driver" effect, Mills[4] reports that experience in several countries in Europe shows that utility-run CFL distribution programs appear to stimulate retail purchases of CFLs through ordinary commercial channels. According to Mills, the Swedish lamp manufacturers' trade organization estimates that 75,000 lamps distributed through a rebate check program also resulted in the purchase of 41,000 additional lamps under ordinary commercial terms. In the Netherlands, one utility-run program that resulted in direct sales of 25,000 lamps reportedly spurred an additional 50,000 indirect sales; another program generated 60,000 direct sales and 40,000 indirect sales. In Switzerland, program placement of 7,000 lamps reportedly resulted in sales through normal channels of an additional 70,000 units.

Second, the revolving fund and the creation of a DSM entity in the utility company will directly and indirectly spur further diffusion of efficient lighting technology, as well as other energy efficient technologies. The emissions reductions associated with the continuing process of innovation and diffusion could also properly be attributed to the ILUMEX project.

The ILUMEX project should, in principle, be credited with all of these effects. Failure to do so would reduce the attractiveness of investing in such projects and, other things being equal, would tend to depress investment in them below optimum levels. In practice, however, it is scientifically impossible to estimate all of these effects with any degree of confidence. While there is a vast theoretical and empirical literature on the determinants of the rates of innovation and diffusion of new technologies, the current state of the art does not permit reliable calculations/predictions of the effects of a demonstration project like that being mounted. Nor, unless very carefully controlled experiments are designed, does it permit accurate ex post determination of these effects. The procedure followed in the

Item	Value	Source
Incandescent Bulb (watts)	67.2	Market survey
CFL replacement lamp (watts)	16.8	Calculated based on 4/1 Factor
Energy Savings/Lamp (watts)	50.4	Calculated
Number of Lamps Replaced	1,500,000	Project assumption
Daily Usage of Lamps (hours)	4.0	Assumption/market survey
Energy loss factor (%)	18.0	Technical data
Energy generation savings (GWH/year)	134.6	Calculated
CO^2 emission factor (kg/kwh)	0.75	Assumption
Methane emission factor (kg/kwh)	1.61×10^{-3}	Assumption
CO^2 emission reductions (kg/year)	101.0×10^6	Calculated
Methane emission reductions (kg/year)	216.7×10^3	Calculated
Methane global warming potential	20.0	
Net abatement effect (kg CO2/yr)	105.3×10^6	Calculated

Figure 1: Mexico ILUMEX Net Abatement Effect

illustrative calculations of the net abatement effect of the ILUMEX project, therefore, takes a much narrower view. The calculation is summarized in Figure 1. As can be seen, the calculation basically involves four groups of factors: (i) factors relating to average wattage reduced per replacement lamp; (ii) number of lamps replaced; (iii) average usage of lamps; and (iv) factors relating to GHG emissions per unit of lamp usage. Based on these measurements/assumptions, it was estimated that annual emissions of CO_2 would be reduced by 101 thousand tons, and that annual emissions of methane would be reduced by 217 tons. No estimate is made for any indirect emissions or abatement of GHGs.

While this procedure underestimates the net abatement effect of the project on account of the "free driver", organizational learning, and revolving fund aspects of the project, it is likely to yield an overestimate of the abatement achieved by the replacement of the lamps per se for two reasons. First, CFLs lower the cost of lighting services. As a result, households may (i) choose to burn lamps longer each day, (ii) substitute lamps with greater light output for lamps with lower light output, and (iii) increase the number of sockets in the household. Each of these behavioral adjustments would tend to reduce the actual impact of the bulbs placed by the project estimated as described above. Second, the per kilowatt hour saved emission factor utilized is probably also too high for the latter years of the project. Mexico is likely, for other reasons, to be shifting its capacity mix and altering its dispatching in a manner that would tend to reduce the marginal emission reduction associated with CFLs.

On balance, however, the omitted "free driver" and other factors (e.g., DSM capacity-building are likely to far outweigh factors that would tend to increase emissions per lamp replaced).[5] The net effect estimated above is thus likely to be a substantial underestimate of the contribution of the project to GHG abatement.

The effect of the CTG project on likely future emissions trajectories is qualitatively different from the effect of the ILUMEX project in that the boiler conversions/technology modifications to be financed under this project would not occur under present economic circumstances. In principle, thus, there are no induced or accelerated boiler conversions that should be attributed to this project.[6] There are, however, some organizational learning and information externalities associated with the project that should lower the cost of at least certain types of future GHG abatement projects and thus contribute to additional GHG abatement.

The CTG calculation, like the ILUMEX calculation, is fundamentally an engineering calculation based on three factors: (i) heat output; (ii) heat input; and (iii) emissions per unit of heat input. Data were obtained from engineering prefeasibility studies which, rather than investigating straight substitution of gas for coal, also examined some other aspects of the energy system to optimize the balance between heat supply and efficiency of

	Value	Source
Facility I		
Energy demand (MWh/yr)	2300	Prefeasibility study
Coal demand (MWh/yr)	2949	Prefeasibility study
Coal CO2 emission factor (tons/MWh)	0.33	Assumption
CO2 emissions (tons/year)	977	Calculated
Gas demand (MWh/yr)	2421	Prefeasibility study
Gas CO2 emission factor (tons/MWh)	0.19	Assumption
CO2 emissions (tons/year)	483	Calculated
CO2 emissions reduction (tons/year)	494	Calculated
Facility II		
Energy demand (MWh/yr)	12770	Prefeasibility study
Coal demand (MWh/year)	16372	Prefeasibility study
Coal CO2 emission factor (tons/MWh)	0.33	Assumption
CO2 emissions (tons/year)	8100	Calculated
Energy demand (MWh/yr)	12770	Prefeasibility study
Energy demand for cogeneration unit (MWh/yr)	5500	Prefeasibility study
Gas demand (MWh/yr)	23138	Prefeasibility study
Gas CO2 emissions factor (tons/MWh)	0.20	Assumption
CO2 emissions (tons/year)	4615	Calculated
CO2 emissions difference (tons/year)	807	Calculated
CO2 reduction from power production (tons/yr)	5358	Calculated
CO2 emissions reduction (tons/yr)	6165	Calculated

Figure 2: Poland CTG Net Abatement Effect

heat transfer/use. The calculation is summarized in Figure 2. As can be seen, it is estimated that annual emission reductions of 494 and 6,165 tons of CO2 would be achieved respectively by the two suprojects each year.

Despite the engineering simplifications, the net abatement effects of the subprojects are probably well-approximated by these calculations. However, although conceptually clearer than the calculation for the ILUMEX project discussed above, the CTG calculation also raises serious issues. The most difficult of these is identifying what the two boiler facility operators would do absent the project. The above calculations assume that they would replace old boilers after 30 years in service with new coal-fired boilers, and re-engineer the installation to take advantage of privately profitable energy efficiency improvements. These assumptions are based on calculations which suggest that re-engineering and replacement would be optimal from the facility operators' standpoints. Replacing boilers with new, more efficient downsized (to take advantage of energy efficiency improvements) would result in substantial reductions of CO_2 emissions. At Facility I, CO_2 emissions would be reduced by an estimated 716 tpy (i.e., from 1,693 tpy to 977 tpy); at Facility II, the reductions would be an estimated 2,681 tpy (i.e., from 8,104 tpy to 5,422 tpy). If, instead, it were assumed that, absent the project, the facility operators would continue to operate their existing boilers, the emissions reductions attributable to the project would be much larger.

Determination of Prices of Joint Implementation Projects

A variety of approaches have been put forward for determining the prices of or compensation due for the emission reduction produced by a joint implementation project. One approach would be to leave this determination to project participants through negotiations. The distribution of gains obtained thusly would be presumptively fair, although the negotiation process to arrive at it may be very costly. Still another approach would be to establish a market. This could be done by setting up a market maker prepared to buy or sell emission reductions at stated prices, via an auction of projects, or independently by any entity offering to (say) buy emission reduction projects. The distribution of gains from market or quasi-market arrangements would depend on elasticities of supply and demand in the

market, as does the distribution of gains from trade of conventional goods and services.

These points are well-illustrated in terms of GEF experience with the ILUMEX and CTG projects. It was impractical to hold mock negotiations concerning pricing and shares of the net abatement achieved by the projects, or to simulate the workings of a market. It is, however, possible to say something on first principles about the some of the determinants of the range of probable outcomes of such negotiations were they possible to hold. From the investor's standpoint, it would make little sense to pay more for an emission reduction than would be obtained through implementation of an equivalent domestic GHG abatement project or through equivalent alternative joint implementation opportunities. These alternatives define an upper bound, "reservation" price that the investor would be willing to pay per unit of emission reduction. From the implementing entity's perspective, it would make little sense to accept as compensation less than the marginal cost,[7] considering the best alternative project, of producing GHG emission reductions via the project. This alternative defines a lower bound reservation price that the implementing entity would be willing to accept.

Price expectations will also play a role in determining reservation prices of implementors and investors. If prices of equivalent emission reductions projects generally are expected to increase, implementors may be unwilling to accept a price based on today's marginal costs. Similarly, investors may be willing to pay more than what they believe to be the current "going" price.

The "equivalent" qualifier in the two preceding paragraphs is important because GHG abatement projects typically involve a number of attributes which affect their potential value to implementors and investors. These include such important project factors as the institutional capacity of the implementor, reliability of the technology, complexity of the project, arrangements for dealing with contingencies, and reputations of the participants. Non-project-specific attributes may also be important. Where nations are involved, international relations considerations may arise. Or, an investor might perceive some longer-term market advantage unrelated to GHG abatement considerations to a joint implementation arrangement and thus be willing to pay more than would be indicated by cost of other GHG abatement options. An implementor might perceive some macroeconomic advantage (e.g., stimulation of employment and domestic output) associated with large-scale implementation of GHG abatement projects and thus be willing to accept less than marginal cost.

These considerations suggest that the negotiated price of an emission reduction produced by any individual joint implementation project could end up at almost any level. Calculations presented in the following paragraphs based on specific reference alternatives for investors and implementors provide at best a very rough guide to the possible range of outcomes. It is important to keep this caveat in mind.

Investors' Reservation Prices. In the present example, on the investors' side, Norway's marginal cost of abating GHG emissions through domestically-implemented measures is believed to be relatively high. It has been estimated that stabilizing emissions at their 1989 levels in the year 2000 would entail an marginal cost in the year 2000 of about $180 per ton of CO_2. Discounted back to 1993 at a 7 percent social discount rate,[8] this implies an marginal cost in 1993 of about US$ 112 per ton. On purely GHG abatement grounds, there would be no reason for Norway to pay any more than this for a CO_2 emission reductions. In fact, its willingness to pay would probably be somewhat lower than this due to alternative possibilities for joint implementation with other OECD and non-OECD countries. There are numerous untapped opportunities for abatement at less that US$ 100/ton of CO_2 equivalent. Still another, somewhat lower benchmark of willingness to pay is provided by the CO_2 tax which Norway presently levies on fossil fuel

Item	Value	Source
Real Social Discount Rate (%)	10	Assumption
Real Utility Discount Rate (%)	12	Utility cost of capital
Real Private Discount Rate (%)	24	Credit card real interest rates
CFL life (hours)	9000	Assumption
Incandescent life (hours)	750	Assumption
Daily usage (hours)	4	Market survey
Incandescent wattage (watts)	67.2	Market survey
CFL wattage (watts)	16.8	Calculated at 4/1
CFL Cost (US $/lamp)	$10.00	Assumed
Incandescent cost (US $/bulb)	$0.75	Assumed
ILUMEX program costs (US $/lamp)	$1.69	Estimated
Incremental annual cost/lamp @ 10%	-$2.88	Calculated
Incremental annual cost/lamp @ 12%	-$3.50	Calculated
Incremental annual cost/lamp @ 24%	-$3.61	Calculated
Incremental annual cost/ton CO_2 @ 10%	-$0.041	Calculated
Incremental annual cost/ton CO_2 @ 12%	-$0.050	Calculated
Incremental annual cost/ton CO_2 @ 24%	-$0.051	Calculated

Figure 3: Mexico ILUMEX Conventional Estimate of Marginal Cost

combustion. This tax is roughly equivalent to US $ 45 per ton of CO_2.

Implementors' Reservation Prices. On the implementors' side, as noted above, one benchmark reservation price is provided by the marginal cost of GHG abatement via the project. It is worthwhile spending some time discussing this benchmark since it also figures prominently in discussions of other methods for price determination (e.g., price set administratively by some international body) and in discussions of the operations of multilateral funding mechanisms such as the GEF and the financial mechanism of the FCCC.

The principles of determination of marginal cost, like the principles of determination of net abatement effects, are relatively clear. The difference between the least cost of an activity/project/policy with and without a GHG emissions constraint imposed is the marginal cost of GHG emissions control.[9] In calculating costs with and without the emissions constraint, any other direct or "spillover" benefits associated with the emissions constraint that would accrue to the project host country should be deducted.

The application of these principles in practice raises some interesting problems. Conventionally calculated, the marginal costs of the ILUMEX project are negative. That is why the project is designated, for GEF purposes, as a Type I Project. The details of the conventional calculation are shown in Figure 3. Note that marginal costs are negative by this calculation, ranging between -$0.04 and -$0.05 per ton of CO2 equivalent reduced depending upon the discount rate, even in the absence of any attempt to adjust for locally accruing benefits such as reductions in concentrations of suspended particulates and sulfur dioxide.

If these calculations are even approximately accurate, CFLs should immediately replace incandescent bulbs in a wide variety of applications on a pure cost-effectiveness basis, without regard for global and local external benefits. In fact, the process of diffusion of CFL technology will take time for a number of reasons. Foremost, consumers need to become informed about the cost-savings they can achieve with CFLs and the quality and reliability of the product. Someone has to produce and disseminate this information. This requires resources. For many products, particularly products where brand names are important, manufacturers will provide this information through advertising. For products like light bulbs, where brand name is not very important, however, manufacturers have little incentive to advertise. By the same token, utilities, which derive their income from sales of power on a cost-plus basis, also have little or not incentive to help consumers acquire information about CFLs.

There frequently are additional factors in developing countries that may slow the

diffusion of CFL technology. CFLs may not perform as expected under developing country power supply conditions. Many consumers may find the initial purchase price prohibitive. In many countries, highly subsidized power tariffs blunt incentives to economize on power usage. In many of these same countries, the power sector is under public ownership and management, and is heavily dependent on the national budget. This also tends to blunt incentives to economize.

The process of diffusion of the technology is essentially a process of overcoming these informational and institutional barriers. The ILUMEX project can be expected to accelerate the diffusion of CFL technology in residential applications by overcoming some of these barriers. On this interpretation of the project, marginal costs would be positive. The basic idea behind this interpretation is illustrated in Figure 4. This figure shows hypothetical stylized "with" and "without" demonstration project emission paths associated with compact fluorescent lamp penetration of the market. "Without" project diffusion is slower (and perhaps the ultimate penetration of the market is less deep) due to the effects of information externalities, possible capital market constraints, and perhaps other factors as well. The vertical distance between the paths is the abatement effect achieved by the project at any point in time, and is thus the marginal contribution of the project to GHG abatement.[10]

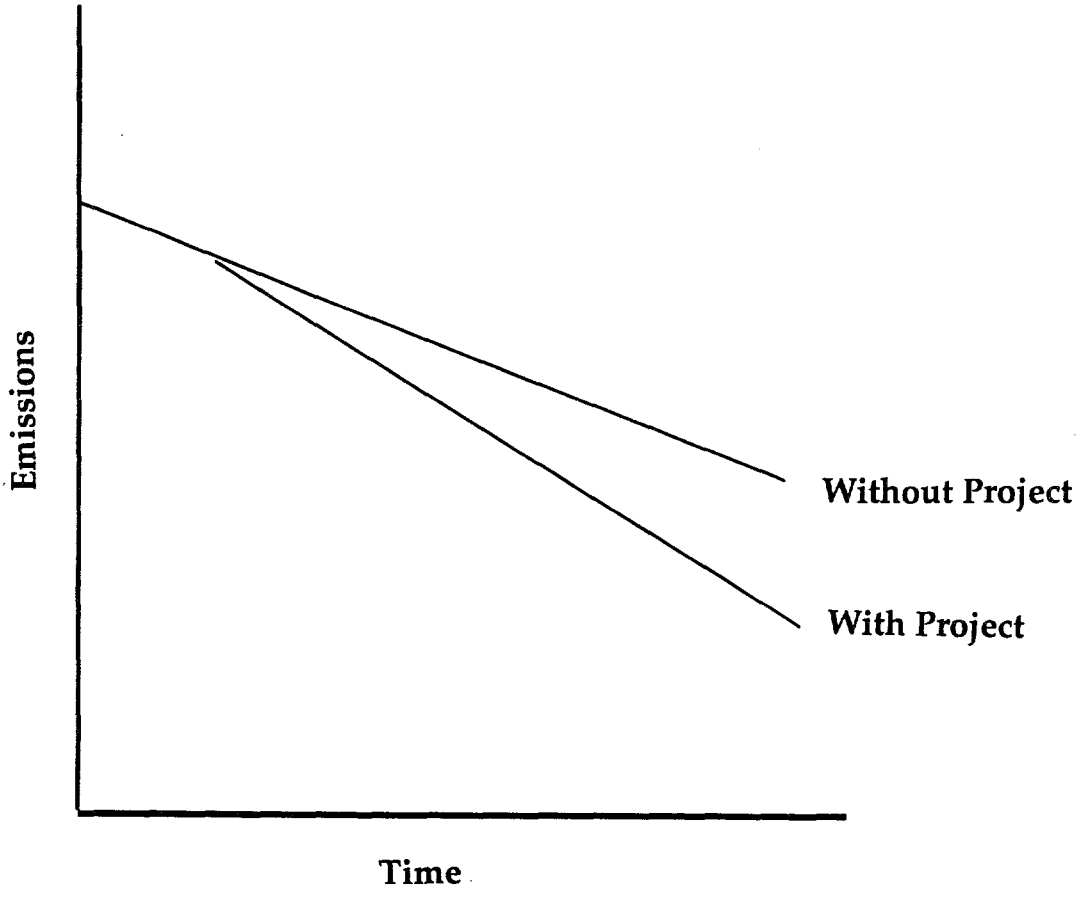

Figure 4: Effect of Project on Emissions Caused by Residential Lighting

On this interpretation, the gross (of any spillover local benefits) marginal costs of the project would be positive, and would be equal -- roughly -- to the total cost of the project, or US $ 23.25 million in the ILUMEX case. Net marginal costs would be these costs less any benefits received by Mexico. The majority of these benefits assume one of two forms. First are the benefits associated with the breaking of informational and institutional barriers to efficient lighting technology. These are measured by the value of the advance (i.e., bringing closer to the present) of the time stream of resource savings that is caused by the project. Second are the benefits associated with local environmental improvements that come about as a consequence of the project (e.g. lower concentrations of suspended particulate matter).

As a practical matter, the methodology for estimating these latter benefits is controversial, involving calculations of the value of reduced morbidity and mortality, increased productivity, and enhanced environmental amenities. The data required for these calculations is sorely lacking in developing countries. With regard to the benefits associated with bringing resource savings closer to the present, one might for purposes of making a rough calculation assume conservatively (and in a manner that is logically consistent with procedure used above to calculate the net abatement effect of the project) that the effect of the project is to advance the realization of savings associated with lamps placed by the project by one year. Under this assumption, the present value of benefits associated with advancing the time stream of benefits range between US$ 5.7 million and US$ 9.4 million, depending upon the discount rate, as shown in Figure 5.

It should be noted that this project rationale does not provide a justification for proliferation of projects that have negative marginal costs as conventionally measured. Any reasonable methodology would conclude that the marginal effect on the diffusion path of a second demonstration project is likely to be much smaller than the effects of a first project, or perhaps even negligible. That is, the marginal cost of accelerating diffusion are likely to rise sharply after the first demonstration project. This will tend to make investment in successive projects progressively less appealing on a marginal cost basis.

Discount Rate	Benefits
10 Percent	US$ 5.7 million
12 Percent	US$ 6.5 million
24 Percent	US$ 9.4 million

Figure 5: Benefits to Mexico of Accelerating Diffusion By One Year

In sum, the above considerations suggest a negative marginal cost of the ILUMEX project on the conventional marginal cost interpretation, and a positive marginal cost of approximately the total cost of the project (US $ 23.25 million), less some undetermined and perhaps undeterminable deduction for benefits accruing to Mexico in virtue of the advance in time of resource savings, other local environmental externalities, informational externalities that accrue to Mexico, and, of course, the future climate change damages prevented or postponed. As a practical matter, given the current state of the art, it is probably infeasible to do anything other than treat the total less an approximate value for the advance in time of resource savings as a rough, albeit high, estimate of marginal cost. On this reasoning, an appropriate reservation price or compensation for the emission reduction on a present value marginal cost basis would be roughly on the order of US $ 13 million to US $ 18 million, or on an annualized basis roughly US$ 30 to US$ 33 per ton of CO_2-equivalent reduced.

The Government of Mexico recognizes that the project will confer benefits on Mexico and, therefore, has agreed to finance $10.0 million of project costs. If this were taken as a rough estimate of domestic benefits, marginal cost of the project would be $13.25 million. This latter figure is the figure being used by the GEF as its estimate of project marginal cost.

In the case of the CTG project, there clearly are positive marginal costs. As noted above, operators of small boiler facilities would not convert to gas under the present incentive structure. The CTG project estimates marginal

Item	Value
Facility I	
Average Annual Cash Flows (US $ '000)	
New Coal-Fired Boiler	46
New Gas-Fired Boiler	34
Incremental Operating Costs (Savings)	- 12
Investment Costs Present Value @ 25% (US$ '000)	
New Coal-Fired Boiler	235
New Gas-Fired Boiler	415
Incremental Investment Costs (Savings)	180
Service Life (years)	17
Internal Rate of Return (percent)	1.4%
Capital Subsidy Required to Achieve 25% IRR (US$ '000)	133
CO_2 Emissions Reduction (TPY)	494
Incremental Cost ($/Ton)	33
Facility II	
Average Annual Cash Flows (US$ '000)	
New Coal-Fired Boiler	297
New Gas-Fired Boiler/Cogen (net)	296
Incremental Operating Cost (Savings)	-1
Investment Costs Present Value @ 25% (US$ '000)	
New Coal-Fired Boiler	1134
New Gas-Fired Boiler/Cogen	5236
Incremental Investment Cost (Savings)	4162
Service Life (years)	17
Internal Rate of Return (percent)	0
Capital Subsidy Required to Achieve 25% IRR (US$ '000)	4159
CO_2 Emission Reduction (TPY)	6165
Incremental Cost ($/Ton)	84

Figure 6: Poland Gas-to-Coal Subproject Marginal Costs

cost as the capital subsidy required to bring the rate of return on boiler conversion up to the facility operator's required rate of return. The calculations for the two subprojects that have been identified are shown in Figure 6. Marginal cost on an annualized per ton basis for Facilities I and II respectively are about US$ 33 and US$ 84.

This calculation raises two serious issues. First, as noted above (see paragraph 29), there is some ambiguity about the appropriate "without project" baseline. If continued use of old boilers were the baseline, incremental CO_2 reductions would be somewhat greater. Marginal investment costs and marginal operating cost savings would also be larger. The net result, however, would be an marginal cost per ton of CO_2-equivalent reduced that is much lower.

Another serious difficulty in these calculations is estimating required internal rates of return on some objective basis. An estimate of 25 percent is used in the calculations shown in the figure. Lower rates would result in lower estimates of marginal cost. The conceptually correct basis is the cost of capital to the facility operator. In macroeconomically stable environments with well-functioning capital markets, this is fairly straightforward to estimate. In economies undergoing upheaval, where posted interest rates bear little relationship to the true cost of capital resources and where all kinds of quantitative restrictions on lending/borrowing may apply, inevitable elements of judgment and ambiguity enter the calculation.

In principle, two further adjustments should be made to the costs calculated in Figure 6. First, some portion of the other costs of the project that are not directly attributable to these two subprojects are nonetheless in some sense caused by them. These costs should be added to the capital subsidies calculated in the figure. Second, as was the case in ILUMEX, these subprojects will produce local benefits that are properly deductible.

Pollutant	Units	Level
SO_2	$/ton	73
Flyash	$/ton	36
NO_x	$/ton	73

Figure 7: Emission Fees Levied in Poland

Poland levies a fee on emissions of selected air pollutants emanating from combustion sources. These fees are as shown in Figure 7. The calculation of marginal costs summarized in Figure 6 include (in operating cost savings) reductions in emissions fees associated with these pollutants. To the extent that these fees represent a reasonable estimate of the incremental benefits Poland derives from control of local air pollution, the calculation thus already includes a rough allowance for this type of domestic benefit.[11] There are probably also other local benefits (e.g., organizational learning), however, for which no allowance has been made.

To sum up, the above considerations concerning (i) Norway's domestic costs of implementing GHG abatement measures and (ii) marginal costs to Mexico and Poland of implementing the GHG abatement measures suggest a very wide range of possible joint implementation project price outcomes in the two cases considered here, ranging from about US$ 30/ton CO_2-equivalent to as much as US$ 100/ton CO_2-equivalent or more. It must be remembered, moreover, that the prices actually established through negotiations could lie outside of this range. This could happen due to other factors, some of which are discussed above, that could be important to either the implementor or the investor.

Performance Issues

The calculations of net abatement effects summarized above unavoidably are based on a number of assumptions. It is thus quite likely that, even within a relatively simple framework for accounting for net abatement, estimates made prior to project implementation will turn out to be wrong. Some mechanism for verification is thus clearly required. Moreover, as in any contractual relationship, a proper incentive framework requires that there be an agreed upon means to determine whether all parties have discharged their obligations properly.

Both projects considered here have a verification procedure built in. In the ILUMEX project, a number of different dimensions of project performance are to be monitored. These include annual electricity savings attributable to CFLs installed under the project during the first year of operation, net energy savings and critical period load reductions directly attributable to the project, changes in utilization of fixtures with CFLs installed under the project, effect of the project on sales of CFLs by retail outlets outside the project, effectiveness of the publicity and sales promotion strategies in creating awareness and stimulating sales of CFLs, and reductions of emissions of pollution from power plants attributable to the project. In the CTG project, each individual subproject financed by the facility will include pre and post conversion calculations and measurement of emissions of greenhouse gases and other air pollutants.

There are several different kinds of risks that are common to project investments, whatever their purpose. First, there is the risk that one or more of the participants in the project will fail to discharge their obligations. The best way to ensure that this does not happen is to structure the agreement between the parties in such a fashion that, at each point during the implementation of the project, all parties have an incentive to perform as agreed. One way of accomplishing this insofar as the implementor of the project is concerned is to require, in general, that the implementor retain an ownership stake in the project during its initial implementation. If the project is successful, this creates an asset that subsequently could be sold or retained, as the implementor prefers.

Many projects will depend on development of new institutions, new markets, and/or adaptation of relatively new technologies to new environments. Both the ILUMEX and the CTG projects have these features. In the case of ILUMEX, there are risks that CFE will not be able to place all of the bulbs, or only be able to do so at substantially higher cost than envisioned in the project design. There are further risks that CFLs will fail under Mexican power system conditions. In the case of CTG, risks include delays in obtaining local financing for the project and difficulties in identifying suitable subprojects for support. While the project designs address these risks adequately, there can be no absolute assurance

that these other problems will not arise. The result could be materially smaller net abatement effects and/or significantly higher project costs.

As with pricing issues, arrangements for handling project risks would probably best be left to the contracting parties. One can envision a wide variety of possible arrangements, ranging from requiring only "best efforts" from an implementor (but otherwise holding the implementor harmless for partial or complete failure of the project) to requiring performance-to-specification and a schedule of penalties for failure to perform. As noted above, the way in which risks are handled will also have a bearing on the pricing of the emission reductions produced by a joint implementation project.

Whatever arrangements are made between contracting parties with respect to risk, the investors will necessarily bear the ultimate risk associated with failure to meet obligations under the FCCC or other cognizant regulatory authorities. There are a number of strategies available for coping with this risk. Countries might, for example, plan to abate (or contract for the abatement of) emissions by more than the required amount, using the cushion as insurance against the failure of some projects. Trade provides another route for dealing with this risk. An investor with a serendipitous or intentional surplus could sell or rent to a party needing additional credit to meet its obligations. It is probable that forward and options transactions would emerge as well.

Still another way to reduce risk would be to invest in a portfolio of projects. This could be done individually or through a project fund like the GEF. In the present case, the CTG project, which will fund a number of subprojects, diversifies against risk associated with individual facility subprojects, although it does not address the risks associated with the possible failure of an implementor or a rather narrow class of technologies.

The risks described above are risks that individual implementors and investors face in individual projects. This does not, it should be stressed, necessarily translate into risks at the global level. Provided the legal and institutional arrangements are structured satisfactorily so as not to provide an systematic incentive to project failure, the global portfolio of all projects would be expected to perform on average about as expected. This is because projects that fail to live up to expectations would tend to be balanced by project that exceed expectations.[12]

Procedural/Documentation Issues

The approach taken in preparation of illustrative legal instruments for joint implementation is modeled on an investment project syndication. This approach is taken for two reasons. First, it builds on approaches that have been taken to cofinancing of GHG abatement projects during the pilot phase of the GEF, and arrangements negotiated by power producers to procure carbon sequestration services in other countries. Second, it recognizes that the FCCC is not at present sufficiently structured to support the development of a full-fledged market based approach to global GHG abatement. The absence of global emissions limits and timetables and standard measurement protocols precludes the definition of a standard commodity or instrument that could be traded.

There would be three basic documents under the syndication approach. The first would be a Project Placement Memorandum. A draft example of this document for the ILUMEX project is contained in Annex B of this paper. This document would offer a specified investment opportunity to selected potential investors on stated terms and conditions. In particular, it would contain (i) a detailed technical description of the project, including a quantitative description of the estimated net GHG abatement to be achieved by the project;[13] (ii) the price or cost at which shares in the project are being offered; (iii) the general terms and conditions under which the offering is made; and (iv) representations and disclaimers.

The Project Placement Memorandum would be the vehicle for soliciting investment, establishing the outlines of the agreement

between the cooperating parties, and for soliciting a determination under the FCCC or under various national laws and regulation of the eligibility of the project for abatement credit. The degree of technical detail would be sufficient to permit relevant national regulatory bodies and/or the relevant body under the FCCC to determine, subject to verification, the presumptive net abatement effect (i.e., the net reduction in global GHG emissions) of the project.

Given the uncertainty about both the degree of abatement that will actually be achieved by the project and the amount of abatement that will be allowed by the responsible regulatory authorities, the investment opportunity would be stated, in both the Project Placement Memorandum and the Legal Agreement in terms of shares of an unknown total, to be determined by the responsible regulatory authority.

The second document would be a Legal Agreement between the various participants in the investment project. A draft example of this document for the ILUMEX project is contained in Annex C of this paper. This document would spell out the rights and responsibilities of each project participant, the remedies available for nonperformance or other forms of project failure, as well as the shares of net abatement due to each. This document would be the basis for submission to regulatory authorities for determination of credits, subject to verification, against the project participants' individual abatement responsibilities.

The Project Placement Memorandum and Legal Agreement would both provide for the subsequent transfer of investors' interests to other parties. This would facilitate the development of a secondary market in project participations, as well as introducing possibilities for development of forward and options markets. Transfers would, of course, be subject to regulation by national authorities and by the FCCC.[14]

The third document would be an Annual Report, prepared by the implementing entity for the project. This document would inform investors concerning the status of the project, as well as provide information required by regulatory bodies to make a determination concerning the abatement of GHGs actually obtained by the project. The information presented would include independent verification (perhaps like an auditor's statement in a financial report) of this net abatement.

"Unofficial" (i.e., prior to operation of the FCCC) joint implementation could begin immediately based on these procedures. Investors and implementors alike would, to be sure, be speculating. In some cases, investors might be able to use investments in projects in another country to meet domestic obligations. For example, if a company resident in a country that taxes CO_2 emissions were to invest in one of the two projects considered here, it might seek some credit against its obligations for CO_2 taxes on fossil fuels. To this end, it could present the Project Placement Memorandum to the tax authorities for a preliminary determination concerning whether offsets against domestic tax liabilities would be granted. A final determination would be based on an executed Legal Agreement establishing the company's ownership of a share of the net abatement achieved, and Annual Reports that establish the amount of abatement actually achieved.

As the apparatus for implementing the FCCC comes into being, essentially this same approach could be followed. The Project Placement Memorandum could be submitted to the implementing arm of the FCCC for preliminary determination that the proposed project meets its requirements for joint implementation. The Legal Agreement would fix shares in a project under implementation, and the Annual Report would provide the information needed for a determination of how much abatement would be credited to individual project participants as an offset to their individual obligations under the FCCC.

[1] Jones, op. cit.

[2] It should be pointed out that the problems that arise are not problems that have to do with joint implementation per se. Rather, they are basic practical difficulties in measuring the full effects of policies and or projects.

[3] See paragraphs 38 and 39 for an explanation as to why CFL technology would be expected to penetrate the Mexican market eventually.

[4] Mills, Evan. "Using Financial Incentives to promote Compact Fluorescent Lamps in Europe: Cost Effectiveness and Consumer Response in 10 Countries", in Right Light, Bright Light, ed. Evan Mills, 1992.

[5] Elasticities of demand for lighting services are probably low and the extent to which the capacity mix and dispatching will shift over the life of the lamps placed by the project is also relatively small.

[6] Poland is expected to tighten substantially its controls and regulations on local air pollution. Under these circumstances, it is probable that boiler conversions that are not privately profitable now would become so. To this extent, the net effect of the CTG project, like the ILUMEX project, is to move forward in time the time at which GHG emission reductions are realized.

[7] The term "incremental cost" is frequently used in discussions of the cost of GHG abatement. It is also used in the FCCC. To avoid confusion with this latter usage, which will be defined by the Conference of Parties, the term "marginal cost" -- meaning the additional economic cost caused by GHG reduction -- is used here. A precise definition is given in paragraph 37 of the paper.

[8] This is the social discount rate currently applied by the Kingdom of Norway to evaluate investment projects.

[9] See King, Kenneth and Mohan Munasinghe, Cost-Effective Means to Limit the Emissions of Greenhouse Gases In Developing Countries, World Bank Environment Department Divisional Working Paper 1992-30, pp. 7-11, for a more complete discussion.

[10] The economic rationale underlying this interpretation of the marginal cost of projects that advance the time stream of global benefits associated with GHG abatement is further explained in Annex A.

[11] Rough estimates of the benefits of reducing local air pollution suggest that the marginal benefits are in fact somewhat larger than is implied by the tax rates in Figure 7.

[12] There may, of course, be some sources of systematic risk that are not easily diversified. If GEF projects are like normal development projects, for example, the portfolio of projects is likely to perform less well under difficult world economic conditions than when the world economy is basically healthy. Note in this case, however, that the lower levels of economic activity associated with weak global economic performance would tend to reduce emission in weak performance years, compensating in some degree, for project portfolio performance. There may, of course, be other forms of systematic risk that do not possess this serendipitous characteristic.

[13] The description of the project would be prepared in accordance with standards established under the FCCC in sufficient detail to permit the Conference of Parties or its designee to determine whether the project concept is consistent with the joint implementation provisions of the Convention, and what the total net abatement credit, subject to verification by the FCCC or other appropriate regulatory body, would be.

[14] At a minimum, both national authorities and the FCCC would have to know the nationality of ownership of offsets to determine whether nations are in compliance with their responsibilities under the FCCC.

4 Concluding Observations

Consideration of the issues raised above suggests a number of conclusions with respect to the questions to be confronted as procedures for joint implementation under the FCCC are fleshed out. Perhaps foremost, it is clear that the fundamental practical problem to be confronted by the Conference of Parties in making operational the joint implementation provisions of the FCCC will be ensuring -- within a reasonable margin of doubt -- that global GHG emissions are reduced relative to what they would have been absent joint implementation. This problem is particularly difficult in the case where joint implementation teams up Annex I with non-Annex I partners since the latter have, as yet, assumed no monitorable obligations with respect to emissions reductions.[1] It should be pointed out, however, that this difficulty is not unique to joint implemenentation. In the absence of committments to emissions limits, any abatement effect (be it achieved through joint implmentation or some other form) will necessarily have to be measured against some purely hypothetical baseline.

The technical/analytical considerations illustrated by the ILUMEX and CTG cases suggest that, at least initiatially, the approach taken to estimating and verifying net abatement probably will have to be relatively simple. It does not seem practical at this juncture to prescribe approaches that would require detailed data and very sophisticated calculations or projections. At present, there appear to be few if any viable alternatives to proceding on a project-by-project basis, allowing considerable latitude and scope for judgement, as illustrated by the analyses of the case studies presented here.

As project experience accumulates, both under joint implementation and under the financing mechanism, it should be possible to strengthen considerably the procedures for estimating net abatement effects of projects ex ante and verifying their effectiveness ex post. The GEF pilot phase portfolio provides a particularly fruitful testbed for the development of new methods. Implementation of GEF projects under a successor phase (assuming that negotiations for a restructuring and replenishment of the GEF are concluded successfully), as well as the first few years of implementation under the financing mechanism and joint implementation provisions of the FCCC could also play an important role. It will be important in setting up the policies and procedures that govern these various forms of implementation to build-in studies, based on careful project-by-project monitoring and evaluation, and studies like PRINCE[2] which also examine and evaluate experience in preparing and revising country studies and plans, designed expressly for the purpose of strengthening methodological approaches. It will also be important to provide for revisiting, on a regular (say, every 3 to 5 years) basis, the regulatory/procedural framework based on the accumulating lessons of experience learned from this growing portfolio.

Pending the development of better methodology, one way of maximizing the likelihood that joint implementation would result in global net abatement is to impose some general restrictions on participation in joint implementation arrangements. For example, it could be stipulated that both investor and implementor nations would have to have "climate change friendly" policy

environments, as determined under procedures to be defined by the Conference of Parties. Examples of criteria that could be established to define "climate change friendly" would be (i) compliance with all key procedural obligations (e.g., current inventory and national plan meeting FCCC-established methodological standards of anthropogenic emissions of GHGs, and current in meeting obligations to contribute to the financing mechanism) under the FCCC and (ii) no subsidies, implicit or exlicit, to net emissions of GHGs (e.g., subsidies to energy consumption, subsidies/taxes that favor GHG-intensive energy forms such as coal relative to oil or gas, subsidies/taxes that encourage deforestation).

Other suggestions have also been put forward with the "net abatement effectiveness" objective, in whole or in part, in mind. Many of these would limit joint implementation according to countries' classifications under the FCCC. One such proposal is that joint implementation be limited to countries that have agreed to specific emissions limitations under the FCCC (i.e., the Annex I countries). Another proposal is that Annex I countries' reliance on joint implementation with non-Annex I countries be limited to some percentage of the projected emissions reductions they need to acheive to meet their FCCC obligations. Still another proposal is that joint implementation with non-Annex I countries be deferred until Annex I countries have met their GHG emission stabilization objectives. While these restrictions would tend to increase the likelihood that Annex I countries' emissions will meet targets, their overall effect on global emissions is uncertain. Joint implementation, by lowering costs and providing potential gains to both investor and implementor alike, may be a very effective instrument for encouraging efforts by Annex I and non-Annex I countries alike in furtherance of the purposes of the FCCC. In addition, restrictions on joint implementation with non-Annex I countries may substantially reduce the cost-effectiveness of whatever degree of global GHG abatment is attained.

Another difficult question, related to the determination of net abatement effects, may also confront the Conference of Parties: whether to place restrictions on joint implementation of "no regrets" interventions like ILUMEX. Policy reforms, although not examined in this paper, also represent another potential type of "no regrets" intervention that could be proposed for joint implementation. For example, it might be proposed that one country provide support to another country to (say) raise its electricity tariffs to the level of long run marginal cost.

There are two potential problems with "no regrets" options when the proposed implementor country has not assumed specific obligations with respect to limitation of its overall GHG emissions. First, true "no regrets" options would be undertaken anyway. There is thus, it could be argued, no net abatement effect associated with their implementation. Second, if "no regrets" projects and/or policies were eligible for joint implementation, potential implementors not otherwise bound by specific emissions limitation obligations might perceive incentives to create or exaggerate existing barriers to the adoption of globally beneficial technologies and policies with the hope of attracting additional international resource transfers. In the worst of circumstances, situations could be envisioned in which the seeking of such transfers could actually result in an increase in global emissions and accumulations from those which might otherwise obtain.

There is a broad range of positions that could be taken with regard to the eligibility of "no regrets" interventions for joint implementation. One possibility would be to simply rule out project and/or policy initiatives that are "no regrets" under the conventional calculus of costs and benefits for joint implementation. This would effectively deal with the perverse incentives problem, but at the possible cost of sacrificing some globally beneficial abatement opportunities. The ILUMEX project considered here, for example, would be ineligible for joint implementation under such an approach.

Another possibility, already outlined above, would be to take the position that a suitable policy environment is a precondition for, but not eligible for, support under joint implementation. This posture would not rule out support for projects like the ILUMEX project provided that a legitimate case can be made that the project will contribute to an acceleration of net abatement of GHGs. It would, however, rule out direct support for policy reforms such as increasing energy tariffs.[3]

Still another alternative would be to place no a priori restrictions on "no regrets" policy reforms and projects as vehicles for joint implementation. As in the case of "no regrets" projects, however, a legitimate case would have to be made, on a case-by-case basis, that there are in fact marginal marginal global benefits that would be accrued. This would preserve the maximum range of choice for joint implementation (and hence should contribute to cost effective implementation of the FCCC), but would entail entail considerable exercise of judgement. In the case of policy interventions, estimation and verification of net abatement would involve policy conterfactuals that are even more daunting than the project counterfactuals illustrated here, and could involve the Conference of Parties in monitoring and supervision of economic policy reform -- a role for which it may not be well suited.

There are two additional fundamental points to be kept in mind when weighing the costs and benefits of alternative postures with regard to restricting joint implementation of "no regrets" interventions. First, many (if not most) interventions that typically are believed to be "no regrets" in fact have real costs attached to them. These may be costs associated with information externalities (e.g., consumer information about new products, organizational knowledge about how to supply a product or service), transitional/adaptational costs (including difficult, perhaps impossible to estimate political costs) associated with changing the way things are done, and/or capital constraints. The presence of these other costs does not necessarily mean that the intervention is not "no-regrets". The economic benefits that accrue domestically may or may not exceed the costs of the intervention, including the costs associated with overcoming these barriers.

Second, as illustrated by the ILUMEX project, even in the case of interventions that appear to be "no regrets" when all domestic costs and benefits are counted conventionally, there is still the issue of the effect of the intervention on the timing and the ultimate extent of GHG emissions reductions. Like the ILUMEX case, many interventions conceptually have the effect of accelerating GHG emissions abatement. If a global benefit is associated with more rapid/earlier abatement per se, then there is a good rationale for not ruling out ipso facto joint implementation of such interventions.

Another clear implication of the case study experience examined here is that there is a great deal to be said for implementation approaches that do not require official or explicit determination of marginal cost.[4] The "operational" methodology, like that for determination of net abatement effects, requires a great deal of judgement, and official determinations of marginal cost plays no essential role in joint implmentation. While prospective parties to a joint implmentation agreement may want to make marginal cost calculations as a point of reference for the bargaining positions they take, this is not necessary.

Finally, it should be noted that there are a number of other important systemic issues with regard to joint implementation that are not discussed in this paper because they do not arise in the context of the two projects examined here. Perhaps the most important of these concern the structuring of the relationship between implementation under the joint implementation provisions of the convention and implementation through the financing mechanism to be established under the FCCC. The challenge to the Conference of Parties will be to give structure to these two instruments so as to maximize their complementarity, and thereby promote more

efficient, effective, equitable GHG abatement than would be attainable via either of the implementation approaches in isolation.

[1] Cases in which Annex I countries are involved in joint implementation do not raise this difficult since it can presumably be determined whether their actual emissions les net holdings of credits for joint implmentation iwth other Annex I countries are less than the emissions limits to which they have agreed.

[2] Program for Measuring Incremental Costs for the Environment. Administrator's Office. Global Environment Facility.

[3] Joint implementation of such projects might indirectly support such reforms, however. Energy efficiency projects, for example, help to blunt the impact on consumers' energy expenditures of tariff increases.

[4] Merkus, op cit, proposes, for example that a company that wihes to invest in emissionsreductions via joint implementation with a company in another country should be required to show that the investment is cost-effective.

Annex A

Additional Explanation of the Calculation of the Marginal Cost of the ILUMEX Project

This annex briefly explains the basic economic logic behind the calculation of the marginal cost of the ILUMEX project, and conceptually similar projects. For this purpose, it is convenient to develop a simple, stylized economic analysis of the optimal time of implementation of a project that has both domestic and global benefits. This analysis is outlined in the following paragraphs.

To simplify, let us assume that the present values in the year implemented of both domestic and global benefits are independent of the year in which the project is implemented, and are equal to D and G respectively. In the case of the ILUMEX project, for example, D would represent the present value in the year incandescent lamps were replaced by compact fluorescent lamps of the present economic value of the energy savings associated with use of these energy efficient lamps. If it were possible to estimate the present value of other domestically-accruing benefits such as the benefits associated with lower emissions of local air pollutants such as particulate matter and sulfur dioxide, these also would be included in the calculation of D.

In principle, global benefits associated with reductions of concentrations of GHGs in the atmosphere would be the major component of the calculation of G. Any portion of this benefit accruing in the domestic/implementing country would be included in the calculation of D rather than G.

In practice, of course, it is extremely difficult to calculate G. This is not essential for our purposes. All that is important is that there are positive global benefits associated with the project.

Assuming an interest rate of r,[1] the present value at the present time of domestic and global benefits if the project is implemented in year T are respectively:

$$De^{-rT}$$

and

$$Ge^{-rT}$$

Let us further assume that the present value at the present time of the costs of implementing the project at time T are given by the relationship C(T), and that C(T) declines as T increases; that is, the present value of implementation costs go down as the date at which the project is to be implemented is extended further into the future. There are several reasons that this might occur. Pushing the project further into the future presumably means that at least some cost outlays can be postponed. Discounting reduces the present value of these costs. More importantly, allowing more time prior to implementation may result in lower costs ipso facto. In the case of ILUMEX, for example, the sooner the time that CFLs are to be placed, the bigger and more expensive the public information, advertising, and marketing outlays that would be required. The relative price of project technologies may decline with time, as appears to be happening with the CFL technology that will be employed in the ILUMEX. And finally, "haste makes waste" is a basic if not terribly scientific principle of project implementation.

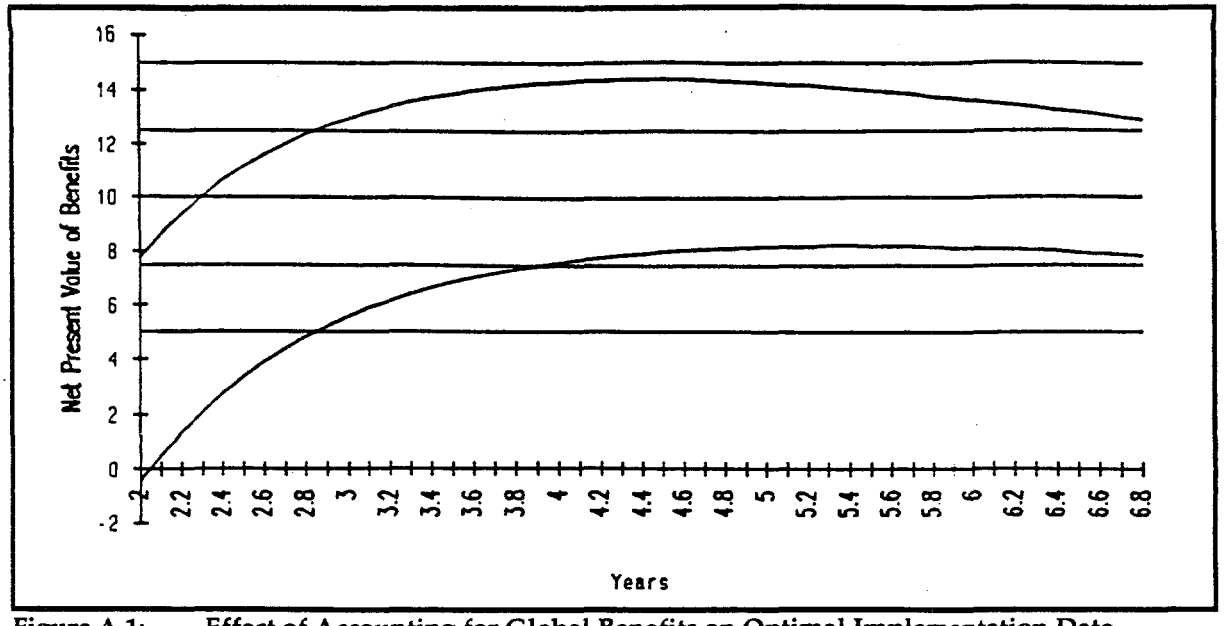

Figure A.1: Effect of Accounting for Global Benefits on Optimal Implementation Date

From the domestic (i.e., implementing) country's perspective, the optimal course of action is to select a project implementation date that maximizes the difference between the present value of domestic benefits of the project and the present value of costs. This is illustrated in Figure A.1, where the lower of the two curves shown represent the net present value of the project, as a function of the implementation date, to the implementor. The domestically optimal implementation date is some 5.3 years hence.

Factoring global benefits into the decision changes the calculus. It shifts the net present value of benefit curve upward and shifts the point at which it reaches a peak leftward.[2] This is shown by the higher of the two curves shown in the figure, which implies an optimum implementation date of some 4.4 years hence.

In other words, form a global perspective, it is optimal to implement the project earlier than it is from a domestic perspective. The additional costs associated with earlier implementation, less the additional domestic benefits realized, are the marginal cost of the project.

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[1] Domestic and global interest rates need not be the same. For simplicity, however, we assume here that they are.

[2] A necessary condition for maximization of the net present value of benefits is that the marginal contribution ot the present value of benefits of advancing the implementation date in time equal the marginal contribution of the present value of costs of doing so. Mathematically, this requires that

$$-rBe^{-rT}-C'(T)=0$$

and

$$r^2Be^{-rT}-C''(T)<0$$

where B represents benefits and C' and C" are respectively the first and second derivatives of C(T) with respect to T. The latter inequality implies that increasing B (to take account of global benefits) implies that T will decrease (i.e., that the upper net benefit curve in Figure A.1 will attain a peak at an earlier time that the lower curve).

Annex B

Prospective Investment Opportunity In Project to Promote Energy Efficiency and Reduce Greenhouse Gas Emissions

The ____ Utilities Company (XUC) is selectively seeking investors for an electric power project ("the project") to take place in the country of ___which is intended to result in enhanced energy efficiency and a reduction of greenhouse gas emissions. XUC will cooperate with the Government of ___, in order to support the Government's request for partial funding of this project from the Global Environment Facility ("GEF"). XUC will implement this project to enable investors to obtain such net credits for greenhouse gas reduction, in proportion to their share of the actual total project cost, as may become available under applicable national or international regulations.

The information set forth herein does not constitute a complete discussion of the terms and conditions governing an investment in the project. The disclosures set forth herein are limited in their entirety by reference to the XUC Legal Agreement and its Technical Annex, to be provided upon request. Investors should carefully review said documents before deciding to proceed with an investment, and it is expected that investors will rely on their own representatives as to all investment, legal, and tax matters that may pertain to this proposed investment.

By accepting this document, the recipient agrees not to reproduce this document, and to return it, together with any accompanying documents, if the recipient does not invest in this project.

The XUC reserves the right to reject any offer of investment in this project, or to accept a smaller size of investment than requested by the potential investor.

This memorandum has not been registered with any international, national, or state securities regulatory commission, nor has any such commission passed upon or reviewed the memorandum. This memorandum does not constitute an offer or solicitation in any nation or state in which such offer is not authorized.

Any investor must be an accredited investor in good standing within any nation or state in which it is incorporated as well as in any nation or state in which it is transacting business.

Description of the Project

Project Cost and Financing:	US$ million
XUC Contribution	10.00
GEF Grant	10.00
Government ____ Grant	
Total Cost	40.00

The total cost of the project described herein is estimated to be $_____. In addition, as part of the project, XUC will take all necessary measures to enable investors to obtain such net credits for

greenhouse gas reduction, in proportion to their share of the actual total project cost, as may become available under applicable national or international regulations.

Background: Demand for electric energy in ____ is high (it is presently estimated at 95 TWh and growing at about 6% per annum). Investments in the order of US$1.5 billion per year will be needed to supply this growing demand. Furthermore, since ____installed capacity is about 80% thermal, there is concern over the gaseous emissions and their deleterious effect on the environment. With assistance from the World Bank, XUC, a publicly owned electric power utility, has undertaken several programs to address these issues. To complement these programs, XUC has identified a project with a significant potential for electric energy conservation. [This project is intended for demonstration purposes. Demonstration projects for energy conservation in lighting would provide a globally-replicable model for demand side management (DSM) with considerable efficiency gains.] The project will replace incandescent light bulbs with _ million highly efficient compact fluorescent lamps (CFL). These lamps require only about 25% of the energy needed by incandescent bulbs to produce the same lighting level and last up to thirteen times longer. Although the initial investment is higher, the CFLs will produce important benefits for the consumers, XUC, the Government and through the abatement of pollution, also for the global environment.

Greenhouse Gas Reduction: An 18 watt CFL that lasts about 10,000 hours (or about 9 years assuming 3 hours of use per day) can replace a 75 watt incandescent bulb that lasts 750 hours, resulting in savings of about 570 kWh for the customer and about 670 kWh at the power station (on the basis of 14% transmission and distribution losses and 5% station losses). It has been estimated that each 10 million bulbs replaced (there are approximately 200 million incandescent bulbs installed in the country) would produce savings of about 750 GWh/year, equivalent to the generation of a peaking thermal plant of about 300 MW of capacity. A feasibility study for the project prepared by the International Institute for Energy Conservation (IIEC) has also estimated that the replacement would prevent the production of 5.8 million metric tons (mt) of CO_2 and 13,600 mt of methane over the life of the 10 million bulbs.

The project will: (a) result in savings to the consumers and provide them with a comparable or superior quality of light. Preliminary calculations prepared by IIEC indicate that on the average the internal rate of return (IRR) for the consumers would be about 60%; (b) enable the country to reduce peak demand by about 80 MW and avoid generating about 140 GWh annually. Preliminary calculations made by the IIEC show that the IRR for this case would be higher than 60%; (c) prevent the production of 870,000 mt of CO_2 over the life of the CFLs; (d) reduce the emission of other pollutants. A study prepared by consultants estimates that, over the life of the bulbs, the project would similarly prevent the production of 7,000 mt of SO_2, 790 tons of NO_x and 700 tons of particles from oil-fired power stations. Similarly, the IIEC estimates the reduction in methane emissions at about 1,900 mt. On the basis of the figures adopted by the Wisconsin Public Service Commission (US$17 per mt of CO_2, US$165 per mt of methane and US$2,977 per mt of NO_x), then the reduction in these gases would result in benefits estimated at about US$2 million per year.

Project implementation: The project will be implemented by XUC. Procurement of the CFLs and the computer equipment needed for project monitoring will follow World Bank's guidelines for procurement through international bids. In determining the winning bid responses, XUC will use technical and non-technical selection criteria. Upon request, all such criteria will be made available to interested investors in advance of the bidding.

In addition to the foregoing, in consultation with investors, XUC will undertake and prepare for dissemination programs and plans for the following:

Project cost and staffing: Project costs will consist of three accounting areas: 1) capital goods acquisition, 2) CFL acquisition costs, and 3) operational costs. The goal of XUC is to keep operational costs under 10% of the project budget. It will also be a goal of XUC to have no increase in XUC staff

as a result of said project unless necessary. All staff will receive training deemed necessary to ensure success of the project. Prior to project implementation XUC will have prepared a Project Implementation training manual for staff use and compliance. This manual will have to be acceptable to the World Bank and, upon request, will be made available to potential investors;

Project marketing: XUC will develop a marketing strategy to enhance successful consumer market penetration of said product;

Project monitoring: XUC will develop a monitoring process to measure project progress, data, and costs;

Project modification:: XUC will keep apprised on technological developments in the field of greenhouse gas reduction and energy efficiency, and intends to implement improved technology should such improvements be readily available for use in said project in a manner that will enhance the ability of the project to meet its objective. Before undertaking such project modifications, XUC will notify its investors and consult with the Advisory Committee.

Project cost accounting: Regular fiscal and financial reports will be prepared and provided monthly to XUC management.

Objective of the Investment

The principal objective of the investment is for XUC's electric power system to obtain enhanced energy efficiency and reduce greenhouse gas emissions. [At the same time, it is an objective of XUC that the project will enable investors to obtain such net credits for greenhouse gas reduction, in proportion to their share of the actual total project cost, as may become available under applicable national or international regulations. In addition, it is an objective for the total amount invested in the project to be replenished within a period of [ten] years from project revenues.]

Closing, Size and Form of the Offering

The initial closing will take place on _____.

The XUC reserves the right to admit additional investors from time to time until (a) the capital reaches $____, or until the first anniversary date of the initial closing. In addition, the offering includes the following requirements:

The minimum size of investment is US$1 million. [The contract unit shall be allowances of 100 tons of Greenhouse Gases. The initial offering price per ton shall be $___ per ton.]

Investors must be institutions.

The maximum number of initial investors is twenty (20). The minimum number is one (1).

Additional investors can be admitted until the capital reach $20 million.

- *Currency*: the form of payment will be in [US$]. This amount shall not be subject to variations in the rate of exchange between this currency and the currency of the Country of whom the currency is denominated. [The investor may select the form of payment, provided that currency fluctuations do not allow the payment to vary from the set offer price required.] The XUC may freely exchange said currency into the form of currency necessary to best facilitate disbursement of said funds.

Term of Investment

The initial investment will be for a term of ten (10) years. Should greenhouse gas reduction opportunities continue beyond that term, the XUC will then have the option of offering an additional term of __ years at a price to be determined by XUC.

Management Expenses

Said invested funds will be available to defray expenses incurred by the XUC or its managers of said project. [Said management fees cannot exceed 3% of the total project [operational] costs without consensus agreement of the Advisory Committee, as referred to herein.]

Tax Consequences

There may be tax consequences resulting from an investment in the Project. However, XUC makes no representations or warranties about said consequences and has prepared no opinion on said consequences. Further, it will be the investor's responsibility to remain informed about all tax consequences that pertain to said investment.

XUC's Responsibility Pertaining to Greenhouse Gas Reduction Allowances

XUC will not be responsible for any activity other than those set forth pursuant to this agreement and any subsequent agreement duly executed between XUC and the investor. In all cases, XUC will not be responsible for activities beyond those lawful activities necessary and consistent with carrying out the objectives of the project.

Record keeping: XUC will calculate and record the amount of any greenhouse gas reduction and provide an analysis of the amount of greenhouse gas reduction over the rate of investment in the project. Said records will kept available for review by any investor at any reasonable time. XUC agrees to install and maintain in proper working order continuous emission monitoring ("CEM") equipment necessary to accurately provide information related to calculation of greenhouse gas reduction.

Greenhouse Gas Reduction Allowances: Beyond fulfilling its responsibilities as set forth in this agreement, however, XUC will not be responsible for the investor obtaining any greenhouse gas reduction allowances, or any other amounts or form of entitlement as a result of the investor's investment in this project. An investor will be notified by XUC of its percentage contribution to the project cost thus allowing the investor to seek a pro rata share of reduction allowances equivalent to other investors. XUC will endeavor to provide such information in a manner conducive to reporting by the investor to any appropriate regulatory authority. XUC will also endeavor to ensure that the project meets such criteria for joint implementation as may be established pursuant to the United Nations Framework Convention on Climate Change (FCCC).

No recourse: Unless due to the gross negligence or willful misconduct of the XUC, the investor shall have no recourse against the investor for any allowances or any other amounts or form of entitlement or remuneration to which the investor considers itself entitled.

- *Technical risks*: Beyond appropriate application of procurement requirements, XUC will not be responsible should the project not meet desired goals as a result of technical difficulties. Such difficulties are not limited to, but include if the technology designed for this project does not perform according to specifications, or if consumer usage patterns and CFL market penetration do not allow the product to be used to the extent intended.

Investor's Responsibility

Each investor will have sole responsibility to obtain any greenhouse gas-based reduction allowances with any governmental or other entity. The XUC or any other offeror of this investment opportunity

makes no guarantee, representation, or warranty that any greenhouse gas-based offset, record, or other allowances is available as a result of this investment. XUC will, however, offer to provide an estimate of project total greenhouse gas reduction, which will be subject to verification by any authority duly appointed for this purpose, including any institution that may be designated pursuant to the FCCC.

Successors and Assigns

Provided such action is lawful under any applicable national or state securities laws, the investor will be entitled to auction, assign, sell, or otherwise transfer its rights or interests in the project to other reputable institutional investors, [including government-regulated commodity markets in good standing], [provided it has obtained prior written consent of said transfer from XUC and, if necessary, the appropriate regulatory authority]. XUC shall not unreasonably withhold consent, but makes no representation with respect to any decision by any regulatory body. Subject to the foregoing, all provisions contained in this agreement or any document or agreement referred to herein or relating hereto shall inure to the benefit of and shall be binding upon the parties to this agreement, their successors and assigns.

Right to Cancel Investment

Both XUC and investors will retain the right to cancel the investment if at any time said arrangements are no longer lawful or cannot be carried out due to force majeure or other events beyond their control which render performance impossible. Such events would include the transfer of XUC's rights or interest in the project.[1] Upon cancellation, XUC and the investor will consult to determine the proportion of return on investment still owing to the investor in proportion to returns earned by al investors. If the parties cannot agree, the matter may be resolved by arbitration pursuant to the paragraph entitled *"Applicable Law."*

Advisory Committee

The XUC will establish an advisory committee consisting of one representative each from the XUC, the Government of __, and __ representatives from the investors. This committee will serve to advise on the approaches necessary to maximize greenhouse gas reduction and energy efficiency

Confidentiality

The material set forth in this document is provided on a confidential basis solely for consideration of the party receiving said document.

Reporting

It will be the obligation of the XUC to prepare an annual report based upon the calendar year detailing the projects' progress toward meeting its dual goals of energy efficiency and greenhouse gas reduction. As part of this report, XUC will provide detailed information on the verifiable net greenhouse gas reduction of the project.

Said reports will be the subject of an annual meeting held in close proximity to the headquarters of the XUC in the spring season of each year.

Applicable Law

Any disputes arising out of the contract shall be governed by the laws of the _____, without regard to its conflict of laws provisions, except as provided in any document forming part of the Legal Agreement with respect to a specifically defined matter.[2]

Dispute Resolution

The Legal Agreement will contain provisions relating to the resolution of disputes which cannot be resolved by the parties themselves. In the first instance, the Agreement will note that the settlement of disputes will be governed by the means selected pursuant to the FCCC. In the event that the FCCC does not determine, or pertain to, the method of dispute resolution, the Agreement can offer a selection agreeable to the parties.[3]

Final Memorandum

This memorandum supersedes any other previously prepared placement memorandum of the XUC pertaining to this project.

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[1] The Legal Agreement will provide detail concerning when XUC's transfer or rights or interests in the project will provide the investor with a right to cancel the investment.

[2] Because the Legal Agreement will likely involve parties from several or more countries, it is recommended that the Legal Agreement identify the applicable law in the event there is a dispute. By selecting the applicable law there would be added certainty that there would be uniform interpretation of the Agreements provisions in the event that there are disputes in more than one country. The Arbitrators would apply the law. Without this provision, the parties would relinquish the right to select the applicable law to the panel of Arbitrators.

[3] For example, one means would be resolution pursuant to the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

Annex C

Contract Between the X Utility Company and Investor for the Greenhouse Gas Emission Reduction Project

General Terms of Contract for Greenhouse Gas Emission Reduction Project

This Contract is made and entered on the _____date of _____, between the X Utility Company and the Investor, whose names appear on the Signature Pages hereof;

Whereas, the parties hereto wish to enter into a contract to enhance the energy efficiency and greenhouse gas reduction emissions from the Project also with the goal of enabling the Investor to obtain greenhouse gas reduction emission allowances, and for the other purposes set forth herein;

Now, therefore, in consideration of the mutual promises and conditions contained in this Contract, the XUC and the Investor hereby in this Contract, the XUC and the Investor hereby agree as follows:

Article 1. Definitions

1.1 In the Contract, as hereinafter defined, the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

a) Advisory Committee means the Committee consisting of one representative of XUC, one from GEF, and one of the Investors, which will provide periodic technical review and advice;

b) Article means an article of the present Contract;

c) CO_2 means carbon dioxide;

d) Commencement date means the date mentioned in the Technical Annex at which the appropriate regulatory authorities authorize commencement of calculation of GHG emission reduction allowances;

e) Closing means the date of signature of the Contract;

f) Contract means all documents expressly incorporated in the present Contract;

g) Contract price means the sum paid per ton of GHG emission reduction and as further defined in article;

h) Country means the country where the Project is located;

i) Effective date means the date upon which the Contract enters into force;

j) Framework Convention on Climate Change (FCCC) shall mean the United Nations Framework Convention on Climate Change;

k) Greenhouse Gas refers to CO_2 or other gases identified for control pursuant to the FCCC;

l) Greenhouse Gas Emission Reduction Allowance refers to the allowance for greenhouse gas emission reduction as investor is entitled to by its investment in the Project;

m) Investor refers to the party to this Contract investing in the Project in return for the objective of obtaining greenhouse gas emission reduction allowances;

n) Project refers to the activities which must occur in order to generate the maximum permissible greenhouse gas emission reductions at the Project site referred to in _____, and during the duration of this Legal Agreement;

o) Project area means the area in which the Project shall be carried out, which area is described in the present Contract and the Technical Annex;

p) Project Placement Memorandum (PPM) refers to the document of said name proffered to the Investor by XUC as a solicitation to invest in the Project as amended or supplemented through;

q) Technical Annex (TA) means the Technical Annex to this Legal Agreement is incorporated as part of this Agreement and is the full and final description of the manner in which Company is obligated pursuant to this Agreement to implement the Project to achieve greenhouse gas emission reduction; and

r) XUC Company means the XUC Utility Company or the Company.

1.2 Words importing only the singular also include the plural and vice versa where the context requires.

Article 2. Applicability of the Contract

2.1 With the exception of the PPM, the terms and conditions of the present Contract and its Annex, are binding on the Parties and supersede and replace any of the prior terms and conditions and form an integral part of the Contract.

Article 3. Interpretation Consistent with FCCC

The terms of this Contract shall be interpreted in a manner which fulfills, and is consistent with, the FCCC, and applicable national law.

Article 4. Description of the Project

Article 5. Basic Objectives

5.1 In order to implement the Project XUC shall take all lawful measures necessary to achieve its objectives during the term of the Contract including:

a) sustainability from the point of view of ecology, local acceptability and economic feasibility;

b) an average GHG reduction during a calendar year of a minimum of ___ tons GHG per unit of investment per year;

c) cost-efficiency; and

d) energy efficiency.

5.2 Any amendment of the Contract pursuant to the provisions of Article __ shall in all cases be subject to the Basic Objectives, and in case of any discrepancy or inconsistency these objectives shall prevail.

Article 6. General Obligations of the Company

Pursuant to this CONTRACT, XUC Company is obligated to take all necessary measures permissible to implement this Project in a manner that will enhance energy efficiency and enable the Investor to obtain the maximum net credit, for greenhouse gas reduction, in proportion to the Investor's investment in the total project cost, as may become available under international, national, and/or state regulations.

Article 7. Representations and Warranties

The XUC represents and warrants to the Investor:

a) that, to the bet of its knowledge, the factual representations set forth in the PPM are true and correct as of the closing date;

b) that it is a Company duly organized and validly existing under the laws of the Country;

c) that the execution of the Contract by the Company has been duly authorized and approved by all necessary corporate action of the XUC and that pursuant to such authorization and approval the XUC has full power and authority to enter into the Contract, to observe the terms and conditions thereof and to perform its obligations thereunder;

d) that it shall in all cases perform any and all of its obligations under the Contract;

e) that it has and shall maintain an adequate capability of fulfilling the Contract;

f) that it has and shall maintain an adequate expertise in the implementation of the Project;

g) that, in addition to the Contract Price, it has and shall procure financial resources sufficient for carrying out the Project during the term of the Contract;

h) that it has all concessions, licenses or permits which may be required by the law or authorities of the Country to fulfill any and all of its obligations under the Contract; that, if necessary, it shall use all efforts to maintain or renew any such concession, license or permit or to obtain any other concession, license or permit that may become required during the term of the Contract, and that it shall inform the Investor promptly of any change or possible change thereof; and

i) that it is entitled to use any patent or invention right, copyright or trademark and any right connected therewith, including processes, know-how and technology, required for fulfilling its obligations under the Contract, and shall, for its account, acquire any such right that may become required for fulfilling its obligations under the Contract;

j) however, XUC does not warrant or represent that the Investor will be able to obtain any for of GHG emission reduction allowance.

The investor represents and warrants to XUC:

a) that as of the closing Date and to the best of its knowledge there are no reasons which would require the Investor to be disqualified, or withdraw or cancel its investment.

Article 8. Responsibility of the Investor to Obtain GHG Credits

8.1 It will be the Investor's sole responsibility to apply for and/or obtain greenhouse gas emission reduction credits. The obligations of XUC are limited to those set forth in the PPM and this Contract.

Article 9. Representation by the Investor

The Investor represents that it is in good standing as an accredited investor within any and all nations and/or states in which it is incorporated, is conducting business, and/or in or from which it is engaged in investing.

Article 10. Time Schedule

10.1 XUC shall carry out the Project during a period of a minimum of ten (10) years, starting on the Commencement Date in accordance with the Technical Annex.

10.2 In the event of delays during the Implementation Phase not caused by Force Majeure as provided in Article 34, Investor may terminate the Contract pursuant to the provisions of article 37(2).

Article 11. Contract Price

11.1 The Contract Price relates to the reduction and abatement GHG by the Project during the term of the Contract.

11.2 The Contract Price is fixed per one hundred (100) ton unit of greenhouse gas emission to be abated during the Project and not subject to any increase caused by changes in the Project, escalation of wages or prices, or otherwise.

11.3 The Contract Price shall solely be applied to the costs of those activities listed in the Technical Annex.

11.4 The Contract Price shall be $_____ per unit (one hundred tons).

11.5 The Investor hereby agrees to purchase ___ units, and at the date of execution of this Contract shall deposit the sum of $_____ in an account selected by the XUC.

11.6 The total amount of all Investors' investments for the Project shall not exceed _____.

11.7 At the Closing Date, payments shall be made by Investor upon the presentation by the XUC of a statement that all activities to be carried out by XUC up to the relevant due date under the Project Placement Memorandum have been fully completed by the Company.

11.8 All transfer taxes and service charges shall be borne by the Company.

Article 12. Currency

12.1 All payments by Investor shall be in United States dollars and shall not be subject to variations in the rate of exchange between this currency and the currency of the Country or any other currency.

12.2 Any reporting by the XUC on budgeting and actual spending on the Project by the Company in the currency of the Country shall clearly state the applied rate of exchange with the US dollar.

Article 13. Cost Incurred Prior to Contract

All costs incurred by a Party prior to the signing of the Form of Agreement for CO_2 Offset in connection with the Project shall be borne by the Party having incurred these costs.

Article 14. Budgets and Financing

The budget for and the financing method of the Project shall be prepared in accordance with the guidelines established by the International Bank for Reconstruction and Development.

Article 15. Operation of the Project

15.1 The Project shall be carried out by XUC in accordance with the Contract and Technical Annex, incorporated herewith.

15.2 The Technical Annex may be revised in accordance with the provisions of this Article.

15.3 The Technical Annex shall include, but is not limited to, adequate information regarding:

a) relevant physical aspects of the Project Area (location, topography, access, infrastructure, maps, climate);

b) relevant public aspects of the Contract Area (national and regional development plans, ongoing demand for energy supply, socio-economic structure of the local population, organization and structure of local and regional authorities);

c) the Company's organization for the Project (management structure, functional structure, organization chart, coordination, office facilities, equipment);

d) staffing and tax description;

e) research program (if any);

f) training of personnel for the Project;

g) the measures for local acceptability of the project, including permits and licenses;

h) time schedules (milestones, activities, reporting, staffing);

i) the budget for the Project;

j) the financing method of the Project; and

k) the accounting method for the Project.

Article 16. Technical Revisions to Project

16.1 Not later than 1 March of each year, the XUC may submit to the Advisory Committee a proposal for a revised issue of the [Technical Annex] [Plan of Operation] for the remaining period of the Project. The Advisory Committee may authorize technical revisions to the Project. Proposals which do not affect GHG reductions do not need Advisory Committee approval.

16.2 Any proposal shall identify the differences, if any, in comparison with the then existing issue of the Technical Annex [Plan of Operation.]

16.3 Any proposal shall not derogate from the PPM or from the terms and conditions set forth in the present unless they have been amended pursuant to the provisions of the present Contract.

16.4 The revised [Technical Annex] [Plan of Operation] shall supersede and replace any previous issue of the [Technical Annex] [Plan of Operation] upon the written approval of the Advisory Committee, which approval shall not be withheld unreasonably, and shall form an integral part of the Contract.

16.5 In the event that the Advisory Committee disapproves the proposal referred to in paragraph __, it shall inform the XUC thereof in writing in a timely fashion and no later than in fifteen (15) working days from receipt advising the reasons of the disapproval and the conditions under which the Advisory Committee's approval may be forthcoming.

16.6 When the XUC and Advisory Committee cannot resolve a dispute concerning a proposed revision, the matter may be resolved through arbitration in accordance with paragraph __.

16.7 In cases of urgency, the XUC may submit to Investor a proposal for a revision of the Plan of Operation at a date earlier than the submission date referred to in paragraph 4. If and when Investor has notified the Company that it agrees that there is a case of urgency, the provisions of this Article shall apply accordingly to such proposal.

16.8 The Advisory Committee shall be entitled to make a proposal for a review of any existing issue of the Plan of Operation on its own motion either in the framework of the procedure described in the preceding paragraphs or otherwise, provided always that such proposals shall comply with the requirements of paragraph 6.

Article 17. Annual Reporting by the XUC

17.1 Not later than 31 January of each year during the Project Phase, the XUC shall submit to the Investors an annual report concerning the progress and status of the Project in the form and manner provided in this Article.

17.2 The report shall cover the period commencing on 1 January and ending on 31 December of the previous year.

17.3 Each report shall contain comprehensive and accurate information concerning the progress and status of the Project at the end of the relevant twelve month period in relation to the then existing Technical Annex.

Article 18. Accounting

18.1 The XUC shall maintain accurate and detailed records of all costs incurred by the XUC in connection with the Project.

18.2 During the first two years of the Project, the XUC shall give the Investor a detailed accounting of the costs referred to in paragraph 1 in the form of an annual accounting report, including a comparison between the budgeted costs and the actual costs of the Project approved by an independent auditing firm in the Country. Said accounting shall be prepared in accordance with the generally accepted accounting principles as applied by internationally reputed auditing firms practicing in the Country. Each accounting report shall be submitted within twelve (12) weeks of the expiry of every period of twelve (12) months starting on the Commencement Date.

18.3 At all times during the term of the Contract, the Advisory Committee[1] shall have the right to have the accounts of XUC audited by an internationally respected auditing firm for the purposes of verifying the compliance by the XUC with any of its obligations under the Contract. The Company shall afford the auditing firm every facility for, and any assistance in, making the audit. The auditing firm shall have access to any and all documents in the possession, custody or control of the Company pertaining to the Project for the above mentioned purpose and shall have the right to reproduce any of the aforesaid documents. The provisions of Article 18(3) shall apply accordingly to the auditing pursuant to this paragraph.

18.4 The Company shall keep the information referred to in this Article available for a period of ten (10) years.

Article 19. Access to Contract Area, Inspections, Tests and Approvals

19.1 At all times during the term of the Contract, the Advisory Committee and any person authorized by it shall, during regular business hours, have access to the Project Area and places where the Company carries out the Project either directly or indirectly. The Company shall afford every facility for and any assistance in obtaining the right to such access.

19.2 At all times during the term of the Contract, the Advisory Committee and any person authorized by it shall be entitled to attend inspections and tests organized by the Company.

Article 20. Expenses of Advisory Committee

20.1 The expenses incurred by the Advisory Committee in connection with its activities described in the paragraphs 18 and 19 shall be charged to XUC.

Article 21. Subcontracting

The Contract or any part thereof may not be subcontracted by the Company to any third party without the prior written approval of the Advisory Committee. Subcontracting does not release the Company from any of its obligations under the Contract. Each subcontract shall contain a waiver by the subcontractor of any third party beneficiary right.

Article 22. Assignment

22.1 Any assignment by the Company of the interests in or rights or obligations, or both, under the Contract shall be null and void unless all of the following conditions have been fulfilled:

a) the assignment will not violate any law, role, order or decree;

b) the Advisory Committee and, if necessary, the GEF and any project participating governmental bodies have consented in writing to such assignment, which consent shall not be unreasonably withheld;

c) the assignee has expressly undertaken in writing with the Investor to be bound by the terms and conditions of the Contract and, in particular, the Technical Annex; and

d) the assignee has the financial capability and the capability with respect to the Project for the remaining term of the Contract and otherwise with respect to discharging the obligations under the Contract, and has confirmed in writing to the Investor the ability to meet the conditions set forth in this paragraph.

22.2 In the event that another company or organization of whatever nature intends to merge with the Company, to acquire the majority of the shares in the Company, or the dominant control over it, or a substantial part of its assets, the Company shall ensure that the other company or organization fulfills the conditions of the Project as if it were a prospective assignee.

22.3 Provided it will not violate any law, rule, order or decree, and it will not jeopardize the ability of the investment to obtain GHG reduction allowance, the Investor shall be entitled to transfer, sell, trade or assign the interests in or rights or obligations, or both, under the Contract, or any part thereof, either temporarily or permanently to any investor or exchange, of good standing.

Article 23. Taxes, duties, etc.

Any taxes, including income, stamp and turnover or value added taxes, duties, including import duties, fines, charges or assessments of any nature levied by any governmental authority of the [Investor's government] in connection with the Contract or the Project, whether levied against [the Investor], the Company or any of its subcontractors, shall be the responsibility of the Company and shall be paid directly by the Company to the government authority concerned. If the Investor or its officers are required to pay any such taxes, duties, fines, charges or assessments in the first instance, or as a result of the Company's failure to comply with any applicable laws or regulations governing their payment, the amount of any payments so made, plus the statutory interest and expense of currency conversion, shall be promptly reimbursed in [the Investor's domestic currency] upon submission of the Investor's invoices therefor.

Article 24. Business Practices

Neither XUC nor the investor shall not pay or agree to pay, directly or indirectly, any funds or anything of value to any public official in the Country for the purpose of, or which would be construed to be for, influencing the official's acts, or to use his influence to the Company's benefit, in relation to the fulfillment of any of its obligations under the Contract.

Article 25. Publicity

Each Party shall be allowed to disclose or divulge non-proprietary information regarding the Project to third parties. The Parties shall keep each other informed of any publication regarding the Project.

Article 26. Insurance

The Company shall, for its account and to the satisfaction of Investor, arrangement for an adequate insurance covering all normally accepted risks relating to the Project.

Article 27. Liability

27.1 XUC shall be liable to the Investor for any loss or damage incurred by the Investor due to the Company's non-compliance with its obligations under the Contract.

27.2 The Investor's liability under the Contract towards the Company shall be expressly limited to the fulfillment of the payment obligation of the Contract Price. Any claim by the Company against the Investor for any damages whatsoever shall be excluded.

Article 28. Indemnity by the Company

The Company shall, at its expense, indemnify and hold harmless the Investor and any of its Board members, officers, employees, advisors, consultants or agents from and against any loss, liability, cost, damage and expenses claimed by any third party for whatever reason in relation to any matter arising under the Contract, except with respect to any matter in which said individual(s) have been adjudicated to have acted with negligence or willful misconduct.

Article 29. No Partnership

The Contract shall not be interpreted or construed as constituting a joint venture or other form of partnership between the Parties.

Article 30. Force Majeure

30.1 Force Majeure shall mean an occurrence beyond the control and without the fault or negligence of a Party, which that Party could not have reasonably foreseen, which causes or results in a failure of such Party to fulfill any obligations under the Contract, and which by the exercise of reasonable diligence that Party could not reasonably have been expected to have avoided or overcome.

30.2 Events which, provided they fulfill the requirements stated in the preceding paragraph, shall constitute Force Majeure, include, but are not limited to, acts (including failure to act) of a government authority, war, fire, explosions, sabotage, nuclear incidents, and earthquakes. Force Majeure invoked by a subcontractor shall be deemed Force Majeure within the meaning of this Article only if the same event would have resulted in Force Majeure for a Party under this article.

30.3 If by reason of Force Majeure a Party is rendered unable, wholly or in part, to carry out its obligations under the Contract, the obligations of the Party concerned shall be suspended so long as and to the extent that the obligations are affected by such Force Majeure.

30.4 In the event of Force Majeure, the Party affected by the Force Majeure shall, with diligence and at its own expense, take all measures necessary to minimize the effects of the Force Majeure situation, to end the Force Majeure situation as soon as possible, and, to the extent that it can be reasonably expected from that Party, to recover the loss during the period of delay caused by Force Majeure.

30.5 Any period referred to in, or determined under, the Contract shall be extended for a period equal to the period of delay caused by Force Majeure to the extent that the period of delay cannot be recovered by the Party affected by the event of Force Majeure.

30.6 In the event of Force Majeure, each of the Parties shall be responsible for its own costs resulting from the Force Majeure situation.

30.7 The Party affected by an event of Force Majeure shall give immediate notice in writing of such event to the other Party. The notice shall include information about the circumstances and a statement of the measures to be taken and the time believed necessary to remedy the Force Majeure situation.

30.8 If the Force Majeure situation affecting one Party has serious consequences for the other Party or if it extends for a period in excess of ninety (90) days, the Parties shall negotiate and mutually agree on an adjustment of the Contract. In the event that no agreement can be reached within hundred and eighty (180) days after the Force Majeure situation has arisen, either Party may request an adjustment or partial or whole termination of the Contract by an arbitral tribunal constituted in accordance with the provisions of Article 43. The Arbitral Tribunal shall have full powers with respect to the aforesaid adjustment or termination.

Article 31. Waiver of Immunity

If the Company becomes subject to dominant control by the Government of the Country or forms part thereof, the Company, on behalf of the Government of the Country and being duly authorized thereto, irrevocably waives any claims to immunity from jurisdiction of an arbitral tribunal constituted pursuant to the provisions of Article __, to immunity in regard to any proceedings to enforce any arbitral award rendered by said arbitral tribunal, including, without limitation, immunity from service of process, and to immunity of any of its property from execution.

Article 32. Duration

The term of the Contract is [ten years], starting on the Commencement Date. During this period, the Contract may not be terminated by either Party, unless the contrary is expressly provided in the Contract.

Article 33. Termination

33.1 The Contract may be terminated forthwith by either Party by notice in writing to the other Party upon the occurrence of any of the following events:

a) insolvency, bankruptcy, liquidation or dissolution of the other Party;

b) general assignment for the benefit of the other Party's creditors or the appointment of a receiver for any property of the other Party;

c) manifest lack of financial resources to continue the Project under the Contract; or

d) assignment of the Contract in violation of the provisions of the first or second paragraph of Article 25.

33.2 Without prejudice to the provisions of the first paragraph, if the Company fails or refuses to perform any of its material obligations under the Contract, the Investor may demand the Company in writing to cur such default. If the Company has not cured the default within thirty (30) days after receipt of said demand or has not given adequate and effective assurance of performance within said period of time, the Investor shall be entitled to terminate the Contract in whole or in part by written notice to the Company.

33.3 In the case of termination of the Legal Agreement by the Investor, the Company shall immediately become liable to reimburse to the Investor the commercial value of the GHG allowances any amounts paid under the Contract with statutory interest from the date or dates of payment by the Investor until the date of reimbursement in full. Any payment by the Company under the provisions of

this paragraph shall be in United States dollars and shall be made within fourteen (14) days after receipt of the termination notice from Investor.

Article 34. Language

All correspondence, notifications, reports and other documents under the Contract shall be in the English language or be accompanied by an English translation to be provided at the expense of the originating Party.

Article 35. Non-waiver of Rights

The failure of either Party to exercise any right given under the Contract, or to insist upon strict compliance by the other Party with any obligation under the Contract, shall not constitute a waiver of any of that Party's rights to demand exact compliance with the terms and conditions of the Contract.

Article 36. Amendment

Any modification of, and addition to, the Contract shall be binding on the Parties only if it is in writing and duly signed by them.

Article 37. Partial Invalidity

37.1 If any provision of the Contract shall be held to be void or unenforceable, it shall be void or unenforceable to that extent and no further, and the invalidity of any provision shall not affect the validity of any other provision of the Contract.

37.2 Where a provision is held to be invalid and one Party is adversely affected, whether as a direct or indirect consequence of such invalidity, the Parties shall endeavor to agree on a modification to the Contract which shall compensate the Party adversely affected and, so far as possible, restore the economic balance between the Parties as reflected in the Contract.

37.3 If the Parties are unable to agree on a modification pursuant to the preceding paragraph, the matter shall, at the request of either party, be referred to arbitration in accordance with the provisions of Article 43. The Arbitral Tribunal shall have the power to modify or amend the Contract in order, so far as possible, to restore the economic balance between the Parties and maintain the aims and objectives of the Contract.

Article 38. Applicable Law

The Contract and any disputes defined in Article 43 shall in all respects exclusively be governed by and construed in accordance with the laws of the [United Kingdom] [State of New York] [Site of the Project], without regard to its conflict of laws rules, except as provided in any document forming part of the Contract with respect to a specifically defined matter.

Article 39. Arbitration

39.1 Any dispute, controversy or claim arising out of or relating to the Contract, or any agreement made in furtherance thereof, whether in contract, tort or at law, or the breach, termination or invalidity thereof, shall be finally settled by arbitration in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITAL) as in force on the effective date of Contract.

39.2 The Appointing Authority shall be the International Court of Arbitration of the International Chamber of Commerce.

39.3 The number of arbitrators shall be three.

39.4 The place of arbitration shall be The Hague, the Netherlands.

39.5 The language of the proceedings shall be English.

39.6 The Arbitral Tribunal shall have the power to complete omissions in or to modify the present Contract, or both.

Article 40. Notices

Any notice under the Contract shall have legal effect when it is delivered to the address of the other Party. Delivery may be made by means of rapid communication, such as telefax..

Article 41. Entire Agreement

Upon execution, the Contract and the Technical Annex constitute the entire agreement between the Parties in respect of the subject matters contained therein and supersede any preceding or concurrent oral or written agreements.

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[1] Investors may wish to consult with their Attorney's concerning potential liability from participating in management of XUC. In strict liability jurisdictions such as the United States the concept of lender liability has potential application to lenders who participated in the management or other activities of a business or site which required environmental remediation.

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