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TO
REDUCE GREENHOUSE GAS EMISSIONS:
WILL IT WORK?**

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**COGENERATION AND COMPETITIVE POWER JOURNAL
(Vol. 13, No. 1, Winter, 1998, pp 23-34)**

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BACKGROUND

Awareness of global environmental issues has been steadily increasing for more than a decade. As a result, numerous international conferences, meetings, treaties and agreements have taken place or been negotiated upon in an effort to mitigate the negative impacts human activity is having on the earth and its atmosphere. Examples of relevant multilateral agreements include:

- The Vienna Convention for the Protection of the Ozone Layer, 1985
- The Montreal Protocol on Substances that Deplete the Ozone Layer, 1987
- The Annual United Nations Conference on the Environment and The Rio Climate Treaty, 1992.

The most recent global initiative, in 1992, concerning the environment, The United Nations Framework Convention on Climate Change (UNFCCC) is focused on the reduction of green-house gas emissions in an effort to prevent climate change and combat potential global warming. Parties of the UNFCCC acknowledge that the global nature of climate change calls for the widest possible cooperation by all countries and their active participation in an effective and appropriate international response.

While the extent, and even the existence, of global warming is somewhat controversial, the majority of the scientific community believes the process, with potentially disastrous consequences, is now occurring. Mankind's release to the atmosphere of certain chemicals, including one class of refrigerants and carbon dioxide (CO₂) is believed to be a major contributor. Carbon dioxide is the only greenhouse gas emitted in substantial quantities from fossil fuel power plants. It, however, is produced in vast amounts from the world's power plants.

Most importantly, a somewhat greater amount of CO₂ is produced from the internal combustion engines of automobiles and trucks.

Target reductions for greenhouse gas emissions are the return and stabilization, prior to calendar year 2000, of emissions at or below levels exhibited in 1990. This is an exceedingly ambitious, and totally unrealistic, target for the industrially advanced countries whose economies depend on large per capita energy and chemical uses. Emission targets have been stated by twenty-eight countries,

for various gases, with differing base-level years, differing target years, and a certain amount of ambiguity.

Many countries are resisting becoming involved for a combination of economic and political reasons. They fear their economic growth will be restrained, and that participation will lead to additional unwelcome involvement in their internal affairs by other countries.

In an effort to meet scheduled reductions in greenhouse gases, in accordance with the UNFCCC, President Clinton instituted the U.S. Climate Change Action Plan in October 1993. A key element of the plan is the establishment of the Climate Challenge Program, a joint voluntary partnership between the electric utility industry and the U.S. Department of Energy with a goal of reducing or avoiding emissions of greenhouse gases, or sequestering them.

The U.S. Climate Challenge Program encourages industry-wide initiatives as a means of accomplishing greenhouse gas reduction goals. It provides the electric utility industry with an opportunity to influence the direction of regulatory approaches that may be implemented in the future. This proactive approach to managing greenhouse gas emissions is an attractive alternative for utilities, as opposed to strict government intervention that dictates specific controls and technologies that must be implemented.

An initiative developed by the Edison Electric Institute, with the support of more than fifty electric utility companies, launched the Utility Forest Carbon Management Program (UFCMP). The goal of this program is to reduce greenhouse gas emissions, as committed to under the Climate Challenge Program. The UFCMP has implemented several voluntary projects, with expected benefits to include the effective management of several million tons of carbon dioxide over project lifetimes.

Examples of UFCMP projects include rural tree planting, forest preservation activities, forest management and research efforts undertaken at both domestic and international sites.

Another program created in accordance with the UNFCCC is the United States Initiative on Joint Implementation (USIJI). This program, also voluntary, seeks as its ultimate objective the stabilization of greenhouse gases at levels that prevent dangerous interference with the earth's climate system. What is unique about this program is that it promotes cooperative agreements between interests in two or more countries. The concept of joint implementation activities was first introduced and adopted at the 1992 Earth Summit in Rio de Janeiro.

The joint implementation program is still in its development stage. All potential projects must meet strict requirements before receiving approval from the USIJI evaluation panel. Project developers seeking to participate must evaluate their prospective projects for expected impacts on greenhouse gas emissions. Any claimed reductions must be verifiable and permanent. Developers must also provide for monitoring and verification of emissions. Projects approved under the USIJI must also receive long-term commitments from developers and project host-country governments, to assure that reductions in greenhouse gas emissions are not ultimately reversed.

Emission credits, also known as emission reduction credits, tradeable emission permits and offsets, created as a result of joint implementation projects, will not be recognized until after the expiration of the pilot phase of the program, due to end in calendar year 2000. It is envisioned that, after the pilot phase is completed, a market-based trading system for greenhouse gas offsets will have developed, enabling participants (both buyers and sellers) to derive benefits. This ability to buy and sell emission credits will ideally create a further incentive for investors in developed countries to undertake additional joint implementation projects in order to create more tradable credits. This expected market-driven growth is the backbone of the joint implementation program, as its success is dependent on voluntary participation.

REQUIREMENTS FOR PARTICIPATION

Since the USIJI is a government program, there are, of course, numerous requirements for participation, most of which are normal and reasonable. Three that Dynalytics specifically calls to the attention of prospective participants must be carefully considered.

- **ADDITIONALITY:** A criteria for USIJI projects requires applicants to demonstrate to the satisfaction of the evaluation panel that proposed measures undertaken are above and beyond what would have reasonably occurred without the project. This may be a contentious issue for power projects that are quite often implemented using gas-fired turbines to rapidly add generating capacity, although indigenous oil, lignite or coal may be available as alternate fuels. Similarly, it may be difficult to establish that fuel-switching or efficiency improvements are above and beyond what would have otherwise occurred.
- **PUBLIC DISCLOSURE:** The program's purpose is to contribute to domestic and international knowledge about joint implementation at the project level. All information submitted to the USIJI evaluation panel for review will thus be considered public and may be published without prior notification or approval of the applicant. Program guidelines allow protection of confidential or proprietary business information. If the applicant wishes to invoke this protection, all information being claimed as confidential must be appropriately indicated when the initial proposal is submitted. The major drawback to asserting confidentiality claims is that the evaluation panel has the right to not include projects which, due to claims of confidentiality, will not serve the program purpose effectively.
- **LONG-TERM NATURE OF PROJECTS:** By their very nature, projects associated with reducing global warming tend to need long times to be effective. It is important to obtain, and document, support of the involved governments. This may be difficult for projects that offer little, if any, direct economic benefits. Given the lengthy project durations, any assessment of economics, moreover, is sensitive to assumptions made about the future value (as a sales price or as a necessary asset for additional construction) of an emission reduction. These are in addition to the more common uncertainties of future utility costs, inflation rates, possible availability of new technologies and the like.

ADVANTAGES OF JOINT IMPLEMENTATION

Benefits from the reduction of greenhouse gases are global, as the earth's atmosphere has no boundaries; reductions made in emissions, no matter in what part of the world they actually occur, will benefit the population as a whole.

The joint implementation approach to managing greenhouse gases is attractive to developers and others from developed countries because it provides the opportunity for reducing emissions at a lower cost. This opportunity exists by undertaking projects in developing countries that are typically rapidly expanding their infrastructure and adding electric capacity, creating an opportunity to reduce emissions through appropriate technology. Seeking emission reductions in highly developed countries is not as attractive to USIJI participants since the margin of improvement is much narrower, due to competitive pressures and prudency reviews that have already forced facilities to control fuel consumption, and thus carbon dioxide emissions.

ADVANTAGES TO PARTICIPATING

Increasing efficiency in developing countries requires the transfer of innovative technologies and expertise to facilitate emission reductions. Without this technology transfer, and substantial financial investment, these countries would not have the resources to realize any reductions in greenhouse gas emissions. By participating in USIJI activities, project participants will provide the necessary financial and technological resources to host countries. In return, participants will receive emission reduction credits resulting from reductions in emissions that are attributable to project activities. These credits, distributed to project partners at percentages negotiated within the partnership, can offset emission reduction obligations in a project partner's home country or, in the future, may be sold or traded.

The USIJI Secretariat sponsors public recognition events, showcasing individual projects and partners in its meetings and publications. The global exposure project participants will receive, as project evaluations are conducted and publicized, will enhance participants' public image and credibility. Successful projects will enhance future projects' chances of receiving approval and obtaining financing, as project acceptance and positive results are demonstrated.

Participants in joint implementation projects during the pilot phase also have the benefit of helping to shape the program during its early development. Additionally, participating in joint implementation projects provides access to energy and environmental markets in a project's host country, which may potentially lead to future business opportunities.

The most important benefit for an electric power project developer is political. The host country can, with the developer's help, demonstrate tangible progress to meeting treaty obligations. Streamlined licensing may be provided as a tacit quid pro quo.

These benefits combined with the health, environmental and economic benefits provided to a project's host country, make joint implementation projects an attractive and viable activity.

DEMONSTRATION PROJECTS

1. Carbon Sequestration Projects

Several projects are exploring ways to use two characteristics of trees; they remove carbon dioxide from the air, and they convert it to plant tissue. Trees are, in fact, approximately fifty percent carbon, by weight. The Rio Bravo Carbon Sequestration Project in Belize is typical. This project, undertaken by Wisconsin Electric Power Company and other investors in the Central American nation of Belize, is an example of a UFCMP project undertaken in accordance with the Climate Challenge Program and the USII. The primary objective of this project is to explore and successfully demonstrate incentive-based opportunities for private voluntary international cooperation in greenhouse gas mitigation, conservation and sustainable development.

The project has two components: (1) The purchase of a 15,000 acre parcel of endangered forest land, adding to existing protected areas. (2) The implementation of economically sustainable forest management practices on the newly acquired land parcel and an additional 120,000 acre parcel of protected forest. The project is collecting data to quantify the optimal balance between cost-effective carbon dioxide sequestration, economically sustainable forest yield and environmental protection. Expected benefits include an estimated 5.2 million tons of carbon dioxide being sequestered over the project life, in addition to providing economic benefits to the neighboring population.

Somewhat similar projects in Costa Rica include the Biodiversifix Forest Restoration Project, Project Carfix (sustainable forest management), Klinkifix (conversion, of low-carbon pastures to high-carbon forests,) and Ecoland (purchase of a tropical forest to avoid deforestation.) Reforestation projects in Russia (Rusafor), Poland (Krkonose Park) and Panama (Chirigui Province) are also proceeding, as are the Bottomland Hardwood Forest Restoration Project, the Pacific Forest Trust's Forests Forever Fund and the Western Oregon Carbon Sequestration Project (all three in the United States) and the Reduced Impact Logging Project in Malaysia.

2. Use of Non-Fossil Fuels

Carbon dioxide reductions can be achieved by fuel switching to solar, wind or hydroelectric sources. The Honduras Solar-Electric project, as an example, intends to replace kerosene lamps with solar powered lights in regions that have no electricity. Additionally, batteries are widely used in Honduras for radios, flashlights and televisions. The project also plans to implement battery-charging using photovoltaic cells, thus displacing electricity that was generated from fossil fuels. Preliminary sponsors include Enersol Associates (a not-for-profit organization) and Sandia National Laboratories. Enersol has received a few small grants, but not yet attracted sufficient funding from investors.

Similar projects include the 6.4 megawatt Aeroenergia Wind Facility Project, the twenty megawatt Plantas Eolicas S.A. Wind facility, and the twenty megawatt Tierras Morenas Windfarm Project (all in Costa Rica), as well as the sixteen megawatt Dona Julia Hydroelectric Project in Costa Rica and the fifty megawatt El Hoyo - Monte Galan Geothermal Power Project in Nicaragua.

3. Fuel Switching: Coal or Oil to Natural Gas

The City of Decin located in northern Bohemia (Czech Republic) will replace part of an aging, lignite/coal fired district heating system. The old coal-fired boilers of the Bynov District Heating

Plant will be replaced with more efficient natural gas, and internal combustion engines, including associated exhaust heat recovery equipment to produce hot water, will be installed. The project is expected to reduce greenhouse gas emissions and improve local air quality. The USIJI partners are the Center for Clean Air Policy, Commonwealth Edison Company, Inc. and Wisconsin Electric Power Company.

4. Miscellaneous

Wood wastes produced during sawmill and logging activities are commonly burned in open fields or dumped into rivers. The Bio-Gen Biomass Power Generation Project in Honduras intends to install a forty-five megawatt waste-to-energy plant, over several years, in three stages. The logic is that since the wood is currently burned, any electricity that will be generated will save the fuel currently used to generate power, and hence reduce carbon dioxide emissions.

The Rusagas: Fugitive Gas Capture Project in Russia is somewhat different from those above. Its intent is to reduce methane emissions at natural gas compressor stations by improving valve-sealing practices, and includes maintenance and training components.

POSSIBILITIES

A project that could meet the criteria for a USIJI project is one in which a thermal power plant that will emit carbon dioxide, and whose justification is solely financial, is combined with a reforestation program or an improved forest management component that provides sufficient carbon dioxide sequestration so that there is a net reduction in overall carbon dioxide emissions. This is the ultimate aim of the Rio Bravo and similar projects.

This type of project, while commendable, will not come close to providing the emission reductions possible by upgrading or replacing inefficient heating or power plants, or by substituting fuels. The following are typical carbon dioxide emissions for a single five-hundred megawatt thermal power plant, for each fuel type:

FUEL	CO2 EMISSIONS (tons/yr)
Gas	2,200,000
Oil	3,100,000
Coal	5,200,000

A forest can typically sequester approximately 0.7 tons of carbon per acre per year. It will thus be necessary to plant approximately one to two million acres of new forest to offset CO2 emissions from a single typical 500 megawatt power plant. Absent government mandates, this simply will not occur. Slowing the rate of deforestation throughout the world is a far more practical approach to carbon sequestration.

A more significant example of a realistic project that will reduce greenhouse gas emissions while providing benefits to a host country is the construction of a modern efficient power plant to replace an older less efficient station, as in the City of Decin. Increased efficiency will lead to a lower fuel

consumption, and hence lower carbon dioxide emissions. The amount of the reduction may possibly be registered and used as a credit, subject to meeting the Additionality requirement.

Another means of reducing carbon dioxide emissions is the replacement of coal by oil, or even better with natural gas. Replacing oil with natural gas will, likewise, reduce carbon dioxide emissions. The amount of the reduction may then be registered and used as a credit, subject again to meeting the Additionality criteria. This is another goal of the City of Decin and similar projects.

Electric power project developers will undoubtedly feel more comfortable, and have substantial experience, with plant upgrading and fuel-switching then with planting trees.

REALITIES

Unless many thousand megawatts of new electric generation capacity are installed, hundreds of millions of people throughout central and western China, central India and Pakistan, as well as much of Africa and the Mideast will be denied the higher living standards they might otherwise have, and are increasingly demanding. The reality is that the major alternate, nuclear power, is not economical and very difficult to site throughout the world. Hydroelectric power generation is a viable option in certain situations, but is fraught with environmental and social problems, often including resettlement of large local populations. Other options such as solar or wind power will never progress beyond small niche uses; fossil fuel fired generation is the only practical way available to meet the massive additional demands that need to be satisfied. And combustion of fossil fuels inescapably produces carbon dioxide.

Studies by others have confirmed Dynalitics' preliminary cost estimates that removing carbon dioxide from flue gases will increase electric generation costs by thirty to fifty percent; an amount that would be devastating to most economies.

CONCLUSION

Dynalitics has concluded that, with the possible exceptions of generation efficiency improvements and/or fuel switching, there is nothing that individual electric power project developers, or even the private electric power industry, can do that will have even a faintly noticeable impact on carbon dioxide emissions. Any meaningful reductions will arise from governmental forces such as carbon taxes, legislated emission caps, insistence on nuclear power, and the like. These will, of course, bring strongly negative economic impacts to power generation, and particularly affect the newly emerging countries. Better demand side management and government-mandated efficiency standards for major electric consuming devices such as refrigerators, motors, compressors and light bulbs can certainly help to some extent.

A MORE PROMISING FOCUS

Fuel usage for power generation and transportation are approximately equal in the industrialized countries, with their large number of private automobiles and trucks. On a more positive note, therefore, Dynalitics believes that forestalling emission increases from automobiles and trucks by

emphasizing efficient low-cost mass transportation in the industrialized countries, as well as those with emerging economies, can be a major step to reducing greenhouse gas emissions. This appears to be far more practical from economic, political and timing viewpoints.

Additional information on Global Warming projects is available from Dynalytics Corp.

ABBREVIATIONS

UFCMP	Utility Forest Carbon Management Program
UNFCCC	The United Nations Framework Convention on Climate Change
USJI	The United States Initiative on Joint Implementation

