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FINAL REPORT

cc: Registry
Ms. Puff

NIGERIA CLEAN DEVELOPMENT MECHANISM (CDM) PHASE II REPORT

Submitted to:

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION (UNIDO)

Presented By

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Chapter i: Table of Content

5.0 PORTFOLIO OF POTENTIAL PROJECTS

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Chapter iii: List Of Abbreviations

AGO	Diesel
BOO	Build-operate-own
BOT	Build-own-transfer
CDM	Clean Development Mechanism
CHP	Combined Heat and Power
DFI	Direct Foreign Investment
ECOWAS	Economic Community of West African States
ESCOS	Energy Service Companies
GHG	Greenhouse Gas
IPP	Independent Power Producer
IPR	Intellectual Property Rights
ISP	Internet Service Provider
IT	Information Technology
KWh	Kilowatt-hour
LPFO	Low-pour fuel oil
LPG	Liquefied Petroleum Gas
MW	Megawatts
NEPA	Nigerian Electric Power Authority
NOTAP	National office for Technology Acquisition and Procurement
NIDB	Nigerian Industrial Development Bank
ROW	Right of way
UNIDO	United Nations Industrial Development Organization
UNFCC	United Nations Framework Convention on Climate Change
UNCED	United Nation Conference on Environment and Development
VAC	Vapor Absorption Compression
WAPCO	West Africa Portland Cement Plc.

Chapter iv: Executive Summary

Chapter 1: Team Work and Dialogue with Stakeholders

At the commencement of the Phase II, six experts covering the areas of; investment/financial analyses, energy, technology transfer, legal, information systems and Comfar III expert, were required to join the national expert to undertake some of the detailed studies that are foreseen in the project and to assist the national consultant with the dialogue with the national stakeholders.

In executing the project activities in Phase II, the international experts, national team which is made up of the national consultant and the six experts and the various categories of stakeholders held several meetings, on-line conference, seminars and a workshop. At these for a various CDM issues were discussed. In some of such meetings, planning towards the establishment of an enabling industrial and financial environment (policy issues) for the smooth implementation of the CDM were discussed. In addition to this, strategies towards the identification and packaging of projects for interested participating companies while evaluating the possible barriers that will constrain the implementation of these projects were achieved.

Chapter 2: Barrier Review

The ability of countries in Africa and other non-Annex 1 Nations to benefit from the CDM as included in the Kyoto Protocol can be hindered by some factors and issues that have been described in this study as barriers. Some of the critical goals of this UNIDO intervention include the identification of such barriers, and the development of strategies to completely remove or reduce their negative impacts to the barest minimum. Barriers to the successful development of CDM projects exist as a result of: technology transfer; legal and legislative; energy and environment information; investment and financial issues.

2.1 Technology Transfer

Technology transfer is the active process of proliferating technology across the border of two entities. Nigeria is a signatory to the Kyoto Protocol and as such, no policy barrier to CDM import to the country currently exists. To accelerate the acquisition of CDM technologies however, the manpower training and the required practical skills development component must precede the start of the CDM projects.

Technology as used in this study is not just the product that is bought and sold it also refers to the procedural and organizational arrangements for carrying out transformation. This can further be explained by the concept of cleaner technologies which focus on optimal products and processes for: pollution prevention; waste reduction; emission reduction and new products that satisfy currently unmet needs.

Technology transfer for CDM should not be conceived as autonomous or parallel to domestic capability development but should complement domestic technology development efforts. Technology acquisition alone is not sufficient for meaningful technological development but must be looked at in terms of its being eventually absorbed and finally diffused to end users in the country. It is conceivable that acquisition of CDM technology will occur as a foreign direct investment (FDI) into the country.

Stability, effectiveness and capability of institutions, saddled with the responsibility of managing technology acquisition such as National Office for Technology Acquisition and Procurement (NOTAP), are also an issue in the evolution of sound technology transfer track for CDM projects. Our evaluation of the existing protocols used by NOTAP to screen technology acquisition may be inadequate to handle CDM technologies and may therefore impair smooth transfer if NOTAP capacity in this regard is not strengthened.

2.1.1 Identified Technology Transfer Barriers

The outcome of the implementation of the questionnaire prepared by the experts and administered in each of the companies were utilized to distill out pertinent technology transfer barriers which are summarized below:

2.1.2 Cadbury Nigeria Plc.

According to the response obtained from Cadbury, the company believes it needs CDM: to minimize GHG emissions; and to improve factory energy efficiency and overall company management standards. The most desirable type of CDM in Cadbury is the transfer of energy equipment and not, new production processes or minor technical changes to existing system. In order to be able to achieve a successful CDM technology transfer, the company is of the opinion that they will need: skill and knowledge transfer and formal training on CDM and the technology to be adopted. It is believed that CDM will improve the efficiency of energy input to their production processes and it is expected that foreign direct investment (FDI) will be one of the major sources of funding for the projects. The company believes that availability of foreign direct investment and aggressive development of human capital will enable them have smooth CDM technology transfer.

Given the above summary of the responses obtained from Cadbury Nigeria Plc on the technology transfer issues for CDM, the following barriers were identified:

- The most important technology transfer barrier is lack of financial capability;
- Closely following this is the weak external institutional linkage, especially as it relates to international conventions like the Kyoto Protocol;

- In addition, there is a weak understanding of the structural details of CDM, which will be crucial to the ability to identify, design, negotiate with technology owners--- very important activities that will take place during the process of developing CDM projects;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;
- Very uncertain and not too clear national policy on global climate change issues.

2.1.3 Nestle Nigeria Plc.

The responses obtained from this company, also a food manufacturing company, indicate that its interest in CDM is dictated by its desire to reduce energy usage per ton of product in its manufacturing facilities. To achieve this, the company believes it will need both new production processes as well as specific equipment transfer to replace or compliment existing ones.

Key factors considered as very important to enhance the transfer of CDM technologies to the factory of Nestle Nigeria Plc. include: grass root understanding of the CDM concept; stabilization of the exchange rate; financial incentives to invest in CDM; and elimination of taxes and duties on CDM goods. Differential fuel subsidy to industry and the general public was considered to be of only low secondary importance to the promotion of the adoption of CDM technologies at least at Nestle. For the success of CDM adoption in the company, training on the benefits and techniques of energy efficiency at all levels of the production system is considered as important.

Given the summary above, the following are the critical technology transfer barriers were distilled as pertinent to Nestle Nigeria Plc.:

- Ability to muster adequate finance is the most serious technology transfer barrier;
- Lack of access to information base on CDM technology, especially as it relates to technology details and system operations training;
- Weakness in the ability to select among competing alternatives due to lack of adequate knowledge and information;
- Inadequate skills on negotiations and bargaining for CDM technology acquisition;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;
- Very uncertain and not too clear national policy on climate change issues.

2.1.4 Tower Aluminum Extrusion Company

According to the response received from Tower Aluminum, the company needs CDM to minimize GHG emissions from their factories and also to improve energy efficiency in their manufacturing operations. They are also of the opinion that directs foreign investment from CDM technology supplier countries, as a compliment to what can be mustered locally will be a necessary condition for the success of CDM technology transfer to their company.

The following were the identified barriers as the technology transfer issues in Tower Aluminum Extrusion Company:

- As in all other cases, financial incapability is the most serious barrier that can constrain the success of CDM technology transfer at Tower Aluminum;
- Not having adequate access to relevant technical information to assist the company in making technical decisions on CDM projects is another barrier;
- Inadequate knowledge on CDM technologies also constrains the ability to evaluate competing technologies;
- For the same reason, inadequate skills on negotiations and bargaining for CDM technology acquisition is another barrier to smooth CDM technology transfer;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;
- Very uncertain and not too clear national policy on climate change issues.

2.2 Legal Barriers to the Adoption of CDM Technologies in Nigeria

Nigeria has always shown keen interest in the international co-operation for the protection of the environment as evidenced in the numerous international agreements to which she is party. Nigeria at the United Nations Conference on Environment and Development (UNCED) of 1992 in Rio de Janeiro, Brazil was amongst the states that signed the United Nations Framework Convention on Climate Change (UNFCCC).

CDM is regarded as a new co-operative mechanism towards the attainment of global sustainable industrial development. A non-Annex 1 country like Nigeria is therefore required to ensure that the enabling environment is provided for CDM implementation. Apart from technical knowledge, the legislative environment under which the CDM activities will operate is very crucial to its success in a developing nation like Nigeria.

2.2.1 National Legislative Framework and Policy

Nigeria ratified the UNFCCC in 1994. However, the national treaty-making process which requires that "no treaty between the federation and any other country shall have the force of law except to the extent to which such a treaty has been enacted into law by the National Assembly." This invariably means that a domestic

law would still have to be made to enable effect to be given to the Convention in Nigeria before its elements/obligations can be considered or incorporated into relevant policies and regulations for implementation. Ratification per se does not make the UNFCCC automatically a domestic law in Nigeria. Nigeria is yet to enact any legislation specifically for the UNFCCC. What it has established, is a UNFCCC National Committee (coordinated by the Ministry of Environment as the national Focal Point), with representatives from Federal Ministries and Agencies relevant to climate change. This body has been mandated to advise the Federal Government of Nigeria, on the formulation of policies and issuance of guidelines for achieving the objectives of the Convention.

With the expected complexity of CDM implementation even when the simplest of the mechanisms that is being looked at is adopted, a regulatory framework would need to be put in place to streamline CDM project activities and to send clear signals about the country's CDM goals, in accordance with the mechanism eventually adopted. In fact, an appropriate legislation, to regulate CDM implementation may be the best option for the Government. Such legislation would have to incorporate the elements of the UNFCCC and the Kyoto Protocol into its provisions.

2.2.2. General Legal Barriers to the Implementation of CDM in Nigeria

The major legal barrier to unconstrained implementation of CDM projects in Nigeria was identified as ***the absence of specific legislative/regulatory framework*** to govern the mechanism, which investors as well as focal recipients can interpret to distill out benefits and costs.

An equally important legal barrier to CDM implementation in Nigeria is the ***absence of an enabling legal framework for proper linkages between government ministries and agencies*** e.g. Ministries of Environment, Industry, Science and Technology, Finance and Agencies such as Energy Commission of Nigeria, Energy Research Institutes etc. for handling CDM issues.

The ***non-complimentarity of the Federal and State administrative and legal framewor*** was identified as a barrier to CDM. Section 20 of the 1999 constitution provides that environmental protection is one of the fundamental objectives and directive principles of the Nigerian state policy. To this extent both the National and State Assembly can make laws on the environment. CDM projects would generally require approvals from not only the Federal but also from State authorities.

2.2.3 Barriers in Existing Legislations

2.2.3.1. Laws Relating to Industrial Energy Efficiency

Projects that promote energy efficiency improvements in industrial facilities are known to lead to reductions in GHG emissions. As such they are regarded as climate-friendly. A major industrial energy is power. By virtue of the National Electric Power Authority (NEPA) Act, NEPA has the monopoly to generate, transmit and distribute electricity in Nigeria and this monopoly has inevitably led to unreliable supply of grid power to industries.

Industrial operators in Nigeria have had to rely on stand-by generators to cater for essential power supplies during periods of power failures from the grid. These generators are very inefficient and as such, a candidate area to achieve improvement in industrial energy supply is in electricity supplies. Bearing in mind the availability and capability of generating power via more efficient systems using natural gas, the monopoly position of NEPA under its enabling act has been a legal barrier to the success of this clean energy route.

2.2.3.2 Laws Relating to Technology Transfer

The regulatory framework for the transfer of these technologies is embodied in the mandates of the National Office for Technology Acquisition and Promotion (NOTAP). NOTAP is empowered by its 1979 Act to carry out inter alia, functions of ensuring the acquisition of, with the best terms and conditions by Nigerian, foreign technologies.

A potential legal barrier to the acquisition of CDM technologies is the lack of provisions in the NOTAP Act considerations for environmentally sound technologies as envisaged in under section 4 of the UNFCCC. NOTAP Act does not make sustainability a consideration neither is environmental protection provided for in its policy framework.

2.2.3.3 Institutional Barriers to the Preparation of CDM Project Agreements

CDM project agreements should be drawn-up and negotiated by Nigerian lawyers who are sufficiently knowledgeable in: industrial processes; climate change issues, especially GHG emissions; UNFCCC, Kyoto Protocol, and CDM issues; technology transfer arrangements; etc. This will facilitate the incorporation of key elements in the legal documents that can promote the global and national climate change goals.

Current knowledge base on CDM issues among government and private sector lawyers in Nigeria is very low. Not many of these lawyers are conversant with the necessary details of the UNFCCC, and its

mechanisms. This is an institutional weakness, which would constitute a barrier to the smooth transfer of CDM technologies.

2.2.3.4 Legal Barriers Specific to the Recipient Companies

An analyses of the completed questionnaires showed that similar conclusions could be reached for each company as far as pertinent legal issues are concerned. The findings from the analyses are summarized below:

- In each of these three companies, the Legal Advisers have only passing knowledge of climate-change issues;
- They have very limited knowledge of the legal implications impact and indeed the benefits of CDM projects in their respective companies;
- Because of this sparse knowledge base, negotiating technology transfer agreements that will arise from CDM project implementation will be hampered;
- Even if such companies retain the services of private solicitors, an institutional barrier will still exist when in-house legal personnel do not possess the requisite knowledge about CDM.

2.3 Information System Barriers

Availability and adequate access to information is one of the very necessary ingredients for a successful CDM program in any country. In this age of information super-highway, access to up-to-date information on technology has now been put at the disposal of most of mankind. This it is believed can accelerate diffusion of technology information and therefore enhance the improvement in living standards in almost all the countries of the world.

The World Wide Web system is now one of the most important global systems for the exchange of different types of information. The ability of a recipient of CDM technology in a non-Annex 1 company to succeed in the technology transfer process, to be able to adapt the technology to suit its purposes and to assimilate the technology for improved services in the future will be strongly dependent on how accessible necessary information is to it. This is a direct function of how accessible the information super-highway is to the recipient.

2.3.1 Information Technology Situation at Cadbury Nigeria Plc.

More than 60% of the slightly over 200 professional staff at Cadbury Nigeria Plc are computer literate. In the recent past, there have been efforts on the part of the management of the company to encourage more of its staff to become computer literate.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company can boast of more than three

professionals with expertise in each of the following areas: data interpretation and analyses; database management; computer programming; web administration; and system/network administration.

Unlike other companies, access to information on climate-friendly technologies was ranked low as against other barrier issues in Cadbury Nigeria Plc. This is a very good indicator to the fact that information system issues as far as climate change is concerned will not be a major barrier to the smooth transfer of CDM technologies in the company.

2.3.2 Information Technology Situation at Nestle Nigeria Plc.

Between 40-60% of the slightly over 100 professional staff at Nestle Nigeria Plc are computer literate. In the recent past, there have been efforts on the part of the management of the company to encourage more of its staff to become computer literate.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company can boast of more than three professionals with expertise in each of the following areas: data interpretation and analyses; database management; computer programming; web administration; and system/network administration.

Information on climate-friendly technologies was considered to be an important barrier in Nestle Nigeria Plc. This is an indication of the fact that information system issues as far as climate change is concerned may be a major barrier to the smooth transfer of CDM technologies in the company.

2.3.3 Information Technology Situation at Tower Aluminum Extrusion Company

The total number of professional staff at Tower Aluminum Extrusion Company number about 500. Only between 10-20% are computer literate. In recent times, the company has been making efforts to encourage more staff members to be computer literate.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company informed us that they have professionals with: expertise in data interpretation and analyses; in database management; in computer programming; in web administration; and system/network administration.

The company concurred with the need for capacity building for enhancing the electronic information exchange and dissemination for CDM. For this capacity building, the company listed improved communication facilities and stable electricity supply, seminars for senior executives and technology transfer

as very important capacity building actions that can enhance the transfer of CDM technology in Tower Aluminum Extrusion Company.

2.4 Finance and Investment Barriers

Implementation of CDM projects in the selected companies will definitely lead to improvement in energy efficiency, reduction of GHGs and cost effective production systems. The implementation of these projects will require substantial capital inputs, a commodity in short supply in all the companies where normally, investment decisions are always made based on traditional criteria such as: returns on investment; payback period; etc

The following were identified during the course of this study as pertinent financial and investment barriers to CDM projects in Nigerian industries:

- Poor availability of local investment funds for industrial development projects;
- High interest rates on locally available funds;
- High exchange rates of the local currency relative to convertible currencies;
- Absence of Government fiscal incentives to promote the availability of funds for industrial development projects;
- Very uncertain investment environment;
- Inadequate knowledge on CDM Investment packaging in Nigerian industries.

2.5 Industrial Energy Efficiency Related Barriers

Generally, it is an acceptable fact that most industrial energy efficiency improvement activities are qualified to be regarded as CDM projects because not only do these projects lead to savings in specific energy consumption, they also, in most cases, lead to significant reduction in GHG emissions, a primary goal of the Kyoto Protocol.

Many Nigerian industries have considered and actually implemented energy efficiency improvement projects in their facilities. These projects has however not been a panacea in most manufacturing industries in Nigeria. Among the three companies that participated at this phase of the project, only one, Cadbury Nigeria Plc., presented us with cogent information on previous energy efficiency improvement projects implemented within their facilities while all of them are aware of the advantages of energy efficiency in corporate profitability and also knowledgeable on the technical options that are available to them to achieve better industrial energy efficiency.

The conclusion from the survey corroborates previous views of some of our study team: that benefits that can accrue to industries in Nigeria from energy efficiency improvement projects is not being tapped (neither has it been adequately tapped in the past) to the optimum as a result of mitigating barriers. Some of these barriers include:

- Relatively low energy prices, that does not provide adequate incentive for energy efficiency improvement investment;
- Low exchange rate of the Naira, that serves as a disincentive for energy efficiency improvement investment;
- Inadequate capacity in Nigerian industries for the identification, design, implementation, operation and maintenance of energy-efficient technologies;
- Inadequate on-line energy monitoring facilities which does not promote energy audit culture;
- Lack of adequate support from decision makers in Nigerian industries for energy efficiency improvement projects, due to the fact that priority is focused on "bread and butter" issues;
- Inappropriate public policy regime that does not promote national energy efficiency;

Chapter 3 Strategy

3.1 Technology Transfer Barrier Removal Strategies

- Creation of an enabling environment through the: enactment and enforcement of environmental regulations; introduction of promotional market mechanisms; introduction of investment incentives; streamlining of the legal framework for technology acquisition, etc.
- Creation of a National Information System for adequate dissemination of technical and non-technical information on CDM.
- Creation of a CDM Technology Incubation and Dissemination Center to facilitate the development of domestic CDM technology capability.
- Development of the capacity of NOTAP as it relates to knowledge on CDM technologies.
- Institutional Capacity Building and strengthening on CDM activities in Government especially at the focal point (Federal Ministry of Environment).
- Training and re-training of manpower that are involved in CDM in Nigeria from industries and the public sector.

3.2 Strategies for the Removal of Legal Barriers

The following strategies will eliminate or reduce the legal barriers identified in a previous section:

- Immediate enactment of a legislation to give effect to the ratification of the UNFCCC in 1994 by Nigeria;

- A national framework document with all its enabling tools must be immediately put in place to streamline and govern CDM activities in Nigeria;
- Legal backing must also be put in place for a body that will have the national mandate to manage all issues arising from the design and implementation of CDM projects in Nigeria;
- The existing NEPA Act must be completely overhauled to strip it of all the traces of monopoly;
- The recently enacted legislation which allowed the involvement of IPPs in the power sector, should be strengthened to allow more participation of IPPs in power generation but also the promotion of Energy Service Companies (ESCOs) in energy generation;
- The NOTAP Act should be amended to include sustainability issues in its policy decisions on technology transfer to promote acquisition of CDM technologies;
- Strengthening of the institutional capacity at NOTAP to identify and promote the transfer of clean technologies.
- Provisions of industrial/intellectual property rights (IPRs) should be built into the amended NOTAP Act;
- Strengthening of the capacity of Lawyers in the private sector to handle legal issues relating to the adoption of CDM technologies in Nigeria.
- Institutional capacity at the Federal and State Ministry of Justice will also have to be built;
- Development, at the manufacturing industry level, the capacity of the legal department to handle climate change issues in general and CDM technology transfer issues specifically.

3.3 Strategies for Removing Information Related Barriers

The following are the emerging strategies that can be used to reduce and in some cases completely eliminate some of the information related barriers that were identified:

- Acquisition of literature on various issues of CDM to set up a CDM Library in each of the participating industry, and at the UNFCCC focal point, the Federal Ministry of Environment;
- The internet connectivity at each of the participating company will be strengthened through the implementation of connection to a wireless ISP;
- Promotion of International Seminars and Workshops on CDM Issues in Nigeria;
- Each of the participating manufacturing industries and other interested stakeholders will be encouraged to participate in discussions and reporting and information dissemination via a specialized CDM website that will be developed as an output of this capacity building project;
- Basic and specific training on information technology, internet services and other related subjects will be carried out for participants drawn from selected stakeholders, including manufacturing industries, government ministries and NGOs, academic institutions etc.

3.4 Strategies for Removing Finance and Investment Barriers

The key strategies already identified and currently being further studied include:

- The financial sector in Nigeria should be consciously organized to provide venture capital to promote CDM projects in Nigeria;
- Capacity building programs to develop CDM investment planning and management capabilities of the finance sector is crucial to the success of CDM projects in Nigeria;
- Financial Institutions operating in Nigeria should be given incentives for funds channeled to CDM projects;
- Recent legislation promoted by the Federal Government to set apart 10% of their after tax profit for investment in SMEs should be amended to promote investment in CDM projects;
- Government must put in place fiscal policies to promote lower interest rates for medium to long-term loans obtained for CDM projects. This will also aid financial additionality considerations for these projects, since without such the projects will not be implemented;
- The financial sector in Nigeria should develop capabilities to participate in the emerging global carbon emission trading.

3.5 Strategies for Removing Barriers Arising From Industrial Energy Efficiency Improvement Capacities

The mitigating strategies to the barriers summarized above are as follows;

- Implementation of a program to strengthen metering facilities, especially for energy, in the selected manufacturing facilities;
- Project implementation should also cover initial and comprehensive energy audits at each of the selected facilities
- Workshops and training seminars on opportunities for energy efficiency improvements in manufacturing industries in Nigeria will be promoted with practical work-through audits;
- Government should put in place legislation to create incentives for energy savings investment in Nigeria industries;
- Training on CDM issues such as: additionality ; baselines; governing mechanism; validation and certification of emission reduction; and monitoring, should be regularly organized, especially during the prompt start period of CDM activities.
- The proposed National Energy Policy should incorporate components to promote industrial energy efficiency improvement.

Chapter 4 Programme

4.1 Nigerian CDM Capacity Building Program

4.1.1. Information Exchange And Stakeholders Awareness Program

The objective of this component is to develop and implement a framework to promote the dissemination of information on CDM and Climate Change Issues to relevant stakeholders.

This objective shall be achieved through the implementation of the following activities:

a. A National Workshop will be held to disseminate the outputs of the UNIDO CDM Capacity Building Project to a wide stakeholder audience at the end of the Phase II Activities;
b. Establishment and the effective operation of the National CDM Library
c. The Office of the Focal Point serving as the Secretariat of the National CDM Committee will acquire relevant CDM/Climate Change Literature and publications and set this up in the National CDM Library;
d. Implementation of Training Seminars for Senior Managers from Industry on Industrial Energy Efficiency and their linkage to CDM;
e. Internet connectivity facilities will be put in place at the CDM Secretariat and a Website on Industry, Climate Change and CDM will be developed and made operational;
f. An Editorial Board for a Quarterly CDM and Climate Change Newsletter will be put in place, and shall come out with the first edition of the Newsletter not later than 3 months after inauguration;
g. A Technical Sub-Committee of the National Committee will be put together to prepare a draft of a National CDM/Climate Change Strategy Document. The draft document should be ready not later than 3 months after the inauguration of the sub-committee;
h. The internet connectivity and access of the three stakeholder companies will be strengthened;
i. A computerized National CDM information System will be developed. Information that will be incorporated within the database will include: National Communications; specific sector emission inventories; local and international climate friendly technologies; etc.;
j. Develop training packages on Industrial Energy Efficiency Improvement projects and its linkage to CDM;

4.1.2. Capacity Building

The key objective of this component will be to eliminate some of the barriers identified in this project through focused implementation of targeted sub-programs, covering: manpower development and capability enhancement;

strengthening and sometimes outright development of institutional infrastructure; and creation of facilitating enabling environment.

The following activities will be carried out under this program:

a. Stemming from the inception workshop, an extensive consensus building dialogue will be carried out among identified stakeholders to determine the best composition of members for the National Committee;

b. Inauguration of the National Committee with a clear term of reference for their activities;

c. Deliberation of the National Committee at regular intervals on crucial CDM and Climate Change issues. They will also serve as the clearinghouse for all CDM project activities in Nigeria;

d. Establishment and equipping of the Climate Change Focal Point Office;

e. Training Workshop on CDM and Climate Change Issues covering: Project Eligibility; GHG Emissions; Determination of Emission Baselines; Sustainable Development Indicators; Additionality; Project Validation, Verification, Certification and Monitoring; CDM Project Cycles; CDM Implementation Models; etc.;

f. Training Workshop for Engineers from Industrial Stakeholder's Facilities on: CDM and Climate Change Issues; CDM Project Identification and Eligibility; Project Design; Techno-Economic Feasibility; Selection of Climate Friendly Equipment and Technologies; Project Funding and Implementation; Industrial Energy Efficiency;

g. Training Workshop for Middle to top Management Personnel from Industry, Public Sector on CDM focusing on issues such as: Investment Promotion for CDM; Marketing of CDM projects; Contractual and Legal Issues Associated with CDM Projects; Negotiating CDM projects; Acquisition of CDM Technologies;

h. Training Course on Energy Auditing, Industrial Energy Efficiency Techniques and Climate Friendly Technologies to be held as part of a recurrent program for training and certifying Energy Auditors

i. Training Workshop on Financing CDM projects and Global Carbon Emission Trading will be held for participants drawn from the financial sector of the economy;

j. A Team drawn mostly from NOTAP and relevant Federal Ministries and Agencies, assisted by UNIDO, will evaluate the existing enabling document of NOTAP to explore how it can be strengthened to carry out its technology acquisition mandate for CDM. The team will also recommend infrastructural strengthening needed to enhance performance of NOTAP;

k. The recommendations of the NOTAP Study Team will be implemented after acceptance by the Federal Government of Nigeria;

l. A CDM-Climate Friendly Technology Incubation Center will be established to: pioneer local

research and development into such technologies; promote industrial energy efficiency improvements; act as the custodian of the industrial energy audit facilities to be acquired; organize the training and certification of Industrial Energy Auditors; provide linkage on CDM and Climate Friendly Technology research to local and international academic and research institutions;

m. The Technology Incubation Center will introduce and implement programs to promote the emergence of Energy Service Companies (ESCOs);

n. A Technical Committee of the National Committee will be established to evaluate all potential fiscal and monetary incentives that can be put in place by government to encourage efficient use of energy and CDM projects. The report of the committee will be presented to different levels of government to seek legislative and executive support for the schemes;

4.13. CDM Policies, Laws, Regulations And Legislative Framework

The objectives of this component can be summarized as follows: the legislative formalization of the ratified UNFCCC; the legislative formalization of the Kyoto Protocol when ratified; strengthening and amendment of existing acts and legislation and promulgation of new ones, to promote climate friendly and industrial energy efficient technologies.

The activities that will lead to the achievement of the above objectives include:

a. A Legal Framework Sub-Committee will be put together by the National Committee to evaluate actions that must be taken to incorporate the UNFCCC protocols and mechanisms into the national laws. The Sub-Committee will also put in place a mechanism to obtain legislative support for the promulgation of a Federal Act to give backing to the UNFCCC that was ratified by Nigeria in 1994. In addition, they will prepare the ground for similar activities to take place when and if the country signs and ratifies the Kyoto Protocol;

b. Lawyers serving in this Sub-Committee, drawn mainly from the Federal, some State Ministries of Justice and from Private Practice, will work with the NOTAP committee to ensure that the legal drafting of an amended NOTAP Act is effectively carried out;

c. The Legal Framework Sub-Committee will collaborate with the Technical Sub-Committee of the National Committee to evaluate the structure and content of a National Bill to promote: industrial energy efficiency; industrial CDM projects; and the adoption of climate friendly technologies by Nigerian industries. The outcome of this work will form the basis of the legal drafting of the energy bill, which will be presented to the legislature and the executive to enhance smooth approval.

4.1.4 National CDM Project Portfolio

The objective of this component is to facilitate the identification, formulation, design, and marketing of industrial CDM projects.

The following activities will facilitate the achievement of the objectives reiterated above:

a. A Survey Evaluation of Potential CDM Projects in the Nigerian Manufacturing Sector. This will be a proliferation of what we have done so far to other industrial stakeholders, with the main goal of identifying candidate projects for inclusion into the National CDM Portfolio;
b. Assessment of Project Sustainable Industrial Development Indices;
c. Preliminary Design (Technical Specifications) of Identified Projects;
d. Estimation of Baseline Emissions and Emission Reduction Potentials of the Projects;
e. Formulation of Preliminary Validation, Verification and Monitoring Protocols for each Project;
f. Techno-Economic Analysis of each Identified Project;
g. Preparation of Bankable Proposal for Each CDM Project;
h. Selection of the Demonstration Project, and Identification of Potential CDM Investors;
i. Negotiation of CER, Unit Value of CER and Project Financing with the Investor;
j. Comprehensive Validation, Preparation of Verification and Monitoring Protocols for the Demonstration Project;
k. Registration of the Demonstration CDM Project;
l. Detailed Design, Equipment Procurement, Installation and Start-up of the Demonstration Project;

j. GHG Emission Monitoring.

4.2 Regional Program Components

4.2.1 Capacity Building

The objective of this component will be to strengthen areas within the CDM project cycle that has been identified as likely to act as a barrier to the successful promotion of CDM projects from the region.

Towards the achievement of the regional capacity building objective, the following activities shall be implemented;

a. UNIDO RIDC as the Regional Focal Point on Climate Change and CDM will be inaugurated with a 3-Day Meeting and Workshop that will be attended by the Members of the 2 Sub-regional Committees and other Stakeholders in the Sub-region;
b. Development of a Website on Climate Change and CDM Activities in the Region. This website shall be hosted at an Internet facility to be located at the Focal Point Offices.
c. The Sub-Regional Committees will meet three times a year and twice jointly, with the Focal Point coordinating;
d. The GHG Emission Inventory Program will commence in each sub-region;

e. The development of a Database of Climate Friendly Technologies will be carried out;
f. A Quarterly Newsletter on CDM and Climate Change Activities in Industries in the Region will be Published;

4.2.2 CDM and Climate Change Issues

The objective of this component is to have in place, a minimum of two demonstration projects in the region. This will aid the learning by doing approach, which is critical to the success of the capacity building program.

The following activities will facilitate the achievement of the objectives reiterated above:

a. Implementation of a minimum of two demonstrations CDM projects in the sub-region. The implementation regime will cover: identification of project; preliminary engineering design (this will include baselines, additionality issues, and emission reduction certification); project feasibility studies; project validation; project certification; detailed engineering; tendering for facility components; procurement; installation and commissioning; project monitoring.
b. Organization of a workshop in each of the two sub-region to disseminate ideas and outputs of the UNIDO CDM Capacity Building Project;
b. Preparation of a Regional CDM Project Profile Document. This will cover the demonstration project as well as other identified projects;
c. Implementation of a regional Network on CDM;
d. Setting up of a Regional Sustainable Industrial Development Fund. This will be achieved via discussions with bilateral and multilateral organizations and agencies;
e. Assess the status of standards, norms and procedures that are applicable to CDM and climate change issues, collate these and formulate a coherent and harmonized regional framework to promote synergy among nations of the region.

4.2.3 Sustainable Technology Transfer

The objective of the program item includes: Access to and ability to adapt and adopt climate friendly technologies; dissemination of the technologies; and maintenance of equipment.

Activities within this program item include:

a. Collation of information on available and relevant cleaner and sustainable CDM industrial technologies and preparation of a database directory for dissemination purposes within the region;
b. Collation of information on existing national technology acquisition program in each country, identifying areas where they can be strengthened towards the promotion of regional synergy for CDM Projects.

c. Training of selected regional experts in the areas of: technology acquisition and adaptation; as well as project negotiation, validation, verification and monitoring.

Chapter 5 Portfolio Of Potential Projects

Questionnaires and direct discussions were utilized to identify potential CDM projects in each of the Companies selected for this project phase. The summary of each of the projects are presented as follows:

5.1 Potential CDM Projects at Cadbury Nigeria Plc.

5.1.1 Trigeneration

The global objective of the Trigeneration as a CDM project in Cadbury as conceptualized in this study can be summarized as follows:

- To replace the current generation of electric power, steam, and chilling with a more efficient system, utilizing CHP linked with a vapor absorption cooling system.
- To put in place such a system that will be operational by 2003, utilizing natural gas as fuel and having a minimum of 15 years life span.
- To incorporate cost effective redundancy into the system being recommended, for example, current installed power capacity in the factory is about 7.3 MW. Peak power demand in 2000 was 3.648 MW.
- Cadbury will still like to be self-sufficient energy-wise, especially if the efficiency of the national supply chain does not improve from historical records. In this respect, the client will prefer a system that is not dependent on energy imports.

The power and heat matching calculations were carried out on three Combined Heat and Power (CHP) alternatives namely, Steam Turbine, Reciprocating Engines, and Gas Turbines. The following conclusions were reached:

- If steam turbines were employed, a CHP system having a capacity of a minimum of 12 MW would be adequate to supply heat power and chilling requirements of the factory even up to the year 2018;
- If a gas turbine or a reciprocating engine is utilized, system capacity that will satisfy factory steam needs up to the year 2018 will be in the region of between 75-95 MW capacities with a large potential for power export;
- The power capacity of the reciprocating engine or gas turbine that will match factory energy needs can be reduced, if proper designs of heat recovery system beyond those normally incorporated into these technologies are included in the specification. This may however reduce the price advantage of these technologies over the conventional steam cycle;

- Our calculations showed that a 5 MW capacity for example, of either a reciprocating engine or a gas turbine would yield a total steam generation of about 4110 Kg/h. This is even not adequate to meet the base year (2000) steam requirement. Tripling the power generating capacity to 15 MW will enable the satisfaction of base year steam requirement, but not the peak steam demand;
- A reduced power capacity can also be achieved by coupling the reduced MW to some of the existing steam production facilities, to satisfy station steam requirements;

5.1.2 Optimization of Energy-Use Efficiency in the Plant

The installation of a trigeneration system at Cadbury is a supply side reaction to the need to improve energy efficiency in the manufacturing plant. The end-use utilization of energy is also a critical source of energy efficiency degradation in a manufacturing plant. When energy efficiency is improved, not only is fuel savings, which is translated to monetary savings, achieved, but reduction in GHGs are also achieved.

5.1.3 Other Potential Projects

5.1.3.1 Steam Use Efficiency Improvement Projects

The aim of this efficiency improvement projects shall be focused on:

- Improvement in the efficiency of the steam distribution network in the factory;
- Improvement in condensate recovery efficiency;
- Improvement in steam metering.

All these will lead to a reduction in fuel use per KG of steam produced, hence an improvement in factory energy efficiency and therefore a reduction in GHG emissions.

5.1.3.2 Power Factor Correction

Electricity is the other very important energy input in the factory of Cadbury Nigeria Plc. Improvement in the efficiency on the generation side will be achieved with the introduction of the trigeneration system. A potential CDM project that has been identified at this stage of the project is focused on improving current level of the factory's power factor. Factory power factor is currently averaging about 80%. Improving this to above 90% using available technology is a feasible CDM project.

5.1.3.3 Installation of a Computerized Energy Management System

Facilities for monitoring energy efficiency in both the generation and the utilization side of energy at Cadbury Nigeria Plc. facilities are currently very poor. Currently, methodologies to facilitate the estimation

of GHG emission reduction that can be attributable to a project geared towards improving energy database management in the manufacturing facilities of Cadbury Nigeria Plc. is being evaluated.

5.2 Potential CDM Projects at Nestle Nigeria Plc.

We identified the following potential CDM projects for implementation at Nestle:

- Trigeneration---coupling a CHP---which produces power, steam and hot water--- to a Vapor Absorption Chiller.
- Optimization of energy-use efficiency in the plant. This will include: steam use efficiency improvements; power factor correction; and installation of computerized energy management system.

5.3 Potential CDM Projects at Tower Aluminum Extrusion Company

5.3.1 Natural Gas Fuelled Power Generation

27% of the demand for power during the year 2000 in the factory of Tower Aluminum was generated on-site in diesel generators. These generators had an average efficiency of about 24%. Tower Aluminum Extrusion Company is interested in implementing a fuel shift for power generation from the existing diesel system to power generators fueled by natural gas. This will not only yield improved energy efficiency, but will also lead to a reduction in GHG emissions.

5.3.2 Conversion of LPFO Fuelled Melting Furnaces to Natural Gas Fired Ones

Fuel combustion in the melting furnaces is currently the leading source of GHG emissions in the production processes at Tower Aluminum Extrusion Company. During the year 2000, the melting furnaces accounted for about 79% of CO_2 emissions in the plant. As such, significant GHG reductions can occur if a more energy efficient melting process can be implemented.

5.3.3 Power Factor Correction

Electricity is the other very important energy input in the factory of Tower Aluminum Extrusion Company. Improvement in the efficiency on the generation side will be achieved with the introduction of the natural gas fuelled power system. A potential CDM project that has been identified at this stage is the improvement of the factory's power factor, which is currently averaging about 84%. This has a improvement potential to above 90% using available technology is a feasible CDM project

CHAPTER 1: TEAM WORK AND DIALOGUE WITH STAKEHOLDERS

At the commencement of Phase II program, six national experts were recruited to join a national team that undertook all the studies that were carried out as part of the project. Specifically, these experts covered the following study areas; investment/financial analyses; energy; technology transfer; legal; information systems; and COMFAR III applications. The national experts also assisted the national consultant during the period of the dialogue that was held with the national stakeholders. Towards the successful implementation of the project, several meetings were held at different participatory levels to plan, strategize, develop and implement various component of the project.

1.1 Nigeria CDM Phase II Commencement Meetings

In implementing the Phase II activities, the project's national team held several meetings with the Program Manager, Dr. Peter Pembleton, the International expert, Dr. Pim Kieskamp, as well as with identified key stakeholders. An inception meeting between the Program Manager, the National Consultant, Dr. F. B. Dayo and the six National Experts preceded these meetings. The inception meeting was held at the UNIDO office in Lagos on the 23rd of February 2001. The Program Manager elucidated the goals and objective of the program to each of the expert, and extensively explained the salient expectations from their participation in the program. This inception meeting was followed by a project commencement meeting, which was held on the 27th of March 2001, also at the UNIDO offices in Lagos Nigeria. In attendance during the first session of this meeting were the Project Manager, the International Expert, the National Team and invited stakeholders. The second session was devoted to detailed discussions between the Program Manager, the International Consultant, the National Consultant and the six national Experts. This meeting focused on planning and strategy development for the implementation of Phase II activities. Details of discussions during these meetings can be found in the attached Annex I.

1.3 The Project Stakeholders

A list of the project stakeholders is presented in Annex II. At the commencement of the Phase II activities, the national team carried out an extensive sensitization program to enhance or generate

the commitment and corporate involvement at the highest managerial level of each of the participating stakeholders. Such a commitment it is believed will enhance the quality of strategic project decisions. This exercise was a very difficult one, however it was very necessary and very crucial to the success of the program. The exercise enabled the National Project team to establish within the stakeholder's facilities, personnel with adequate understanding of the project, and especially salient issues relating to the Clean Development Mechanism of the Kyoto Protocol. The exercise also enabled the national team to identify 2 companies among the large list of identified stakeholders, who joined 1 that was identified during Phase 1 activities for more active participation in the capacity building project.

Two cement companies, West African Portland Portland Cement Company (WAPCO) and Ashaka Cement Plc., which showed very keen interest in the CDM project during the Phase I activities were replaced with the two newly identified companies, due to the dis-interest shown by the management of WAPCO at a meeting in late 2000. Although no such direct attitude was observed from the management of Ashaka, the Project Manager and the National Team were of the opinion that a similar reaction was likely. As a result, the participation of the two cement sector firms was discontinued. Tower Aluminum Extrusion Company and Nestle Nigeria Plc., having shown keen interest in the project were admitted to replace the two cement companies in the project. These two companies along with Cadbury Nigeria Plc. were the companies for which potential CDM projects were packaged, and all the activities of Phase 2 reported herein applies. Several meetings were held with these three companies by the national team, as a basis for which salient project information was gathered.

Various planning meetings were held between members of the national team. Questionnaires were drawn up based on the evaluation of the data that were required from the participating companies. In addition, the national team held several meetings with the 3 participating companies, during which the questionnaires were administered. During such meetings, members of the national expert team also collected other pertinent data, apart from familiarizing themselves with the operations of the companies. This enabled the team to evaluate, in a preliminary sense, potential CDM projects in each of the companies. It also afforded us the opportunity to carry out a qualitative analysis of potential project related constraints.

1.3 International Workshop

The workshop *'Building Capacity to Facilitate CDM Projects: Oil and Gas and Manufacturing Industry Sectors'* was organized in order to, among other things: provide an overview of the policy and institutional framework required for projects that are likely to occur through the Climate Convention and its Kyoto Protocol with a concentration on the oil and gas and industrial sectors; commence the 'learning-by-doing' process of building capacity in identifying, developing and implementing CDM projects in the two sectors; present and discuss possible CDM projects in Nigeria; establish a platform for partnership among key Nigerian stakeholders in government, industry and civil society and a forum for regular discussions on climate change issues; share experiences & best practices on practical policy & programmatic initiatives/actions; and to discuss possible future follow-up activities.

About one hundred and thirty participants and observers, representing the different groups of stakeholder that will be participating in the project should the Kyoto Protocol enter into force and the CDM become a means to attract foreign direct investment and climate-friendly technologies and know-how into the country, attended the workshop.

CHAPTER 2 BARRIER REVIEW

The ability of countries in Africa and other non-Annex 1 Nations to benefit from the CDM as included in the Kyoto Protocol can be hindered by some factors and issues that have been described in this study as barriers. Some of the critical goals of this UNIDO intervention include the identification of such barriers, and the development of strategies to completely remove or reduce their negative impacts to the barest minimum. Barriers to the successful development of CDM projects exist as a result of: technology transfer; legal and legislative; energy and environment information; investment and financial issues. In this section, we present a vivid discussion of these issues especially as they relate to barriers to the implementation of CDM projects in Nigerian industries.

2.1 Technology Transfer

2.1.1 General Considerations

Technology transfer is the active process of proliferating technology across the border of two entities. A positive-goal oriented process of interaction between two or more social actors that may be in the form of formal training, equipment or capital good transfer and even mere discussions. This implies that technology transfer plays a central role in sustainable process and economic development of any nation.

Article 12 of the Kyoto Protocol to the UNFCCC offers the Clean Development Mechanism as a tool to assist developing countries, which are Parties to the Protocol, to achieve sustainable development while helping to checkmate un-controlled global emission of Greenhouse Gases (GHG). CDM also offers developed countries opportunity to achieve compliance with their quantified emission limitation and reduction commitments under Article 3 of the protocol. The CDM *per see* is therefore a technology capability transfer likely to be a major source of Direct Foreign Investment (DFI) to a developing country like Nigeria. The package may consist of physical transfer of equipment, technical knowledge, skills and expertise that underline the country's capacity to undertake contemporary *clean* and *end-of-pipe* activities.

The motivation to adopt CDM in Nigeria will be guided by the desire to benefit from the clean technology possibilities offered by the Kyoto Protocol. For this desire to be met, transfer of technology and technological know-how must take place. Adequate transfer of CDM technology and know-how will also

enhance the prospect for greater integration of local enterprises into global trade and production networks. For CDM to become operational in Nigeria an enabling environment will be needed. Creation of this enabling environment may require: the enactment and enforcement of environmental regulations; introduction of promotional market mechanisms; introduction of investment incentives; streamlining of the legal framework for technology acquisition, to mention a few.

Nigeria is a signatory to the Kyoto Protocol and as such, no policy barrier to CDM import to the country currently exists. To accelerate the acquisition of CDM technologies however, the manpower training and the required practical skills development component must precede the start of the CDM projects. For this purpose, participating Companies can send their operations personnel to work in similar plants elsewhere to gain experience as part of the technology diffusion process. This is very crucial to the success of the technology transfer process since a cogent factor in CDM technology transfer is the availability of competent and experienced personnel.

Technological changes have become an essential ingredient in the process of improving industrial efficiency. Technology as used in this study is not just the product that is bought and sold; it is also more than just a physical process that transforms inputs into outputs. It refers, in addition to these, to procedural and organizational arrangements for carrying out transformation. For example, the concept of cleaner technologies focus on optimal products and processes for: pollution prevention; waste reduction; emission reduction and new products that satisfy currently unmet needs.

Technology transfer may involve the adoption of technological innovation in the form of new production processes or minor technical change to improve profitability, reduce pollution, reduce energy costs, etc. Facilities so adopted that reduces environmental stress, such as emissions and wastes, per unit of output is usually referred to as cleaner technologies. At the industrial sectoral level, it is recognized that firms with strong technological accumulation, or with strong links to overseas firms having such features, usually possess the capability to carry out technical changes such as the modification of production processes to reduce pollution and/or introduce energy efficient technologies. Availability of technical skills/knowledge, external and internal institutional linkages are therefore critical variables that determines, the firm's capacity to cope with CDM projects. They are indeed some of the critical variables or parameters that will form the kernel of efforts to build adequate capacity for adaptive technology transfer for CDM.

Another important issue in technology transfer for CDM is that it should not be conceived as autonomous or parallel to domestic capability development but should complement domestic technology development efforts. Technology acquisition alone is not sufficient for meaningful technological development but must be looked at in terms of its being eventually absorbed and finally diffused to end users in the country. For technology acquisition to be successful considerable efforts will have to be expended to acquire or have access to necessary information concerning the appropriateness, nature and other conditions that may be tied to the transfer processes. Information flow will therefore be critical to the success of the process of acquiring any CDM technology. Equally important is the estimation of the emission reduction achievable and its eventual validation after the project is commissioned.

It is therefore important that at the onset of planning the acquisition of CDM technology, technical information should be readily available. It is conceivable that acquisition of CDM technology will occur as a foreign direct investment (FDI) into the country. According to UNIDO (1996) more than 30% of total world FDI compared to 20% in the mid-80's went to the developing countries. When CDM becomes operational, it is likely to contribute to a higher growth of FDIs into these nations, Nigeria inclusive. CDM projects being an *intertwining* venture can lead to scores of strategic alliances and other forms of international networks in addition to the orthodox FDI. It is therefore desirable to understand the FDI-technology dynamics.

Another important issue in technology transfer is that of technology adoption, adaptation and absorption. It has been established in other previous studies that successful technological development in Africa will require not only foreign technology inputs but also domestic technology development. Technological learning process drives technological capability accumulation and the process is cumulative and evolutionary. Technological capabilities are needed to start up operations and are vital to attaining the preset norms. There is a need to examine the complimentarity of foreign technology imports and endogenous technology capability building. While energy and GHG emission reduction could promote local efficiency, import of technological wares can provide extended market for such innovations. Because industrial technology does not often come *off-the-shelf*, some level of un-packaging may be called for. *Project engineering* will be needed to provide information needed to make the CDM technology operational in a particular setting. This will involve detail evaluation of alternative technologies before a candidate is chosen, basic engineering to supply the core technology and detailed engineering to supply the details of the components.

Stability, effectiveness and capability of institutions, saddled with the responsibility of managing technology acquisition into Nigeria are also an issue in the evolution of sound technology transfer track for CDM projects. One of such institutions is the National Office for Technology Acquisition and Procurement (NOTAP). This Federal Agency is saddled with the responsibility of evaluating and ensuring that technology imported into Nigeria is of sound quality. It is not our intention in this study to produce a critique of the adequacy or otherwise of NOTAP in its mandate, however, adequate understanding of the goals and objectives of the Kyoto Protocol as it relates to CDM is very important if the Agency is to play its critical roles in CDM technology transfer.

Our evaluation of the existing protocols used by NOTAP to screen technology acquisition may be inadequate to handle CDM technologies and may therefore impair smooth transfer if NOTAP capacity in this regard is not strengthened. Equally important is the ability and capability of financial institutions to fund CDM projects. It is true that substantial component of the capital needed to fund CDM projects will come into the country as FDIs, the ability to muster local equity and debt will be crucial to the success of CDM technology acquisition. Government must consciously pioneer institutional framework strengthening to provide adequate legislative, regulatory, communication, technical and financial supports and other motivations and incentives geared towards promoting the transfer of CDM technology to Nigeria.

2.1.2 Identified Technology Transfer Barriers

Given the general discussions of issues pertinent to technology transfer as it relates to CDM, we prepared a questionnaire dealing with technology transfer issues in the acquisition of production equipment, which was implemented in each of the recipient companies. The outcome of the implementation of the questionnaire in each of the companies were utilized to distill out pertinent technology transfer barriers which are summarized below:

2.1.2.1 Cadbury Nigeria Plc.

Before providing a summary of technology transfer barriers identified using the designed questionnaire at Cadbury Nigeria Plc., we want to present a summary of the response from the company. According to the response obtained from Cadbury, the company believes it needs CDM: to minimize GHG emissions; and to improve factory energy efficiency and overall company management standards. The most desirable type of

CDM in Cadbury is the transfer of energy equipment and not, new production processes or minor technical changes to existing system. In order to be able to achieve a successful CDM technology transfer, the company is of the opinion that they will need: skill and knowledge transfer and formal training on CDM and the technology to be adopted.

It is believed that CDM will improve the efficiency of energy input to their production processes and it is expected that foreign direct investment (FDI) will be one of the major sources of funding for the projects. Capital goods acquisition as well as energy efficiency improvements were rated as the leading relevant CDM requirements at Cadbury Nigeria Plc. The leading barrier to the smooth transfer of CDM technology to Cadbury has been identified to be financial inadequacy. Next to these were: unstable exchange rate; unclear format for certified emission and compliance enforcement; non-availability of local infrastructure and advance training of key company personnel on CDM.

The company believes that availability of foreign direct investment and aggressive development of human capital will enable them have smooth CDM technology transfer. They are expecting assistance in terms of financing and personnel training to come from Annex 1 nations as well as their business partners overseas. As mentioned in an earlier section of this report, Cadbury has identified some key CDM projects that it is interested in pursuing if all the barriers can be surmounted. These projects are not expected to lead to any major modifications to their production processes nor a change in the quality of their raw materials.

A key factor that was identified as requiring capacity strengthening in order to enhance the ability of Cadbury to cope with the identified CDM includes is external institutional linkages. Also requiring some strengthening but to a lesser extent are: acquisition of basic skills and knowledge; access to information on the desired CDM technology; and skills for selecting/bargaining/operating/maintaining the alternative CDM technologies.

Given the above summary of the responses obtained from Cadbury Nigeria Plc as regards technology transfer issues for CDM, the following barriers were identified:

- The most important technology transfer barrier is lack of financial capability;
- Closely following this is the weak external institutional linkage, especially as it relates to international conventions like the Kyoto Protocol;

- In addition, there is a weak understanding of the structural details of CDM, which will be crucial to the ability to identify, design, negotiate with technology owners--- very important activities that will take place during the process of developing CDM projects;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;
- Very uncertain and not too clear national policy on global climate change issues.

2.2 Nestle Nigeria Plc.

The responses obtained from this company, also a food manufacturing company, indicate that its interest in CDM is dictated by its desire to reduce energy usage per ton of product in its manufacturing facilities. To achieve this, the company believes it will need both new production processes as well as specific equipment transfer to replace or compliment existing ones. In order to be able to achieve a successful CDM technology transfer, the company is of the opinion that its personnel especially the technical staff will only need some formal training on CDM and the technologies to be adopted. It is also believed that CDM will improve the efficiency of the company's processing equipment.

When asked to rate CDM requirements in order of relevance to the company's set-up, acquisition of capital goods was rated as most relevant, followed by formal training on CDM technology abroad and in Nigeria. Skills import for the purpose of developing CDM for the company was rated as least relevant. Key factors considered as very important to enhance the transfer of CDM technologies to the factory of Nestle Nigeria Plc. include: grass root understanding of the CDM concept; stabilization of the exchange rate; financial incentives to invest in CDM; and elimination of taxes and duties on CDM goods.

Differential fuel subsidy to industry and the general public was considered to be of only low secondary importance to the promotion of the adoption of CDM technologies at least at Nestle. For the success of CDM adoption in the company, training on the benefits and techniques of energy efficiency at all levels of the production system is considered as important. In addition, management of Nestle Nigeria Plc. are of the opinion that the following incentives if put in place will go along way to promote the adoption of CDM technologies in their factory: subsidy on equipment cost, probably via assistance from multilateral agencies; tax relief from government, especially on investment on CDM facilities; as well as a stable exchange rate.

At the level of the responses received from the company by the time of preparing this report, not much details of identified CDM projects was made available to us. The single statement that was used to qualify the request for a detailed description of identified CDM projects is: *"introduction of more fuel efficient ways of manufacturing"*. This we believe implies that the company is interested in clean energy technology similar to the ones we identified in the other company in the same sector. A positive response was given to the question on whether or not major modifications in the existing production system will be needed to achieve the CDM goals. The conclusion one can draw from this is that Nestle is perhaps planning a major overhaul of its aging production facilities, and sees the opportunity for CDM project as a win-win strategy to do this. Even with this major modification envisaged, it is not expected that there will be a major change in raw material quality. Even with this level of expected major improvement to existing manufacturing facilities, the company is of the view that no human resource supplement will be needed to operate transferred CDM projects to the factory.

A foreign linkage that the factory management feels will be beneficial in its efforts at adapting CDM technology for better profitability and more environmentally benign future production is the NESTEC. How this will enhance CDM capabilities in the company was not spelt out in the answers provided. Four factors were rated as very important to the ability of Nestle to cope with desired CDM projects. These are: basic skills and knowledge acquisition; external institutional linkages; raw material supplies; and the capability to maintain the adopted CDM technologies. The capability of the company was scored to be low on two factors, which will require capacity building if they are not to constrain the smooth transfer of the CDM technologies. These are: information base on CDM technologies, especially as it relates to operator training; and selection/bargaining and procurement between alternative technologies. Given the summary above, the following critical technology transfer barriers were distilled as pertinent to Nestle Nigeria Plc.:

- Ability to muster adequate finance is the most serious technology transfer barrier;
- Lack of access to information base on CDM technology, especially as it relates to technology details and system operations training;
- Weakness in the ability to select among competing alternatives due to lack of adequate knowledge and information;
- Inadequate skills on negotiations and bargaining for CDM technology acquisition;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;

- Very uncertain and not too clear national policy on climate change issues.

2.1.2.3 Tower Aluminum Extrusion Company.

According to the response received from Tower Aluminum, the company needs CDM to minimize GHG emissions from their factories and also to improve energy efficiency in their manufacturing operations. Management of the company believes that minor technical changes to the existing facilities will be required to achieve this aim. They believe that skill and knowledge transfer will be crucial to their ability to smoothly transfer and assimilate CDM technology into their manufacturing facilities. They are also of the opinion that directs foreign investment from CDM technology supplier countries, as a compliment to what can be mustered locally will be a necessary condition for the success of CDM technology transfer to their company.

The response from the company also indicated that if CDM technology is implemented in Tower Aluminum factory, energy efficiency would improve, atmospheric pollution and CO_2 emissions will also be reduced. In the response, requirement for capital goods transfer was rated as of the highest relevance to the success of CDM projects at Tower Aluminum. Formal training abroad and skills imports were rated as next. Six factors that can make CDM technology transfer to Tower Aluminum possible were rated as very important. They include: introduction of CDM concept in High School curriculum; stabilization of the exchange rate; availability of financial incentive for Investment in CDM technologies; differential fuel subsidy to industry and the general public; improved public infrastructure; and elimination of taxes and duties on CDM goods. Advance training of key industrial personnel before the start-up of any CDM project was considered as less important, however, in-house training of personnel is regarded as suitable for the smooth and successful adoption of CDM technologies.

As regards incentives needed to enhance the transfer of CDM technology to Tower Aluminum, availability of foreign direct investment and fiscal incentives from government to industries investing in CDM technologies were ranked as the most important. As elucidated in an earlier section of this report, all the CDM projects identified at Tower Aluminum falls under the category of energy efficiency improvement with pollution abatement as an additional benefit. The company is of the opinion that major modifications including complete change of electricity generating equipment as well as the fuel burners in the furnaces will have to be carried out to achieve its CDM objectives. No major changes in the quality of raw materials

or supplementary provision of human resources, beyond what is the present endowment will be needed to operate the CDM technologies.

The company suggested that regular monitoring of the progress of the implementation of the CDM project as well as regular auditing of GHG emission reduction would be needed to ensure commitment to the process once initiated. In terms of ability of Tower Aluminum to cope with the desired CDM projects, the following two factors were considered inadequate, and these are: internal institutional linkages; and clear understanding of potential benefits. Some capacity building will be needed to promote the following factors to levels that will not constrain the success of the CDM project in the company: access to pertinent CDM technology information; ability to select among competing alternatives; ability to bargain and negotiate with technology suppliers; and identification of problems and procurement of solutions related to the matching of the CDM technology to the existing facilities.

Given the elucidation presented above, the following technology transfer related barriers were identified for the adoption of CDM technology at Tower Aluminum:

- As in all other cases, financial incapability is the most serious barrier that can constrain the success of CDM technology transfer at Tower Aluminum;
- Not having adequate access to relevant technical information to assist the company in making technical decisions on CDM projects is another barrier;
- Inadequate knowledge on CDM technologies also constrains the ability to evaluate competing technologies;
- For the same reason, inadequate skills on negotiations and bargaining for CDM technology acquisition is another barrier to smooth CDM technology transfer;
- Weak manpower endowment both in number and quality for energy systems, relative to the company's manpower endowment in its core area;
- Very uncertain and not too clear national policy on climate change issues.

2.2 Legal Barriers to the Adoption of CDM Technologies in Nigeria

2.2.1 General Consideration

Nigeria has always shown keen interest in the international co-operation for the protection of the environment as evidenced in the numerous international agreements to which she is party. Nigeria at the United Nations Conference on Environment and Development (UNCED) of 1992 in Rio de Janeiro, Brazil was amongst the states that signed the United Nations Framework Convention on Climate Change (UNFCCC). It would be recalled that the conference had been convened to, inter alia, elaborate strategies and measures to halt and reverse the effects of environmental degradation in the context of strengthened national and international efforts to promote sustainable and environmentally sound development in all countries.

In pursuit of the objective of the UNFCCC, which is, the mitigation of climate change, the Kyoto Protocol established in S.12, the Clean Development Mechanism (CDM) for the purpose of assisting developing country parties to the protocol (referred to as Non-Annex 1 countries) achieve sustainable development as well as developed nations (Annex 1 countries) comply with their certified quantified emission limitations and reduction commitments.

It is anticipated that Non-Annex 1 countries shall reap the gains of the protocol in terms of project activities requiring in most cases, foreign direct investment, leading to certified emission reductions. Implementation of the protocol, it is further envisaged would involve several stakeholders ranging from government agencies, industries and private sector organizations, finance suppliers and to non-governmental organizations. The process is expected to activate/stimulate certain sectors for economic development. In fact, the CDM is regarded as a new co-operative mechanism towards the attainment of global sustainable industrial development. A non-Annex 1 country like Nigeria is therefore required to ensure that the enabling environment is provided for CDM implementation. Apart from technical knowledge, the legislative environment under which the CDM activities will operate is very crucial to its success in a developing nation like Nigeria.

2.2.2 National Legislative Framework and Policy

CDM implementation is an international obligation, which has to be translated into national legislation or policy before a regulatory framework can be established for its support. The legal issue for consideration therefore is whether or not the domestic or national legislative process can accommodate the CDM obligation. For many countries, obligations assumed under international agreements, do not automatically form part of domestic legislations.

In Nigeria as an example, the treaty making process is entrenched in the 1999 national constitution which provides that the National Assembly (which consists of the Senate and the House of Representative) that is empowered specifically to transform an international agreement to have the force of law in the country. Section 12 of this constitution thereof provides accordingly that ***"no treaty between the federation and any other country shall have the force of law except to the extent to which such a treaty has been enacted into law by the National Assembly"***. What this means in effect is that the process of ratification, which is the legislative process adopted in many Commonwealth countries like Nigeria must first of all be put in place as a seal to indicate its willingness to accept to be bound by the obligations of that international agreement.

Nigeria ratified the UNFCCC in 1994, however, the treaty-making process as elucidated above, requires that a domestic law would still have to be made to enable effect to be given to the Convention in Nigeria, so that its elements/obligations can be considered or incorporated into relevant policies and regulations for implementation. Ratification per se does not make the UNFCCC automatically a domestic law in Nigeria. Nigeria is yet to enact any legislation specifically for the UNFCCC. What it has established, is a UNFCCC National Committee (coordinated by the Ministry of Environment as the national Focal Point), with representatives from Federal Ministries and Agencies relevant to climate change. This body has been mandated to advise the Federal Government of Nigeria, on the formulation of policies and issuance of guidelines for achieving the objectives of the Convention.

With the expected complexity of CDM implementation even when the simplest of the mechanisms that is been looked at is adopted, a regulatory framework would need to be put in place to streamline CDM project activities and to send clear signals about the country's CDM goals, in accordance with the mechanism eventually adopted. Clear policies, establishing a national CDM Authority would be required to co-ordinate

CDM projects especially as regards matters relating to: project eligibility; national CDM goals and objectives; certification; baselines; verification, validation, reporting and monitoring. These processes would definitely require comprehensive guidelines, which must be put together to govern the CDM process.

In fact, an appropriate legislation, to regulate CDM implementation may be the best option for the Government. Such legislation would have to incorporate the elements of the UNFCCC and the Kyoto Protocol into its provisions. For this purpose, the Executive arm of Government would forward a bill to the National Assembly for approval to pass it into a law that would provide the legal framework specifically for CDM activities in Nigeria.

2.2.3 General Legal Barriers to the Implementation of CDM in Nigeria

Given the elucidations presented above, we conclude that the major legal barrier to unconstrained implementation of CDM projects in Nigeria is ***the absence of specific legislative/regulatory framework*** to govern the mechanism, which investors as well as focal recipients can interpret to distill out benefits and costs. There are existing legislations, which relate to foreign investment and technology transfer issues but none specific for CDM.

An equally important legal barrier to CDM implementation in Nigeria is the ***absence of an enabling legal framework for proper linkages between government ministries and agencies*** e.g. Ministries of Environment, Industry, Science and Technology, Finance and Agencies such as Energy Commission of Nigeria, Energy Research Institutes etc. for handling CDM issues. The Nigerian UNFCCC National Committee can be developed into such a linkage group, but this will be only after proper capacity building has taken place. In the absence of such a framework, the lack of the necessary linkages and the overlapping legal and policy implementation responsibilities, will become a potential barrier to the success of CDM projects in the country.

Another potential barrier may result from the ***non-complimentarity of the Federal and State administrative and legal framework.*** Section 20 of the 1999 constitution provides that environmental protection is one of the fundamental objectives and directive principles of the Nigerian state policy. To this extent both the National and State Assembly can make laws on the environment. CDM projects would

generally require approvals from not only the Federal but also from State authorities. For example, permit to use the Land required by an Independent Power Producer (IPP), may have to be obtained from the state government in whom the constitution vests, land ownership. Acquisition of land for example, with its attendant pitfalls e.g. the right of way (ROW) issues, may impede or slow down CDM project approvals.

2.2.4 Barriers in Existing Legislations

This will be considered from the point of view of relevant barriers in the laws and policy instruments covering, foreign investment in climate-friendly technologies, dispute settlement arrangements, etc. especially those that may affect the success of CDM project implementation.

2.2.4.1 Laws Relating to Industrial Energy Efficiency

Projects that promote energy efficiency improvements in industrial facilities are known to lead to reductions in GHG emissions. As such they are regarded as climate-friendly. A major industrial energy is power. By virtue of the National Electric Power Authority (NEPA) Act, NEPA has the monopoly to generate, transmit and distribute electricity in Nigeria. More often than not, especially in this era of unreliable supply of grid power to industries, this monopoly can impede sustainable energy supply infrastructure development.

Industrial operators in Nigeria have had to rely on stand-by generators to cater for essential power supplies during periods of power failures from the grid. These generators are very inefficient and as such, a candidate area to achieve improvement in industrial energy supply is in electricity supplies. With the availability of natural gas in some parts of the nation, it is not surprising that use of the gas to generate electricity in more efficient systems is being promoted by emerging independent power producers (IPPs). The monopoly position of NEPA under its enabling act has been a legal barrier to the success of this clean energy route. Some efforts has recently been made to reduce the effects of this barrier through the recent promulgation of the bill allowing IPPs and emergency power producers (EPPs) to generate power and sell to the national grid. The recent problems that has been encountered by the first IPP project in Lagos area is an indication that more fine-tuning of the legal framework is needed before the impediments can be completely removed.

2.2.4.2 Laws Relating to Technology Transfer

The national policy on the environment provides that one of the policy goals of sustainable development is the encouragement of the use of state-of-the art equipment and environmentally sound technologies in all sectors of the economy, to promote in-plant safety and healthy environment. The regulatory framework for the transfer of these technologies is embodied in the mandates of the National Office for Technology Acquisition and Promotion (NOTAP). NOTAP is empowered by its 1979 Act to carry out inter alia, functions of ensuring the acquisition of, with the best terms and conditions by Nigerian, foreign technologies.

A potential legal barrier to the acquisition of CDM technologies is therefore the lack of provisions in the NOTAP Act considerations for environmentally sound technologies as envisaged in under section 4 of the UNFCCC. NOTAP Act does not make sustainability a consideration neither is environmental protection provided for in its policy framework. It is therefore not attuned to ensuring that technology transfer for production processes incorporates realistic climate-friendly facilities. The issue of Intellectual Property Rights (IPR) is also not addressed in the NOTAP act. The absence of good and realistic IPR regime linkages to NOTAP weakens its ability to adequately facilitate the transfer of clean-technologies.

2.2.4.3 Institutional Barriers to the Preparation of CDM Project Agreements

It is very important that CDM project agreements (whether they are Build-own-and transfer /Build-own and operate/bilateral/joint venture) be drawn-up and negotiated by Nigerian lawyers who are sufficiently knowledgeable in: industrial processes; climate change issues, especially GHG emissions; UNFCCC, Kyoto Protocol, and CDM issues; technology transfer arrangements; etc. This will facilitate the incorporation of key elements in the legal documents that can promote the global and national climate change goals.

Current knowledge base on CDM issues among government and private sector lawyers in Nigeria is very low. Not many of these lawyers are conversant with the necessary details of the UNFCCC, and its mechanisms. This is an institutional weakness, which would constitute a barrier to the smooth transfer of CDM technologies. This even become very crucial given the fact that it is the general policy of government

in Nigeria not to give legal briefs to private solicitors even when the latter may possess better negotiating skills.

2.2.5 Legal Barriers Specific to the Recipient Companies

Discussions were held with and questionnaires on legal issues pertaining to CDM administered at each of the three recipient companies. In each case, the focal contact person for the legal issue discussion and questionnaire administration was the Company's Legal Advisers. An analyses of the completed questionnaires showed that similar conclusions could be reached for each company as far as pertinent legal issues are concerned. The findings from the analyses are summarized below:

- In each of these three companies, the Legal Advisers have only passing knowledge of climate-change issues;
- They have very limited knowledge of the legal implications impact and indeed the benefits of CDM projects in their respective companies;
- Because of this sparse knowledge base, negotiating technology transfer agreements that will arise from CDM project implementation will be hampered;
- Even if such companies retain the services of private solicitors, an institutional barrier will still exist when in-house legal personnel do not possess the requisite knowledge about CDM;

2.3 Information System Barriers

2.3.1 General Considerations

Availability and adequate access to information is one of the very necessary ingredients for a successful CDM program in any country. In this age of information super-highway, access to up-to-date information on technology has now been put at the disposal of most of mankind. This it is believed can accelerate diffusion of technology information and therefore enhance the improvement in living standards in almost all the countries of the world. The heterogeneous nature of the distribution of scarce capital resources the world over has not helped the quick emergence of the rosy picture painted above. Lack or inadequacy of capital resources in many developing countries has led to existence on the periphery of the information-highway. The result is that: in many nations in the less developed or developing world, computer

ownership per capita is abysmally low; only a few percentage of the population have access to the super-highway. As a matter of fact, many people in the developing world do not have access to a computer not to talk of having Internet connectivity. We are even made to believe that a significant percentage of the population in many developing countries has never seen a computer. In the last decade or so, the situation seems to be improving worldwide and even in developing nations.

The World Wide Web system is now one of the most important global systems for the exchange of different types of information. The ability of a recipient of CDM technology in a non-Annex 1 company to succeed in the technology transfer process, to be able to adapt the technology to suit its purposes, to assimilate the technology for improved services in the future will be strongly dependent on how accessible necessary information is to it. Quick access to sound information is now a direct function of how accessible the information super-highway is to the recipient. It is therefore not a coincidence that in searching for information related issues that can constitute a barrier to the transfer of CDM technologies, we have focused our searchlight on: access to computer facilities; internet connectivity; and internet literacy at each of the three recipient manufacturing companies covered by this study. A major common barrier to adequate Internet connectivity in Nigeria is the poor national communication system. The more common dial-up system is very unreliable, and it takes sometimes hours before a successful connection to an Internet Service Provider (ISP) can be made. In order to qualitatively encode the information system situation in each company, a questionnaire was administered.

2.3.2 Information Technology Situation at Cadbury Nigeria Plc.

More than 60% of the slightly over 200 professional staff at Cadbury Nigeria Plc are computer literate. In the recent past, there have been efforts on the part of the management of the company to encourage more of its staff to become computer literate. This is because management is aware of the importance of value-added potentials of computer literacy among professional staffs in a modern production facility. There are more than 30 Units of personal computers in the company. The most popular brand being the Dell brand all connected in a local area server-based network, using a Windows operating system.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company can boast of more than three professionals with expertise in each of the following areas: data interpretation and analyses; database

management; computer programming; web administration; and system/network administration. According to the response obtained, search on the Web for information on new technologies or production procedures in the food manufacturing sector occurs with an average frequency of about once a week. The company has its own Website (www.cadburynigeria.com). There are trained professionals in information technology or related disciplines on the staff of the company. Many of such professionals are engaged full time in IT related work within the company. The company is willing to be part of a national or global network for information exchange and dissemination on CDM.

When presented with a list of barriers that may be militating against the adoption of climate-friendly technologies in the industrial sector, the company identified the high initial capital input as the most major culprit. Closely following this according to the response is the gamut of government policies such as taxation, energy pricing, subsidies etc. Lack of institutional support was also identified as constraining. Others in decreasing order of importance include: no incentive to deviate from existing practices; lack of information on climate-friendly technologies; lack of capacity to service and maintain the new technologies; lack of access to climate-friendly technologies; and lack of awareness of the existence of climate-friendly technologies. The fact that access to information on climate-friendly technologies was ranked low in importance is a very good indicator to the fact that information system issues as far as climate change is concerned will not be a major barrier to the smooth transfer of CDM technologies to Cadbury Nigeria Plc. Capacity building for information system will only strengthen the already sound situation.

For this capacity building, the company gave human resource development as the most important capacity building activity that can enhance the transfer of CDM technology in Cadbury. Others in order decreasing importance that were ranked include: technology transfer; improved communication facilities and stable electricity; seminars for senior executives; and recruitment of IT professionals.

2.3.3 Information Technology Situation at Nestle Nigeria Plc.

Between 40-60% of the slightly over 100 professional staff at Nestle Nigeria Plc are computer literate. In the recent past, there have been efforts on the part of the management of the company to encourage more of its staff to become computer literate. This is because management is aware of the importance of value-added potentials of computer literacy among professional staff in a modern production facility. There are

more than 30 Units of IBM compatible personal computers in the company, all connected in a local area server-based network, using a Windows operating system.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company can boast of more than three professionals with expertise in each of the following areas: data interpretation and analyses; database management; computer programming; web administration; and system/network administration. According to the response obtained, search on the Web for information on new technologies or production procedures in the food manufacturing sector occurs only once in a while, meaning not too frequently. The company does not have its own Website. There are trained professionals in information technology or related disciplines on the staff of the company. Many of such professionals are however not engaged full time in IT related work within the company. The company is willing to be part of a national or global network for information exchange and dissemination on CDM.

When presented with a list of barriers that may be militating against the adoption of climate-friendly technologies in the industrial sector, the company identified the high initial capital cost, lack of incentives to deviate from existing practices, lack of access to climate change technology and government policies and inaction as the major important barriers. Lack of awareness of the existence of climate-friendly technologies, lack of information on climate-friendly technologies, and lack of capacity to service and maintain the new technologies were considered as only slightly important. Lack of institutional support was not considered to be important.

The fact that access to information on climate-friendly technologies was considered to be an important barrier in this company is a very good indicator of the fact that information system issues as far as climate change is concerned may be a major barrier to the smooth transfer of CDM technologies to Nestle Nigeria Plc. It is obvious that compared to the other food company, information system capacity is limited at Nestle compared to the other food company. This is even obvious from the fact that while almost all the senior line managers have direct Internet connectivity with personalized e-mail addresses at Cadbury, their counterparts in Nestle do not. Only those at the level of Executive Directors and above at Nestle have direct access. Capacity building for information system will therefore be a very critical component of the activities to develop CDM capabilities at Nestle.

For this capacity building, the company listed improved communication facilities and stable electricity supply as the most important capacity building activity that can enhance the transfer of CDM technology in Nestle Nigeria Plc. Seminars for senior executives and technology transfer were ranked as important while recruitment of IT professionals and human resource development were ranked as only slightly important.

2.3.4 Information Technology Situation at Tower Aluminum Extrusion Company

The total number of professional staff at Tower Aluminum Extrusion Company number about 500. Only between 10-20% are computer literate. In recent times, the company has been making efforts to encourage more staff members to be computer literate. This is in realization of the fact that computer literate workforce in this modern times are usually more productive. There are over 30 IBM compatible personal computers on a server-based network within a Windows operating system environment.

The company has Internet access connectivity on each of the computers and there is a company-wide operational e-mail address system. Among its workforce, the company informed us that they have professionals with: expertise in data interpretation and analyses; in database management; in computer programming; in web administration; and system/network administration. According to the response obtained, search on the Web for information on new technologies or production procedures for aluminum manufacturing occurs weekly. The company does not have its own Website. There are trained professionals in information technology or related disciplines on the staff of the company. Many of such professionals are however not engaged full time in IT related work within the company. The company is willing to be part of a national or global network for information exchange and dissemination on CDM.

On the issue of barriers that may constrain the smooth transfer of CDM projects to the company, lack of awareness of the existence of climate-friendly technologies and lack of institutional support were ranked as the most important. Judged as important were: lack of information on climate-friendly technologies; high initial capital; and negative government policies. No incentives to deviate from existing practices; lack of access to climate-friendly technologies and lack of capacity to service and maintain the new technologies were adjudged to be only slightly important. The company concurred with the need for capacity building for enhancing the electronic information exchange and dissemination for CDM. For this capacity building, the company listed improved communication facilities and stable electricity supply, seminars for senior executives and technology transfer as very important capacity building actions that can enhance the transfer

of CDM technology in Tower Aluminum Extrusion Company. Human resource development was ranked as important while recruitment of IT professionals was adjudged as only slightly important.

2.4 Finance and Investment Barriers

Implementation of CDM projects in the selected companies will definitely lead to improvement in energy efficiency, reduction of GHGs and cost effective production systems. The implementation of these projects will require substantial capital inputs, a commodity in short supply in all the companies being studied. Investment decisions are always made in these companies based on traditional criteria such as: returns on investment; payback period; etc. In one of these companies, we were made to understand that investment in new equipment, expansion projects etc. are guided by the fact that for a "go" decision to given by top management, the investment is expected to yield a return on investment that is greater than a threshold that is corporately fixed. The level of this threshold we are made to understand, is dependent on several factors among which are: opportunity cost of funds; return on alternative investment portfolio available to the company; exchange rate especially where there are foreign inputs; etc.

In a techno-economic analysis carried out in the early 1990s, by Triple "E" Systems Associates Ltd., for one of the recipient companies, we found out that the level of this threshold can be many percentage points higher than the market cost of money. We also found out that projects identified by a department in the company are funded as if the department is receiving a loan from the main company. The implication of this is that each operational department is expected to provide strong evidence to top management on value addition that will result from the implementation of any new project, especially as it relates to future cash standing of the company. The stringent conditions new projects are expected to pass before it can be considered for implementation makes it a Herculean task for most CDM projects to be considered for implementation under normal or standard conditions in any of the companies considered in this study. It is therefore not surprising that in each of the companies, the leading barrier to the implementation of CDM is identified to be financial incapability.

Our evaluation of the availability of venture capital funds for industrial capacity development or expansion projects in Nigeria showed that the existence of such funds is close to nil. Most Commercial and Merchant Banks operating in the country do not have fund lines that are openly accessible for these kinds of project. Short term financing is available at very exorbitant rates, which in itself is a major hindrance to industrial

development. Long-term industrial development loans that should be available from the Nigeria Industrial Development Bank (NIDB) are scarce. Their availability is strongly linked to accessibility of the NIDB to foreign development funds, especially from regional and international finance institutions. Our investigations showed that while these funds were readily available to the NIDB in the late seventies to the mid-eighties, this availability dwindled to a very low level by the early to the late nineties as a result of combination of forces among which the most important include: the poor loan servicing atmosphere prevalent in the country for previous industrial development loans; the uncertain political atmosphere in Nigeria pre-2000; and the general downturn of the global economy.

We believe that it is the realization of this situation that partly led the Federal Government of Nigeria to give a directive, backed up by Federal legislation, that Banks operating in Nigeria must earmark a minimum of 10% of their after tax profit to funding of Small and Medium Enterprise projects. This is a positive beginning that we believe will have a positive rub-on effect on the success of CDM projects in Nigeria. Given the preambles above, the following were identified during the course of this study as pertinent financial and investment barriers to CDM projects in Nigerian industries:

- Poor availability of local investment funds for industrial development projects;
- High interest rates on locally available funds;
- High exchange rates of the local currency relative to convertible currencies;
- Absence of Government fiscal incentives to promote the availability of funds for industrial development projects;
- Very uncertain investment environment;
- Inadequate knowledge on CDM Investment packaging in Nigerian industries.

2.5 Industrial Energy Efficiency Related Barriers

It is a generally acceptable fact that most industrial energy efficiency improvement activities are qualified to be regarded as CDM projects. This is because not only do these projects lead to savings in specific energy consumption, they also in most cases lead to significant reduction in GHG emissions, a primary goal of the Kyoto Protocol. It is therefore not surprising that many of the projects identified in the three participating companies are energy efficiency improvement projects. The fact that many of these projects are actually not being implemented by the industries despite their potentials to significantly reduce

production costs is an indication that some barriers to their implementation do exist. Many of these barriers have been discussed under other headings in previous sections. Our intention in this present section is to discuss those barriers, if any, which can be categorized as been dictated by the subject of energy efficiency itself.

In many developed countries, the benefits of energy efficiency retrofits in existing manufacturing facilities have been recognized for over three decades. As a result of the shocks of the crude oil price increases of the early 1970s, many of the fundamental principles of energy efficiency were practiced in many of such facilities in the industries of developed countries, leading to significant drops in specific energy consumption in many manufacturing sectors of such nations. The methodological framework, recommended implementation formats; and other things required to duplicate the successes achieved in other parts of the world are available and are accessible to industries in the non-Annex 1 countries. As a matter of fact, the World Bank introduced many of such efforts in the 1980s into some industries in these nations, but had mixed successes.

Many Nigerian industries have in recent times also considered and actually implemented energy efficiency improvement projects in their facilities. Energy efficiency improvement projects has however not been a panacea in most manufacturing industries in Nigeria. Among the three companies that participated at this phase of the project, all are aware of the advantages of energy efficiency in corporate profitability. All are also knowledgeable on the technical options that are available to them to achieve better industrial energy efficiency. Only one, Cadbury Nigeria Plc., presented us with cogent information on previous energy efficiency improvement projects implemented within their facilities. This includes the recent shift of steam generation from fuel oil to natural gas.

The decision to shift to natural gas we were made to understand was borne out of the realization that it will lead to savings in energy costs. One of the recipients, Nestle Nigeria Plc. also recently implemented some metering projects covering: steam generation and distribution; fuel; and water. The main driving force to the decision to implement these projects was the realization that: the ability to understand energy efficiency improvement potentials in a manufacturing enterprise, is dependent on the ability to monitor key utilities, fuel supplies and utilization; monitoring ability on the other hand is dependent on having in place, critical, functional, on-line measurement facilities. The conclusion from the present survey corroborates previous views of some of our study team: that benefits that can accrue to industries in Nigeria from energy

efficiency improvement projects is not being tapped (neither has it been adequately tapped in the past) to the optimum as a result of mitigating barriers. Some of these barriers include:

- Relatively low energy prices, that does not provide adequate incentive for energy efficiency improvement investment;
- Low exchange rate of the Naira, that serves as a disincentive for energy efficiency improvement investment;
- Inadequate capacity in Nigerian industries for the identification, design, implementation, operation and maintenance of energy-efficient technologies;
- Inadequate on-line energy monitoring facilities which does not promote energy audit culture;
- Lack of adequate support from decision makers in Nigerian industries for energy efficiency improvement projects, due to the fact that priority is focused on "bread and butter" issues;
- Inappropriate public policy regime that does not promote national energy efficiency;

CHAPTER 3 STRATEGY

In this section, we present an elucidation of our attempt in the study to identify and provide strategies that can be utilized to eliminate or reduce to the barest minimum some of the barriers to CDM implementation. We have presented the elucidation according to the each of the barrier category under consideration. These include: technology transfer; legal; information systems; finance and investment; and energy efficiency improvement related.

3.1 Technology Transfer Barrier Removal Strategies

- For CDM to become operational in Nigeria an enabling environment must be created. Creation of this enabling environment will require: the enactment and enforcement of environmental regulations; introduction of promotional market mechanisms; introduction of investment incentives; streamlining of the legal framework for technology acquisition, to mention a few.

- Creation of a National Information System for adequate dissemination of technical and non-technical information on CDM will be required. The creation of such a system will be critical to the success of the process of acquiring any CDM technology.

- Creation of a CDM Technology Incubation and Dissemination Center will go a long way to facilitate the development of domestic CDM technology capability.

- The capacity of NOTAP, especially as it relates to knowledge on CDM technologies must be developed. Stability, effectiveness and capability of NOTAP---- an institution, saddled with the responsibility of managing technology acquisition into Nigeria are critical issues in the evolution of sound technology transfer track for CDM projects.

- Institutional Capacity Building and strengthening on CDM activities in Government especially at the focal point (Federal Ministry of Environment) is an essential ingredient for the success of the CDM program in Nigeria. This will involve capacity building for legislative, regulatory, communication, technical and financial supports for the transfer of CDM technology to Nigeria.

- Training and re-training of manpower from industries and the public sector who will be involved in the process of technology transfer for CDM in Nigeria is a critical barrier removal action that must be put in place.

3.2 Strategies for the Removal of Legal Barriers

The following strategies will eliminate or reduce the legal barriers identified in a previous section:

- A legislation must be immediately enacted to give effect to the ratification of the UNFCCC in 1994 by Nigeria;

- A national framework document with all its enabling tools must be immediately put in place to streamline and govern CDM activities in Nigeria;

- Legal backing must also be put in place for a body that will have the national mandate to manage all issues arising from the design and implementation of CDM projects in Nigeria;

- The existing NEPA Act must be completely overhauled to strip it of all the traces of monopoly;

- The recently enacted legislation which allowed the involvement of IPPs in the power sector, should be strengthened to allow more participation of IPPs in power generation but also the promotion of Energy Service Companies (ESCOs) in energy generation;

- The NOTAP Act should be amended to include sustainability issues in its policy decisions on technology transfer to promote acquisition of CDM technologies;

- Institutional capacity at NOTAP to identify and promote the transfer of clean technologies should be built and/or strengthened;

- Provisions for the consideration of industrial/intellectual property rights (IPRs) should be built into the amended NOTAP Act;

- The capacity of Lawyers in the private sector to handle legal issues relating to the adoption of CDM technologies in Nigeria needs to be strengthened. Such capacity currently exist but can be said to be quantitatively inadequate;

- Institutional capacity at the Federal and State Ministry of Justice will also have to be built;

- At the manufacturing industry level, the capacity of the legal department to handle climate change issues in general and CDM technology transfer issues specifically, need to be developed.

3.3 Strategies for Removing Information Related Barriers

The following are the emerging strategies that can be used to reduce and in some cases completely eliminate some of the information related barriers identified in an earlier section of this report:

- Literature on various issues of CDM will be acquired during this phase of the project to set up a CDM Library in each of the participating industry, and at the UNFCCC focal point, the Federal Ministry of Environment;

- The internet connectivity at each of the participating company will be strengthened through the implementation of connection to a wireless ISP;

- International Seminars and Workshops on CDM Issues that will be held in Nigeria, will be promoted as part of this Capacity Building Project;

- Each of the participating manufacturing industries and other interested stakeholders will be encouraged to participate in discussions and reporting and information dissemination via a specialized CDM website that will be developed as an output of this capacity building project;

- Basic and specific training on information technology, internet services and other related subjects will be carried out for participants drawn from selected stakeholders, including manufacturing industries, government ministries and NGOs, academic institutions etc.

3.4 Strategies for Removing Finance and Investment Barriers

The key strategies already identified and currently being further studied include:

- The financial sector in Nigeria should be consciously organized to provide venture capital to promote CDM projects in Nigeria;

- Capacity building programs to develop CDM investment planning and management capabilities of the finance sector is crucial to the success of CDM projects in Nigeria;

- Financial Institutions operating in Nigeria should be given incentives for funds channeled to CDM projects;

- Recent legislation promoted by the Federal Government to set apart 10% of their after tax profit for investment in SMEs should be amended to promote investment in CDM projects;

- Government must put in place fiscal policies to promote lower interest rates for medium to long-term loans obtained for CDM projects. This will also aid financial additionality considerations for these projects, since without such the projects will not be implemented;

- The financial sector in Nigeria should develop capabilities to participate in the emerging global carbon emission trading.

3.5 Strategies for Removing Barriers Arising From Industrial Energy Efficiency Improvement Capacities

Energy efficiency improvement projects in manufacturing enterprises are no doubt, potential CDM projects. The ability to identify such opportunities is however closely linked to the ability to quantitatively and qualitatively evaluate energy supplies and utilization in the factory. This last requirement is hampered by lack of monitoring instrumentation in almost all manufacturing facilities in Nigeria. Even in the facilities of the three companies--leading industries in their sectors—which are participating in this phase

of the project, steam and fuel meters were not in place. Given the barriers identified in an earlier section, the following mitigating strategies were identified and are currently being studied:

- The current project should include the implementation of a program to strengthen metering facilities, especially for energy, in the selected manufacturing facilities;

- Project implementation should also cover initial and comprehensive energy audits at each of the selected facilities. The metering and the energy audit initiatives will not only facilitate the identification of cost-effective energy efficiency improvements, but will also facilitate the practical building of capacities in each of the companies;

- Workshops and training seminars on opportunities for energy efficiency improvements in manufacturing industries in Nigeria will be promoted with practical work-through audits;

- Government should put in place legislation to create incentives for energy savings investment in Nigeria industries;

- Training on CDM issues such as: additionality ; baselines; governing mechanism; validation and certification of emission reduction; and monitoring, should be regularly organized, especially during the prompt start period of CDM activities. This will help to develop various types of capacities, needed for project design and implementation;

- The proposed National Energy Policy should incorporate components to promote industrial energy efficiency improvement.

CHAPTER 4 PROGRAMME

The program has been presented under two main categories. These are the Nigerian CDM capacity building program and the regional program.

4.1 Nigerian CDM Capacity Building Program

4.1.1. Information Exchange And Stakeholders Awareness Program

The objective of this component is to develop and implement a framework to promote the dissemination of information on CDM and Climate Change Issues to relevant stakeholders. This will enhance the creation of awareness among stakeholders on CDM projects in particular and climate change issues in general.

The above objectives of this program will be achieved through the implementation of the following activities:

a. A National Workshop will be held to disseminate the outputs of the UNIDO CDM Capacity Building Project to a wide stakeholder audience at the end of the Phase II Activities;
b. Establishment and the effective operation of the National CDM Library
c. The Office of the Focal Point serving as the Secretariat of the National CDM Committee will acquire relevant CDM/Climate Change Literature and publications and set this up in the National CDM Library;
d. Implementation of Training Seminars for Senior Managers from Industry on Industrial Energy Efficiency and their linkage to CDM;
e. Internet connectivity facilities will be put in place at the CDM Secretariat and a Website on Industry, Climate Change and CDM will be developed and made operational;
f. An Editorial Board for a Quarterly CDM and Climate Change Newsletter will be put in place, and shall come out with the first edition of the Newsletter not later than 3 months after inauguration;
g. A Technical Sub-Committee of the National Committee will be put together to prepare a draft of a National CDM/Climate Change Strategy Document. The draft document should be ready not later than 3 months after the inauguration of the sub-committee;
h. The internet connectivity and access of the three stakeholder companies will be strengthened;

i. A computerized National CDM information System will be developed. Information that will be incorporated within the database will include: National Communications; specific sector emission inventories; local and international climate friendly technologies; etc.;

j. Develop training packages on Industrial Energy Efficiency Improvement projects and its linkage to CDM;

4.1.2. Capacity Building

The key objective of this component will be to eliminate some of the barriers identified in this project through focused implementation of targeted sub-programs, covering: manpower development and capability enhancement; strengthening and sometimes outright development of institutional infrastructure; and creation of facilitating enabling environment.

The following activities will be carried out under this program:

a. Stemming from the inception workshop, an extensive consensus building dialogue will be carried out among identified stakeholders to determine the best composition of members for the National Committee;

b. Inauguration of the National Committee with a clear term of reference for their activities;

c. Deliberation of the National Committee at regular intervals on crucial CDM and Climate Change issues. They will also serve as the clearinghouse for all CDM project activities in Nigeria;

d. Establishment and equipping of the Climate Change Focal Point Office;

e. Training Workshop on CDM and Climate Change Issues covering: Project Eligibility; GHG Emissions; Determination of Emission Baselines; Sustainable Development Indicators; Additionality; Project Validation, Verification, Certification and Monitoring; CDM Project Cycles; CDM Implementation Models; etc.;

f. Training Workshop for Engineers from Industrial Stakeholder's Facilities on: CDM and Climate Change Issues; CDM Project Identification and Eligibility; Project Design; Techno-Economic Feasibility; Selection of Climate Friendly Equipment and Technologies; Project Funding and Implementation; Industrial Energy Efficiency;

g. Training Workshop for Middle to top Management Personnel from Industry, Public Sector on

CDM focusing on issues such as: Investment Promotion for CDM; Marketing of CDM projects; Contractual and Legal Issues Associated with CDM Projects; Negotiating CDM projects; Acquisition of CDM Technologies;

h. Training Course on Energy Auditing, Industrial Energy Efficiency Techniques and Climate Friendly Technologies to be held as part of a recurrent program for training and certifying Energy Auditors;

i. Training Workshop on Financing CDM projects and Global Carbon Emission Trading will be held for participants drawn from the financial sector of the economy;

j. A Team drawn mostly from NOTAP and relevant Federal Ministries and Agencies, assisted by UNIDO, will evaluate the existing enabling document of NOTAP to explore how it can be strengthened to carry out its technology acquisition mandate for CDM. The team will also recommend infrastructural strengthening needed to enhance performance of NOTAP;

k. The recommendations of the NOTAP Study Team will be implemented after acceptance by the Federal Government of Nigeria;

l. A CDM-Climate Friendly Technology Incubation Center will be established to: pioneer local research and development into such technologies; promote industrial energy efficiency improvements; act as the custodian of the industrial energy audit facilities to be acquired; organize the training and certification of Industrial Energy Auditors; provide linkage on CDM and Climate Friendly Technology research to local and international academic and research institutions;

m. The Technology Incubation Center will introduce and implement programs to promote the emergence of Energy Service Companies (ESCOs);

n. A Technical Committee of the National Committee will be established to evaluate all potential fiscal and monetary incentives that can be put in place by government to encourage efficient use energy and CDM projects. The report of the committee will be presented to different levels of government to seek legislative and executive support for the schemes;

4.13. CDM Policies, Laws, Regulations And Legislative Framework

The objectives of this component can be summarized as follows: the legislative formalization of the ratified UNFCCC; the legislative formalization of the Kyoto Protocol when ratified; strengthening and amendment of existing acts and legislation and promulgation of new ones, to promote climate friendly and industrial energy efficient technologies.

The activities that will lead to the achievement of the above objectives include:

a. A Legal Framework Sub-Committee will be put together by the National Committee to evaluate actions that must be taken to incorporate the UNFCCC protocols and mechanisms into the national laws. The Sub-Committee will also put in place a mechanism to obtain legislative support for the promulgation of a Federal Act to give backing to the UNFCCC that was ratified by Nigeria in 1994. In addition, they will prepare the ground for similar activities to take place when and if the country signs and ratifies the Kyoto Protocol;
b. Lawyers serving in this Sub-Committee, drawn mainly from the Federal, some State Ministries of Justice and from Private Practice, will work with the NOTAP committee to ensure that the legal drafting of an amended NOTAP Act is effectively carried out;
c. The Legal Framework Sub-Committee will collaborate with the Technical Sub-Committee of the National Committee to evaluate the structure and content of a National Bill to promote: industrial energy efficiency; industrial CDM projects; and the adoption of climate friendly technologies by Nigerian industries. The outcome of this work will form the basis of the legal drafting of the energy bill, which will be presented to the legislature and the executive to enhance smooth approval.

4.14. National CDM Project Portfolio

The objective of this component is to facilitate the identification, formulation, design, and marketing of industrial CDM projects. The goal is to have a register of CDM projects, which is frequently updated and made available to the international carbon investment community. Another objective is to use the activities leading to the formulation of a national CDM project portfolio as a forum for learning-by-doing.

The following activities will facilitate the achievement of the objectives reiterated above:

a. A Survey Evaluation of Potential CDM Projects in the Nigerian Manufacturing Sector. This will be a proliferation of what we have done so far to other industrial stakeholders, with the main goal of identifying candidate projects for inclusion into the National CDM Portfolio;
b. Assessment of Project Sustainable Industrial Development Indices;
c. Preliminary Design (Technical Specifications) of Identified Projects;

d. Estimation of Baseline Emissions and Emission Reduction Potentials of the Projects;
e. Formulation of Preliminary Validation, Verification and Monitoring Protocols for each Project;
f. Techno-Economic Analysis of each Identified Project;
g. Preparation of Bankable Proposal for Each CDM Project;
h. Selection of the Demonstration Project, and Identification of Potential CDM Investors;
i. Negotiation of CER, Unit Value of CER and Project Financing with the Investor;
j. Comprehensive Validation, Preparation of Verification and Monitoring Protocols for the Demonstration Project;
k. Registration of the Demonstration CDM Project;
l. Detailed Design, Equipment Procurement, Installation and Start-up of the Demonstration Project;
j. GHG Emission Monitoring.

4.2 Regional Program Components

4.2.1 Capacity Building

The objective of this component will be to strengthen areas within the CDM project cycle that has been identified as likely to act as a barrier to the successful promotion of CDM projects from the region.

Towards the achievement of the regional capacity building goals, the following activities shall be implemented;

a. UNIDO RIDC as the Regional Focal Point on Climate Change and CDM will be inaugurated with 3-Day Meeting and Workshop that will be attended by the Members of the 2 Sub-regional Committees and other Stakeholders in the Sub-region;
b. Development of a Website on Climate Change and CDM Activities in the Region. This website shall be hosted at an Internet facility to be located at the Focal Point Offices.
c. The Sub-Regional Committees will meet three times a year and twice jointly, with the Focal Point coordinating;
d. The GHG Emission Inventory Program will commence in each sub-region;
e. The development of a Database of Climate Friendly Technologies will be carried out;

f. A Quarterly Newsletter on CDM and Climate Change Activities in Industries in the Region will be Published;

4.2.2 CDM and Climate Change Issues

The objective of this component is to have in place, a minimum of two demonstration projects in the region. This will aid the learning by doing approach, which is critical to the success of the capacity building program. Secondly, the program will put in place, a modus operandi for identifying sound CDM projects in the region. Finally a structure for assisting member nation in the understanding Climate Change Issues will be put in place.

The following activities will facilitate the achievement of the objectives reiterated above:

a. Implementation of a minimum of two demonstrations CDM projects in the sub-region. The implementation regime will cover: identification of project; preliminary engineering design (this will include baselines, additionality issues, and emission reduction certification); project feasibility studies; project validation; project certification; detailed engineering; tendering for facility components; procurement; installation and commissioning; project monitoring. In all these activities, "learning by doing" as a capacity building tool will be accentuated.

b. Organization of a workshop in each of the two sub-region to disseminate ideas and outputs of the UNIDO CDM Capacity Building Project;

c. Preparation of a Regional CDM Project Profile Document. This will cover the demonstration project as well as other identified projects;

d. Implementation of a regional Network on CDM;

e. Setting up of a Regional Sustainable Industrial Development Fund. This will be achieved via discussions with bilateral and multilateral organizations and agencies;

f. Assess the status of standards, norms and procedures that are applicable to CDM and climate change issues, collate these and formulate a coherent and harmonized regional framework to promote synergy among nations of the region.

4.2.3 Sustainable Technology Transfer

The objective of the program item includes: Access to and ability to adapt and adopt climate friendly technologies; dissemination of the technologies; and maintenance of equipment. This will facilitate access to relevant industrial climate friendly technologies, and adaptation/development of such technologies for the sustainable industrial development of the sub region.

Activities within this program item include:

a. Collation of information on available and relevant cleaner and sustainable CDM industrial technologies and preparation of a database directory for dissemination purposes within the region;
b. Collation of information on existing national technology acquisition program in each country, identifying areas where they can be strengthened towards the promotion of regional synergy for CDM Projects.
c. Training of selected regional experts in the areas of: technology acquisition and adaptation; as well as project negotiation, validation, verification and monitoring.

CHAPTER 5 PORTFOLIO OF POTENTIAL PROJECTS

Questionnaires and direct discussions were utilized to identify potential CDM projects in each of the Companies selected for this phase of the project. In this section, we present a summary on each of the projects.

5.1 Potential CDM Projects at Cadbury Nigeria Plc.

5.1.1 Trigeneration

This company is interested in tri-generation technology to improve energy management and efficiency in electricity, cooling and heat supply. Because of the epileptic nature of power supply from the National Electric Power Authority (NEPA), Cadbury has hitherto depended solely on diesel generators for power generation. Its manufacturing facilities are not connected (neither are there plans to connect) to the national grid. Furthermore, the company generates the steam needed for its manufacturing processes in on-site fuel oil fired boilers. The implication of this energy supply structure is that the major energy security consideration has been and continues to be, adequate, timely and reliable supply of diesel and fuel oil.

Cadbury Nigeria is located in the Ikeja business district that is currently connected to City Gate via the Gaslink Nigeria Ltd natural gas supply facilities. To improve energy security, productivity, and enhance energy economics and environmental performance, company management converted the boiler facilities to dual fired systems with the capability of firing either natural gas or LPFO. The company started to produce steam by firing Natural Gas in its boilers starting from December 2000. This development will create an annual reduction of about 34% in GHG emissions in the factory, in addition to about 55% reduction in fuel cost.

The fact that the efficiency of energy production in the company can further be improved with the use of a combined heat and power system linked to a vapor absorption compression (VAC) facility was explored as part of the work that was carried out during our phase 1 activities. The proposition is that Cadbury will replace its current power, steam and chilling supply facilities with a trigeneration system that is capable of supplying all the factory's demand for energy and perhaps produce excess power for export to the grid. Our investigation showed that in the absence of the Kyoto Protocol, especially the CDM, Cadbury would not

have considered the adoption of the proposed system due to the fact that: it is considered more expensive than status quo alternatives; the company had just invested in conversion of its boilers to dual firing; and there is a feeling that the adoption of CHP system linked to a VAC being more sophisticated compared to the status quo system, will require specialized knowledge not currently available in the company.

Another critical issue that we identified from discussions with top management of Cadbury is that: energy is not the core business of the company, and as such, company management is willing to download the production of its energy requirement to others, as long as the energy price is competitive to current and alternative sources and the supply can be considered reliable. When a third party energy supply company takes up such a responsibility, then Cadbury will be able to utilize the scarce capital available to it to strengthen its core business. In this regard, Cadbury seems to prefer a Build-Operate-Own (BOO) or a Build-Own-Transfer (BOT) scheme.

As part of project development responsibilities under the phase 2 activities of this UNIDO funded Capacity Building project, we carried out steam and heat matching calculations to evaluate the appropriateness of some Cogeneration technologies given Cadbury's heat and power demand now and into the future. The global objective of the Trigeneration as a CDM project in Cadbury as conceptualized in this study can be summarized as follows:

- To replace the current generation of electric power, steam, and chilling with a more efficient system, utilizing CHP linked with a vapor absorption cooling system.

- To put in place such a system that will be operational by 2003, utilizing natural gas as fuel a having a minimum of 15 years life span.

- To incorporate cost effective redundancy into the system being recommended, for example, current installed power capacity in the factory is about 7.3 MW. Peak power demand in 2000 was 3.648 MW.

- Cadbury will still like to be self-sufficient energy-wise, especially if the efficiency of the national supply chain does not improve from historical records. In this respect, the client will prefer a system that is not dependent on energy imports.

It may however consider the export of power if it is feasible, cost effective and will bring a higher return for the project.

The power and heat matching calculations were carried out on three Combined Heat and Power (CHP) alternatives, namely, Steam Turbine, Reciprocating Engines, and Gas Turbines. The following conclusions were reached:

- If steam turbines were employed, a CHP system having a capacity of a minimum of 12 MW would be adequate to supply heat power and chilling requirements of the factory even up to the year 2018;

- If a gas turbine or a reciprocating engine is utilized, system capacity that will satisfy factory steam needs up to the year 2018 will be in the region of between 75-95 MW capacities with a large potential for power export;

- The power capacity of the reciprocating engine or gas turbine that will match factory energy needs can be reduced, if proper designs of heat recovery system beyond those normally incorporated into these technologies are included in the specification. This may however reduce the price advantage of these technologies over the conventional steam cycle;

- Our calculations showed that a 5 MW capacity for example, of either a reciprocating engine or a gas turbine would yield a total steam generation of about 4110 Kg/h. This is even not adequate to meet the base year (2000) steam requirement. Tripling the power generating capacity to 15 MW will enable the satisfaction of base year steam requirement, but not the peak steam demand;

- A reduced power capacity can also be achieved by coupling the reduced MW to some of the existing steam production facilities, to satisfy station steam requirements;

We are currently compiling information on possible system configurations to satisfy the trigenerations project objectives elucidated above. System specification data are currently being assembled from international system vendors. Once all the information is in place, it is our plan to evaluate the technical

and financial characteristics of the alternatives using COMFAR. Output from this exercise will assist decision-making on the best configuration to be adopted for this project.

5.1.2 Optimization of Energy-Use Efficiency in the Plant

The installation of a trigeneration system at Cadbury is a supply side reaction to the need to improve energy efficiency in the manufacturing plant. The end-use utilization of energy is also a critical source of energy efficiency degradation in a manufacturing plant. When energy efficiency is improved, not only is fuel savings, which is translated to monetary savings, achieved, but reduction in GHGs are also achieved. Historical data showed that about 4%/annum autonomous energy efficiency savings has been achieved over the years at Cadbury facilities. Discussions with top management also indicated that opportunity for energy efficiency improvements beyond the autonomous level exist in the Cadbury plant. Some of the key elements of the energy use optimization, which has been identified as key CDM projects in the manufacturing facilities of Cadbury Nigeria Ltd, includes:

5.1.3 Other Potential Projects

5.1.3.1 Steam Use Efficiency Improvement Projects

Steam is an important energy in the food processing operations in the factory of Cadbury Nigeria Plc. The introduction of trigeneration facilities will ensure efficient generation of the energy form. The focus in this efficiency improvement project will therefore be focused on:

- Improvement in the efficiency of the steam distribution network in the factory;
- Improvement in condensate recovery efficiency;
- Improvement in steam metering.

All these will lead to a reduction in fuel use per KG of steam produced, hence an improvement in factory energy efficiency and therefore a reduction in GHG emissions. The identification of energy efficiency improvement options in the plant will follow a comprehensive energy audit of the manufacturing plant.

5.1.3.2 Power Factor Correction

Electricity is the other very important energy input in the factory of Cadbury Nigeria Plc. Improvement in the efficiency on the generation side will be achieved with the introduction of the trigeneration system. A potential CDM project that has been identified at this stage of the project is focused on improving current level of the factory's power factor. Factory power factor is currently averaging about 80%. Improving this to above 90% using available technology is a feasible CDM project. It has been estimated that this can shave off about 10% of fuel required for power generation and therefore and a commensurate reduction in GHG emissions. We are still gathering data to put some system data on this potential CDM project.

5.1.3.3 Installation of a Computerized Energy Management System

Facilities for monitoring energy efficiency in both the generation and the utilization side of energy at Cadbury Nigeria Plc. facilities are currently very poor. As a matter of fact, the non-availability of the desirable on-line energy monitoring equipment prevented us from carrying out a quick walk-through energy audit during this phase of the project. We are currently looking at methodologies to facilitate the estimation of GHG emission reduction that can be attributable to a project geared towards improving energy database management in the manufacturing facilities of Cadbury Nigeria Plc.

5.2 Potential CDM Projects at Nestle Nigeria Plc.

We identified the following potential CDM projects for implementation at Nestle:

- Trigeneration—coupling a CHP—which produces power, steam and hot water— to a Vapor Absorption Chiller.
- Optimization of energy-use efficiency in the plant. This will include: steam use efficiency improvements; power factor correction; and installation of computerized energy management system.

5.3 Potential CDM Projects at Tower Aluminum Extrusion Company

5.3.1 Natural Gas Fuelled Power Generation

As elucidated in an earlier section, 27% of the demand for power during the year 2000 in the factory of Tower Aluminum was generated on-site in diesel generators. These generators had an average efficiency of about 24%. Tower Aluminum Extrusion Company is interested in implementing a fuel shift for power generation from the existing diesel system to power generators fueled by natural gas. This will not only yield improved energy efficiency, but will also lead to a reduction in GHG emissions.

5.3.2 Conversion of LPFO Fuelled Melting Furnaces to Natural Gas Fired Ones

Fuel combustion in the melting furnaces is currently the leading source of GHG emissions in the production processes at Tower Aluminum Extrusion Company. During the year 2000, the melting furnaces accounted for about 79% of CO_2 emissions in the plant. As such, significant GHG reductions can occur if a more energy efficient melting process can be implemented. According to Management sources, conversion of the current LPFO fuelled melting furnace to a natural gas fired type, will yield higher energy efficiency and thus lead to significant GHG emission reduction. This is currently feasible at the plant located at the Ikeja industrial area that has already been linked to natural gas supply facilities.

The same cannot be said of the manufacturing facilities located at Akowonjo area of Lagos. This area has not been linked to natural gas infrastructure, and we observe that neither the Federal Government gas company nor the private gas distribution companies are planning such an investment. We are currently studying whether or not demand for natural gas in the area is adequate to make a natural gas pipeline to the area (from the Lagos area infrastructure) economically feasible. If it is, we shall prepare it as a CDM project.

5.3.3 Power Factor Correction

Electricity is the other very important energy input in the factory of Tower Aluminum Extrusion Company. Improvement in the efficiency on the generation side will be achieved with the introduction of the natural gas fuelled power system. A potential CDM project that has been

identified at this stage is the improvement of the factory's power factor. Factory power factor is currently averaging about 84%. Improving this to above 90% using available technology is a feasible CDM project. It has been estimated that this can shave off about 8% of fuel required for power generation and therefore and a commensurate reduction in GHG emissions. We are still gathering data to put some system data on this potential CDM project.

ANNEX 1

CDM PHASE II STAKEHOLDERS MEETING

ON: THE 27TH OF MARCH 2001

AT: UNIDO CONFERENCE ROOM, UNIDO, LAGOS.

In attendance at the meeting were;

1.	Mr. Peter Pembleton	UNIDO Project Manager
2.	Mr. Pim Kieskamp	ETC Project Consultant
3.	Dr. F. B. Dayo	CDM – National Consultant - *Leader, National Team*
4.	Prof. Adegbulugbe	Energy use in Industry – *Member, National Team*
5.	Dr. F. I. Ibitoye	Information Systems – *Member, National Team*
6.	Mrs. Boma Doherty	Legal Issues – *Member, National Team*
7.	Mr. Sola Ibikunle	Investment Analyses – *Member, National Team*
8.	Mr. Olayinka Odebunmi	Comfar III Expert – *Member, National Team*
9.	Mr. John Akande	Technology Transfer - *Member, National Team*
10.	Mr. F. A. Egbamuno	Nestle Nigeria Plc., Agbara.
11.	Mr. Fouad Chalfoun	100, Ladipo street, Mushin.
12.	Mr. Engr. Kunle Sobanwa	Cadbury Nigeria Plc, Ikeja, Lagos.
13.	Mr. D. W. Sabarwaz	Tower Aluminium (Nig.) Plc., Lagos.
14.	Mr. Dayo Orekoya	Dunlop Nigeria Plc., Ikeja.
15.	Mr. Samuel Adenekan	Nestle Nigeria Plc,. Ilupeju
16.	Mr. Olumide Akinsola	Nigeria Conservation Foundation (NCF)
17.	Mr. O. Oyefuga	Pamaque Nigeria Limited, Ikeja.
18.	Mr. James New	Consultants, UNIDO
19.	Mr. Jide Mike	Manufacturers Association of Nigeria (MAN)
20.	Mr. Adeyemi I. Folounsho	Manufacturers Association of Nigeria (MAN)
21.	Mr. Emmanuel Ekpo	Triple "E" System Associates Ltd., Anthony, Lagos.
22.	Mr. O. A. Adeleke	Debo IndustriesLtd., Oshodi.
23.	Mr. A. M. Anand	Thermax Ltd., India c/o Nulti Cheminds, Ikeja, Lagos.

The meeting commenced at about 11.00am with a presentation of the various components of the CDM by Mr. Pembleton. According to him, the implementation of CDM has been divided into four main project phases. These include;

Phase I: National Capacity Building to Facilitate the Implementation of CDM project in Nigeria.

Phase II: Program Development

Phase III: Implementation of Programmes (Pilot Projects)

Phase IV: CDM Projects

In his presentation, Mr. Pembleton reiterated the various project activities that were carried out in the course of implementing the CDM Phase I programme. He intimated the meeting that the stakeholders meeting was organized to mark the commencement of the CDM Phase II programme. As indicated by him, project activities for the phase II include, setting up of core groups, surveys, identification of barriers; multi-stakeholders workshops, development of strategy, preparation of draft programme, regional workshop, and side event at COP 6. To this effect, he said six national experts to handle various issues that will contribute towards the programme development have been appointed. According to him, as these activities are being implemented locally, ECOWAS/COMESA will be implementing the regional component with inputs from national teams, the CTA and UNIDO. The regional program is targeted at supporting the development of a common approach by African industry to the climate change negotiations. He encouraged the stakeholders and the national experts to participate in the UNIDO on-line conferencing facility on the Internet, as this is the most cost-effective way of conferencing on issues relating to the project. He therefore instructed the experts to make available to him their e-mail addresses so he can forward their respective passwords to them for their access to the conference room on the UNIDO web page. In addition to this, he said the PowerPoint presentations of the CTA & Project Manager are available from the web page http://www.unido.org/doc/381449.htmls.

Mr. Pim Kieskamp, in his presentation discussed among other things the decision tools that will be utilized in the development of the draft programme as scheduled in the phase II project activities. These tools include Comfar III Expart, Identifier and Leap 2000. These tools will particularly be useful in the evaluation of investment opportunities, cost of investment, BOO/BOT JV issues, financial schemes, risk, insurance and security.

Moderating the meeting, Dr. Dayo thanked the two presenters. Stressing the irrevocable need to carry out the programme he said the project needs to be implemented whether or not CDM takes off. According to him, the goal here for us in Nigeria is to participate at this early stage of the programme conceptualization to ensure that we can benefit from the programme immediately the Kyoto Protocol as it relates to CDM project is ratified.

Mr. Peter Pembleton further explained that the scheduled workshop on CDM which UNIDO planned with Petrad and World Bank had to be postponed because of inadequate dialogue between the various Nigerian stakeholders involved. Speaking with regards to the participating companies, he said due to changes in management structure resulting from the changes in ownership of WAPCO and unavailability of time, the company will not be able to participate effectively in the current exercise. Invariably, this leaves room for the inclusion of more industry into the programme. According to him, Nestle will be a very useful addition to the CDM phase II activities as well as the Country Service Framework (CSF) under the agro-food processing industries.

Dr. Dayo reiterated that three industries namely: Cadbury; WAPCO; and Ashaka cement, were identified for the capacity building. According to him, while we are yet to make any progress in the CDM project for WAPCO and Ashaka cement, substantial progress is being made in Cadbury. He informed the audience that the Project Team is at the middle of a technical pre-design of a cogeneration facility for its plant. The lack of any progress at WAPCO and Ashaka cement and the apparent disinterest of WAPCO have therefore created vacancies for of two projects that could be taken up by other companies. He encouraged the management of companies like Dunlop, Nestle, etc to signify interest. He informed the meeting that there are already interested international investors, financials and technology suppliers who are interested in the Cadbury project.

Mr. Pembleton corroborated what Dr. Dayo said and promised that the Climate Change document that was prepared in Phase I of the project will be made available to them. In addition to this he seized the opportunity of the meeting to invite the stakeholders present at the meeting to visit the project web site for further information.

Questions and Discussions:

Questions by: Mr. Adenekan of Nestle

Q1: Mr. Adenekan requested for an explanation on the issue of certified emission reduction (CER) as it affect private sector participation.

Q2: He also wanted to know the reason for non participation of the media towards public enlightenment.

Q3: What are sustainability indicators, technology, and economic, social and environmental impact?

R1: Explaining the CER issues, Mr. Pembleton reiterated the use of project tools such as IDENTIFY to calculate baselines, evaluate technology option that is most appropriate for a particular project, calculation of emissions, savings, cost benefit analysis, and CER's.

In his own remark, Mr. Kieskamp said UNFCCC is expected to come up with guidelines for CER's calculations as well as verifications and certifications. According to him, guidelines on business-as-usual (BAU) and what-if scenarios will be given for industry, transport, agricultural and other sectors.

Buttressing this issue, Dr. Dayo pointed out the fact that the governing body of CDM will eventually come up with a guideline for CER's calculations, verifications certifications, environmental additionality, investments additionality, etc.

Mr. Pembleton informed the participants that there are experts at UNIDO that are currently studying baseline methodologies.

R2: Dr. Dayo in his response to the question said that while the media was very crucial to the success of the programme, it is very important to understand the project critical issues. In addition to this, appropriate timing of the involvement of the general populace and the media is very crucial towards the achievement of the project objectives. However, he reiterated that adequate media participation shall be achieved at the national multi-stakeholders workshop.

Reacting on the same issue, Mr. Pembleton said that the workshop that was postponed was meant to be a launching pad for the CDM and the CSF for the country. He further stated that when the workshop eventually takes place, media outfits from the radio, television and newspaper shall be invited. In addition to this, awareness of the project shall be achieved through MAN's newsletters, etc. He further informed the participants that a small contract (funded separately to the regional programme, under the UNIDO CSF project) has been packaged along with the project activities for raising awareness and preparation of articles for publications. He therefore implored NGO's, industries and other stakeholders to start writing on the project.

R3: In his response to the question on sustainability indicators, Dr. Dayo said they are in existence but not collated in the required format. He said the indices are available in the Vision 2010 and the Industrial sector planning documentation. It was also brought to the notice of the participants that Nestle and FME have set-up a committee that is saddled with the responsibility of collating sustainability indicators for the country.

Request by: *Mr. Sobanwa of Cadbury Nigeria.*

Q1: How can UNIDO assist in carrying out the energy audit (EA) that is a requirement for project packaging?

R: Dr. Dayo further expatiated the question by explaining that, in order to build a cogeneration facility, the companies need to first establish the energy efficiency of the existing facility. This energy efficiency can only be established through the implementation of a comprehensive/work-through energy audit. Such an exercise requires the use of some

specialized metering systems that are very expensive, making it unaffordable by most of the existing companies.

In his response to the question, Mr. Pembleton said that there is no funding from UNIDO for this purpose. He reiterated the fact that, there are a lot of interests in the development of an industrial project for CDM. A small budget for purchasing metering equipment for the companies might be one of the items deemed necessary for inclusion in Phase III. He said EA is a very essential component of the Nigerian CDM programme that is key to making concrete and accurate judgments. Similarly, about 8-10 months should be earmarked for EA in Phase III. Furthermore, he informed the participants that "identified needs" will be part of the outcome of this year's CDM activities.

Dr. Dayo rounding up the response to this question said, the Regional Director of UNIDO is to contact the various groups for their cooperation in order to work together. Such cooperation will be strengthened through the contribution in the development of their in-house capacity for auditing.

Questions by: Dr. Akande

Q1: What is the definition of industry as it relates to small and medium enterprise in the CDM?

R: Mr. James New responded to this question by pointing out the fact that, calculations for SME are more difficult than for industry as they are often scattered and without reliable database.

Mr. Pembleton said that in terms of CDM projects for SME's, project clustering will be considered as the multiple problems of scattered SME's will inevitably make project packaging and implementation complicated.

In his reaction, Dr. Dayo said SME's are very important and formed one of the Pilot projects being packaged in the Phase I of this project. According to him, the project is conceptualized for over 200 saw millers located at Oko-baba area in Lagos State for the

utilization of their generated waste in the firing of a cogeneration facility that will in turn supply them with electricity, steam and possibly some supply to the grid.

Contribution: Mr. Samuel Adenekan

C1: Contributing to the discussion, Mr. Samuel Adenekan said all the problems affecting the industry should be listed and projects that can be supported by the CDM programme listed against these problems. According to him these companies can easily choose from these project for implementation.

R1: Mr. Kieskamp was quick to refer Mr. Adenekan to page19, Annex 1 in the report of the project activity in Phase I.

Nigeria Conservation Foundation (NCF):

Mr. Olumide Akinsola said NCF has appraised and assessed the effort of the various parties on this project as it relates to UNIDO, the International expert and the National experts and the organisation wishes to commend them all for their progressive strife in the programme. He stated that the organization will like to be informed as things are developing with the project.

Rounding up the meeting, Mr. Pembleton said it is essential that government ownership of the programme is assured. He also implored all the participants and their companies to cooperate with the national team in carrying out the phase II activities.

Briefs on the Stakeholders in attendance at the Meeting

Manufacturers Association of Nigeria (MAN)

This is a private institution that is set-up through the alliance of all manufacturers in the country. In principle, MAN protects the interest of all manufacturers in the country and

serves, among other things, as the common forum for communicating with various governmental agencies. The contact person for the association is Dr.U.E. Okeke who is the Director-General of the association. The contact address of MAN is 77, Obafemi Awolowo Way, Ikeja, Lagos.

Dunlop Industries Plc.

Dunlop Industries Plc is a private company that specializes in the manufacturing of tyres, syntetics, plastics and paints. The contact person of the company is Mr. J. D. Lawuyi who is the company's Group Managing Director. The head office of the company is located at Oba Akran Avenue, Ikeja, Lagos.

Cadbury Nigeria Plc.

Cadbury Nigeria Plc. is a leading private industry in Nigeria that manufactures food drinks, foods and confectionery. The contact person of the company is Mr. Bunmi Oni who is the company's Managing Director. The company is situated at Agidingbi, in Ikeja Industrial Area, Lagos.

Nestle Foods (Nigeria) Plc.

Nestle Foods (Nigeria) Plc. is a private industry that manufactures food and food drinks. The contact person for the company is the Managing Director, Mr. Jean Louis Chaumel. Nestle Foods (Nigeria) Plc headquarters is located at Ilupeju Industrial Estate, Oshodi, Lagos.

Nigerian Conservation Foundation (NCF)

Nigerian Conservation Foundation (NCF) is one of the non-governmental organization in the country. The contact person for the organization is Mr. J. A. Dosunmu. The head office of NCF is located at Plot 5, Moseley Road, Ikoyi, Lagos.

Debo Industries Limited, Oshodi

Debo Industries limited is a private company that specializes in the manufacture of deep freezer, refrigerators, air conditioners and milling machines. The contact person is Mr. Adekunle Adebowale who is the General Manager/C.E.O. the head office of the company is located at plot 6, Block H, Oshodi Industrial Scheme, Lagos.

Cybele Cosmetics Limited

Cybele cosmetics limited, is a private industry that manufactures cosmetics and pharmaceuticals. The contact person for the company is Mr. Fouad Chalfoun who is the Asst. General Manager. The head office is at 98/100, Ladipo Street, Matori Industrial Estate, Mushin, Lagos.

Tower Aluminium (Nig.) Plc.

Tower aluminum Nig. Plc. is one of the leading private industries in Nigeria that manufactures aluminum/sheet corrugated, fabricated sheets, and extruded aluminum profiles for window and door. The contact person is Mr. D.N. Sabarwal who is the Managing Director. The head office of the company is located at 9,Oba Akran Avenue, Ikeja Industrial Estate, Lagos.

Pamaque Nigeria Limited

Pamaque Nigeria Limited is a private company that specializes in the design, fabrication and construction of metal-plate structures (Tanks and Vessels). The contact person is Mr. O. Oyefuga who is the Chief Executive Officer of the company. Head office is at 8, Iya-Oloye Crescent, Mile 8, Ikorodu Road, Onigbongbo, Lagos.

CDM PHASE II: NATIONAL TEAM MEETING

ON: THE 27TH OF MARCH 2001

AT: UNIDO CONFERENCE ROOM, UNIDO, LAGOS.

In attendance at this meeting were;

1. Mr. Peter Pembleton
2. Mr. Pim Kieskamp
3. Dr. F. B. Dayo
4. Prof. A. O. Adegbulugbe
5. Mr. James New
6. Dr. F. I. Ibitoye
7. Mr. S. Ibikunle
8. Mrs. Boma Doherty
9. Mr. J. Akande
10. Mr. Odebunmi Olayinka
11. Mr. Emmanuel Ekpo

The meeting started with the introduction of all the members of the team. Dr. Dayo then gave a brief introduction of the project. He reiterated the fact that this is the phase II of the project and that Mr. Pembleton has just being able to secure a seed money to start this phase.

Mr. Pembleton afterwards gave the background information for the phase II activities. He said just as Dr. Dayo has pointed out, the seed money is just for kick-starting the process as it relates to putting together the national programme. He said this phase is considered as the preparatory assistance and hence each of the experts are not hired as consultant. According to him, the elements of the programme to be generated from this phase include:

- Purchase of equipment
- Training (experts and immediate stakeholders)

- Generation of programme framework
- Packaging of project document (Mr. Pembleton and Mr. Kieskamp)
- Generate ownership ourselves as team members, etc

Mr. Pim Kieskamp further elucidated the fact that despite the low level of financial resource available for this phase, all the team member should ensure that the project is continuously moving as other counties are continually progressing in the project.

Mr. Pembleton further informed the members of the national team that the official project management tool for the CDM is the internet and members can visit the UNIDO Africa, industry & CDM WebBoard at the following address: http:/www.unido.org/webboard/wbpx.isa/~africa-climate for information, chatting with experts from other participating countries and downloading of required documents. He then explained the scheduled activities for the phase II which according to him include:

- Set-up core group
- Concept Workshop
- Surveys
- Identify Barriers (assessment, prioritization and mitigation)
    - *Investment*
    - *Motivation*
    - *Financial*
    - *Technology*
    - *Nigeria Specific*
- Develop Strategy
- Draft Programme

The team should develop a strategy & programme to remove various identified barriers in the legislative, the financing, support (to CDM), in this phase. The draft programme will detail among other things, the output of the phase II programme, the activities to be carried out and the identified project to be implemented. At the UNIDO office, he said the representatives of the regional organizations ECOWAS and COMESA will be handling the regional component of the project.

UNIDO and ETC will guide this process. The regional meeting and the CoP7 meeting will be organized by them. The scheduled activities here include;

- Contract ECOWAS
- Contract COMESA
- Create African Group of Experts
- Organize regional meeting at Abuja for the 4th of October (Concept Workshop & Planning)
- Participation in COP 7 scheduled for 29th of Oct to 9th Of Nov.

The expected report from the implementation of the phase II project activities and their respective dates are as follows;

1.	1st report	Due at the end of April Content: Meetings, names, stakeholders & attendance, schedule of TOR implementation.
2.	2nd report	Due between May – June Content: Surveys, analysis, capacity need problems, etc
3.	3rd report	Due by July ending Content: Identification and prioritization of barriers.
4.	4th report	Due by end of September content: Input to regional workshop, strategy and part/all of programme.
5.	Final report	Nigeria component of the regional integrated programme

The meeting was ended on this note.

E-mail addresses of the national team members are provided as follows;

1.	Dr. F. B. Dayo	triple-e@triplesys.com
2.	Prof. A. Adegbulugbe	heptagon@hotmail.com, heptagon@nova.net.ng
3.	Dr. F. Ibitoye	fibitoye@oauife.edu.ng, fibitoye@yahoo.com
4.	Mrs. Boma Doherty	bomadoherty_co2000@yahoo.com
5.	Mr. Odebunmi Olayinka	triple-e@triplesys.com
6.	Dr. John Akande	drjohnakande@yahoo.com
7.	Mr. Ibikunle	ibikunlesola@yahoo.com

Developing National Capacity To Implement Industrial Clean Development Mechanisms Projects In Selected Industries In Nigeria: Preparatory Assistance Phase

CDM National Experts Meeting of 10th April, 2001

Objective Of Meeting:

The main objective of the meeting were identified as follows:

i. To structure out the programme (i.e. determining strategy to be adopted at this phase of the projects.)
ii. To analyse the role of each expert in the team i.e. definition of assignments

The Project

The national co-ordinatior; Dr. F. B. Dayo refreshed the memory of other members of the team as he gave the background information which he highlighted as follows:

i. That the project is being designed to assist in the development of an enabling environment for industries to participate in the Clean Development Mechanism in Nigeria, by identifying and indeed removing the possible technologies.
ii. The project will also encourage the implementation of industrial projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The targeted beneficiaries of the project will be the industrial sector, industry support organizations, technology divisions, investment services, academia and indeed the policy making bodies that have impact on industrial development and transfer of technology and investment.
Since the CDM project is actually designed to cover six national components in Africa (i.e. Ghana, Kenya, Senegal, Zambia, Zimbabwe and Nigeria), Dr. F.B.O. Dayo has been interacting with the other project coordinator in each of these countries.

Programme Strategy:

The strategy to be adopted was structured out as highlighted below:

i. To finalize the recipient companies. It was agreed that we concentrate on Nestle (Nig.) Plc. And Tower Aluminum in addition to Cadbury, which is already in our plan.

ii. To carry out a mutual education programme. This programme is designed to educate each of the recipient companies on the CDM project and indeed what they stand to gain from the exercise. The programme would also provide opportunity for us to learn from them especially as regards their operations, the extend of relevance of such company to this type of exercise e.t.c.

iii. Implementation of CDM projects in each of the selected environments.

iv. Identification of possible barriers to these projects.

v. Identify and develop strategies to remove barriers to the transfer of climate-friendly industrial technologies.

vi. Implement the strategies adopted, to remove these barriers.

vii. To implement and monitor CDM projects in these environments.

Assignment were then defined for each of the expert with respect to the area of participation. The team is to meet on Thursday 19th April 2001, as they are expected to visit Cadbury (Nig.) Plc., Ikeja.

ANNEX II

Project Stakeholder

Stakeholders in the on-going CDM project in Nigeria has been broadly classified by institutions into four main categories. These are: Government Institutions; Private Sectors Institutions; International Institutions; and Non-governmental Organizations (NGO's). Most of these stakeholders in the above categorization have been contacted, appropriately sensitized on the goals & objectives of the Kyoto Protocol and they have actually been participating in meetings, discussions and studies being executed within the project. Some of these stakeholders include:

(a) **Government Institutions**

These are government institutions that were set-up at the Federal level primarily to control, regulate and manage the activities of various sectors of the country's economy. The involvement of these institutions in the current CDM initiative is particularly important as there exist a lot of projects in these sectors that has direct or indirect impact on the ozone layer and their implementation could be facilitated under the initiative. Some of these institutions are;

1. Federal Ministry of Industry

The Federal Government has set-up the Federal Ministry of Industry (FMI) primarily to formulate and implement appropriate policy measures that will improve and sustain the investment climate and also ensure the most efficient allocation of functions and resources between the public and private sectors of the economy. The contact person of the Federal Ministry of Industry is the Honorable Minister of Industry, Dr. Iyorchia Ayu. The head office of FMI is located at the Federal Government Secretariat, Garki, Abuja.

2. Federal Ministry of Science and Technology

This Ministry was set-up by the Federal Government for management, regulation and development of all issues and activities in the Science and Technology sub-sector of the nation. The contact person for the institution is the Honourable Minister of Federal Ministry of Science & Technology Chief Ebitimi Banigo. The head office of the institution is located at the New Federal Secretariat Complex, Shehu Shagari Way, Abuja.

3. Federal Ministry of Power & Steel

The Federal Ministry of Power and Steel, as the name implies control and manages various activities that are carried out in the Power and Steel sub-sector. The contact person for the institution is the Honourable Minister for the Federal Ministry of Power & Steel, Chief Bola Ige. The head office is situated at the federal secretariat complex, Abuja.

4. Nigerian National Petroleum Corporation (NNPC)

The Nigerian National Petroleum Corporation (NNPC) is a Federal government institution with the mandate of managing, controlling, regulating and administering the upstream and downstream activities of the petroleum sector. The contact person for the purpose institution is the corporations Group Managing Director, Mr. Gaius Obaseki. The head office of the institution is located at; NNPC Towers, Herbert Maucaulay Way, Central Business District, Garki, Abuja.

5. National Electric Power Authority (NEPA)

National Electric Power Authority (NEPA) is the Federal Government institution saddled with the responsibility of managing and controlling all activities that relates to electric power generation and distribution in the country. The contact person of the organization is Mr. Bello Suleiman who is the appointed Managing Director NEPA.

6. **Energy Commission of Nigeria (ECN)**

The Energy Commission of Nigeria is a Federal government institution that is set-up to implement policies that will facilitate adequate and sustainable development of energy and its supply at acceptable costs to meet the needs of the country's inhabitants using optimal production and end-use efficient facilities. The contact person for the institution is Professor Ibrahim Umar who is the Director-General of the institution. The contact address of the institution is 10 Okotie- Eboh Road, Ikoyi, Lagos.

7. **Centre for Energy Research and Development (CERD)**

The Centre for Energy Research and Development (CERD) is an institution that was set-up by the Federal government to facilitate research and development of energy issues in the country. In addition to this, the institution is also to effectively co-ordinate the activities of the various energy institutions in the country. The Director General of CERD is Prof. A. O. Adegbulugbe and the contact address is the Centre for Energy Research and Development, Obafemi Awolowo University, Ile-Ife, Osun State.

(b) <u>Private Sector Institutions</u>

1. **Manufacturers Association of Nigeria (MAN)**

This is a private institution that is set-up through the alliance of all manufacturers in the country. In principle, MAN protects the interest of all manufacturers in the country and serves, among other things, as the common forum for communicating with various governmental agencies. The contact persons for the association is Mr. Jide A. Mike and Mr. Adeyemi I. Folorunsho. The contact address of MAN is 77, Obafemi Awolowo Way, Ikeja, Lagos.

2. **Dunlop Industries Plc.**

Dunlop Industries Plc is a private company that specializes in the manufacturing of tyres, syntetics, plastics and paints. The company's Group Managing Director is Mr. J. D. Lawuyi while the contact person for the company is Mr. Dayo Orekoya. The head office of the company is located at Oba Akran Avenue, Ikeja, Lagos.

3. **Cadbury Nigeria Plc.**

Cadbury Nigeria Plc. is a leading private industry in Nigeria that manufactures food drinks, foods and confectionery. The company's Managing Director is Dr. Bunmi Oni while the contact person for this project is Engr. Kunle Sobanwa. The company is situated at Agidingbi, in Ikeja Industrial Area, Lagos.

4. **West African Portland Cement Plc. (WAPCO)**

West African Portland Cement Plc. (WAPCO) is the largest producer of cement in Nigeria. The company's contact person is Engr. J. O. Makoju who is the Managing Director/Chief Executive. The company's headquarters is located at Elephant Cement House, Assbifi Road, Ikeja Business District, Alausa, Ikeja, Lagos.

5. **Benue Cement Company**

Benue Cement Company is also one of the cement producer in Nigeria. Engineer S. I. Nyagba is the Managing Director/Chief Executive of the company and is the contact person for the current initiative. Benue Cement Company head office is situated at Plot 306, Adeola Odeku Street, Victoria Island, Lagos

6. **Ashaka Cement Plc.**

Ashaka Cement Plc (Ashaka Cem) is another cement producing company that is located in Gombe, in the North eastern part of Nigeria. Mr Jammes Cook who is the compny's Deputy Managing Director is the contact person for the company.

7. Nestle Foods (Nigeria) Plc.

Nestle Foods (Nigeria) Plc. is a private industry that manufactures food and food drinks. The Managing Director of the company is Mr. Jean Louis Chaumel while the contact persons for this project is Engr. F.A. Egbamuno and Mr. Adenekan. Nestle Foods (Nigeria) Plc headquarters is located at Ilupeju Industrial Estate, Oshodi, Lagos.

8. Cement Manufactures Association of Nigeria (CMAN)

This is a private institution that is set-up through the alliance of all manufacturersof cement in the country. Just as with MAN, CMAN protects the interest of all cement manufacturers in the country and serves, among other things, as the common medium for communicating with various governmental agencies. The contact person for the association for the current initiative is Mr James Cook, the Deputy Managing Director of Ashaka Cement.

9. Chevron Nigeria Limited (CNL)

Chevron Nigeria limited is a subsidiary of Chevron Corporation which operates for and on behalf of Nigerian National Petroleum Corporation (NNPC) in the exploitation and exploration activities of the country's Petroleum sector. The company's Managing Director is Mr Kirkland and the head office is located at 2, Chevron drive, Lekki Penninsula, Lagos.

10. Shell Petroleum Development Company (SPDC)

SPDC in joint venture with NNPC, is another major operator in the Nigerian Petroleum sector.

11. Debo Industries

Debo industries is one of the leading manufacturers of refrigerators in Nigeria. The company headquarters is located at Plot 6, Block H, Oshodi Industrial Scheme, Oshodi, Lagos. The contact person for this project is Mr. O. A. Adeleke.

12. Tower Aluminium

Tower Aluminium Group is a leading industry in the construction industry in Nigeria that is involve in the production of roofing coils, hollowares products, extrusion profiles, etc. The company's head office is located in the Ikeja Industrial area of Lagos State. The Managing Director of the company is Mr. D. W. Sabarwal while the contact person for the project is Mr. Pabalkar.

(c) Non-Government Organizations (NGO's)

1. Nigerian Conservation Foundation (NCF)

Nigerian Conservation Foundation (NCF) is one of the non-governmental organization in the country. The contact person for the organization is Mr. J. A. Dosunmu. The head office of NCF is located at Plot 5, Moseley Road, Ikoyi, Lagos.

2. Friends of the Environment (FOE)

Friends of the Environment (FOE) is also one of the non-governmental organizations in existence in the Nigeria. The organization is Chaired by Engr. (Mrs) J. O. Maduka FOE head office is located at 106/110 Lewis Street, Lagos.

3. Enabling Environment Forum (EEF)

Another non-governmental organization that is in active existence in the country is the Enabling Environment Forum (EEF). Mr. Udochuku Uwakaneme is President of EEF. The head office of the organisation is located at the General Motors Building, Oregun Road, Ikeja, Lagos.

(d) International Institutions

These are institutions that are international based and has membership from government of various countries of the world. The following are the identified international institutions, their local representatives and contact addresses.

1. **Food and Agricultural Organization (FAO)**

The FAO Representative in Nigeria is Dr. Hashim A-Shami and could be contacted at No.17, Ontario Crescent, Maitama, Abuja

2. **World Health Organization (WHO)**

The contact person of WHO in Nigeria is Dr. Evarist Njelesani and can be contacted at No. 443, Herbert Macauley Street, Opposite Yaba College of Technology, Yaba, Lagos.

3. **International Finance Organization (IFC)**

Mr. Akbar Husain is the IFC representative in the country and can be contacted at No. 1, Mekunwen Road, Ikoyi, Lagos.

4. **United Nations Information Center (UNIC)**

The director of UNIC in Nigeria is Mr. C. F. Njinga and the contact address of the organisation is No. 17 Kingsway Road, Ikoyi, Lagos.

5. **United Nations Fund for Population Activity (UNFPA)**

Mr. J. Bill Musoke is the UNFPA representative and the organisation contact address is No. 11, Oyinkan Abayomi Drive, Ikoyi, Lagos.

6. **United Nations Educational Scientific and Cultural Organization (UNESCO)**

Mr. Emmanuel Apea is the UNESCO representative in Nigeria and can be contacted at Plot 777, Bouake Street, Off Rabat Road, Off Herbert Macaulay Way, Wuse, Zone 6, Abuja.

7. **World Metallurgical Organization (WMO) – West Africa**

The representative of WMO for West Africa in Nigeria is Mr. M. Y. Boulama. WMO office in Nigeria is located at No. 14, Broad Street, Lagos.

8. **United Nation International Children and Education Fund (UNICEF)**

Dr. Christian Voumard is the UNICEF representative in the country and can be contacted at No. 30a, Oyinkan Abayomi Drive, Ikoyi, Lagos.

9. **United Nations High Commission for Refugees. (UNHCR)**

UNHCR representative in the country is Mr. Godfrey Sabiti. The head office of the institution is 13 Awolowo Road, Ikoyi, Lagos.

10. **United Nations Drug Control Programme (UNDCP)**

Mr. S. B. Raza is the UNDCP representative in Nigeria. UNDCP office is located at No. 11, Oyinkan Abayomi Drive, Ikoyi, Lagos.

11. **United Nations Development Fund for Women (UNIFEM)**

Ms. R. Amadi-Njoku is the UNIFEM advisor in the country and he can be contacted at No.11, Oyinkan Abayomi Drive, Ikoyi, Lagos.

12. **International Labour Organisation (ILO)**

Ms. Cynthia Yinusa is the Officer-in-Charge of ILO in Nigeria. The head office of the organisation is located at Glass House, 188 Awolowo Road, Ikoyi, Lagos.

ANNEX III

UNIDO Abbreviated Project Description

Targeted Industry:

Cadbury Nigeria Plc., Ikeja, Nigeria

1 PROJECT BACKGROUND

Cadbury Nigeria is interested in tri-generation technology to improve energy management and efficiency in electricity, cooling and heat supply. Because of the epileptic nature of power supply from the National Electric Power Authority (NEPA), Cadbury has always depended solely on on-site diesel generators for power generation. Its manufacturing facilities are not connected (neither are there plans to connect) to the national grid. Furthermore, the company generates the steam needed for its manufacturing processes in on-site fuel oil fired boilers. The implication of this energy supply structure is that the major energy security consideration has been and continues to be, adequate, timely and reliable supply of diesel and fuel oil.

Cadbury Nigeria is located in the Ikeja business district that is currently connected to City Gate via the Gaslink Nigeria Ltd natural gas supply facilities. To improve energy security, productivity, and enhance energy economics and environmental performance, company management converted the boiler facilities to dual fired systems with the capability of firing either natural gas or LPFO. The company started to produce steam by firing natural gas in its boilers in December 2000. It has been estimated that this shift to natural gas will result in a 55% GHG emissions reduction annually in the factory, in addition to about a 40% reduction in fuel costs.

2 PROJECT DESCRIPTION

2.1 Basic Considerations in Project Design

The efficiency of energy production in the company can be improved with the use of a combined heat and power system linked to a vapor absorption compression (VAC) facility. The proposition is that Cadbury will replace its current power, steam and chilling supply facilities with a tri-generation system that is capable of supplying all of the factory's demand for energy and perhaps produce excess power for export to the grid. Our investigation showed that in the absence of the Kyoto Protocol, especially the CDM, Cadbury would not have considered the adoption of the proposed system due to the following facts: it is considered more expensive than status quo alternatives; the company had just invested in conversion of its boilers to dual firing; and there is a general feeling that a CHP system linked to a VAC is more sophisticated compared to the status quo system, and as such would require specialized knowledge not currently available in the company.

Another critical issue that we identified from discussions with top management of Cadbury is that energy is not the core business of the company. As such, company management is willing to relinquish the responsibility of capital investment in energy infrastructure to others, as long as the resulting energy price is competitive to current and alternative sources and the supply can be considered to be reliable. When a third party energy supply company takes up such a responsibility, then Cadbury will be able to utilize the scarce capital available to it to strengthen its core business. In this regard, Cadbury seems to prefer a Build-Operate-Own (BOO) or a Build-Own-Transfer (BOT) scheme.

As part of project development responsibilities under the phase 2 activities of this UNIDO funded Capacity Building project, the appropriateness of some Cogeneration technologies given Cadbury's heat and power demand now and into the future were evaluated. The objectives of the Tri-generation CDM project in Cadbury as conceptualized in this study can be summarized as follows:

- To replace the current generation of electric power, steam, and chilling with a more efficient system, utilizing CHP linked with a vapor absorption cooling system.
- To put in place such a system that will be operational by 2003, utilizing natural gas as fuel and having a minimum of 15 years life span.
- To incorporate cost effective redundancy into the system being recommended, for example, current installed power capacity in the factory is about 7.3 MW. Peak power demand in 2000 was 3.648 MW.
- Cadbury would still like to be self-sufficient energy-wise, especially if the efficiency of the national supply chain does not improve. In this respect, the client will prefer a system that is not dependent on energy imports.
- Cadbury is particularly not interested in exporting excess power to the grid, given the fact that the Nigerian power market is not yet ripe for such transactions. There is no enabling legislation guiding power buy backs. Cadbury is therefore keen, at least in the first few years of its cogeneration system, to put in place a system that will satisfy its power and heat demands.

2.2 Site Power and Heat Matching Calculations

To carry out these calculations, the terminal year energy supply situations were estimated. In order to do this, we utilized escalation factors derived by the client as representing the most feasible future conditions. We estimated the following possible demand for the **terminal year 2017** as follows:

- **Total Electricity Demand** **53594.91 MWh**
- **Total Steam Demand** **34.62×10^4 tonnes**
- **Cooling**
  - Refrigeration Duty **1304.45 RT**
  - Steam Requirement for VAC **5870 kg/h**

The power and heat matching calculations were carried out for three Combined Heat and Power (CHP) alternatives, namely, Steam Turbine, Reciprocating Engines, and Gas Turbines. The following conclusions were deduced:

- If steam turbines were employed, a CHP system having a capacity of a minimum of 12 MW would be adequate to supply heat power and chilling requirements of the factory even up to the terminal year 2017;

- If a gas turbine or a reciprocating engine is utilized, system capacity that will satisfy factory steam needs up to the year 2018 will be in the region of between 75-95 MW capacities with a large potential for power export;

- The power capacity of the reciprocating engine or gas turbine that will match factory energy needs can be reduced, if proper designs of heat recovery system beyond those normally incorporated into these technologies are included in the specification. This may however reduce the price advantage of these technologies over the conventional steam cycle;

- Our calculations showed that a 5 MW capacity for example without supplementary firing, or advanced heat recuperation facilities, for either a reciprocating engine or a gas turbine would yield a total steam generation of about 4110 kg/h. This is even not adequate to meet the base year (2000) steam requirement. Tripling the power generating capacity to 15 MW will enable the satisfaction of base year steam requirement, but not the peak steam demand;

- A reduced power capacity can also be achieved by coupling the reduced MW to some of the existing steam production facilities, to satisfy station steam requirements;

Given the results elucidated above, and Cadbury preferences for system set up, we devised the following systems characteristics for the CDM project:

2.3 Characteristics of the CDM Project: Tri-generation at Cadbury Nigeria Plc.

- System Capacity: Start-up Capacity of 7.5MW in 3 Modules each 2.5 MW, Capacity to be added as demand dictates with time;

- Technology Type Options:
  - Steam Turbine – Will need auxiliary firing below 12 MW, if site steam demand is to be met;
  - Reciprocating Engine – At 7.5 MW, site steam demand can only be met via supplementary firing. If power export can be considered, a capacity of over 85 MW will meet Station steam demand to the end of the project time;
  - Gas Turbine – Same situation as above. If power export can be considered, system capacity that will satisfy site energy requirement may be as high as 100 MW.

We are currently compiling information on possible system configurations to satisfy the tri-generation project objectives elucidated above. System specification data are currently being assembled from international system vendors. Once all of the information is in place, we plan to carry out a techno-economic evaluation of possible alternatives using COMFAR-IV. Output from this exercise will form the basis of the best configuration to be adopted for this project.

3 Contribution to Sustainable Industrial Development

The project would provide Cadbury with reliable energy supply. This in turn would improve the company's performance and profitability and contribute to economic development in the country. Switching to natural gas would reduce the carbon intensity of energy use and thereby reduce the

company's greenhouse gas emissions. Eliminating diesel use would also reduce emissions of other key environmental pollutants, including sulfur.

4 GREENHOUSE-GAS EMISSIONS ABATEMENT

4.1 Project Baseline

The status quo power, steam and chilling situation is represented by the system in place in the year 2000. The energy characteristics for the year 2000 are described below:

- **Power**
  - Total Electricity Consumed — **24866.5 MWh**
  - Total Diesel Consumed — **6.51×10^6 Liters**
- **Steam**
  - Total Steam Consumed — **24.39×10^4 tonnes**
  - Total Fuel Oil Consumed — LPFO: **5.423×10^6 Liters**; Diesel: **0.610×10^6 Liters**; N.Gas: **0.174×10^6 Liters**
- **Cooling**
  - Power Demand for Chilling (VCC) — **850 kW**
  - Refrigeration Duty — **860 RT**

Fuel combusted for energy production is the main source of GHGs in the plant. LPFO and natural gas are used for steam generation, with natural gas becoming the primary fuel used for this purpose as of December 2000. Diesel is and still remains the only fuel used for electricity generation. Although natural gas is available at the factory, the generators are yet to be converted to utilize natural gas. Combusting the fuels mentioned above results in emissions of carbon dioxide and other greenhouse gases. Table 1 below, gives a summary of CO_2 emissions from Cadbury manufacturing facilities in selected years.

Table 1: CO_2 Emissions from Fuel Combustion at Cadbury (Thousand Tonnes of CO_2)

Year	From LPFO	From AGO	From N. Gas	Total
1996	17.0	15.4	0.0	32.4
1997	17.7	14.4	0.0	32.1
1998	18.3	15.9	0.0	34.2
1999	20.7	16.6	0.0	37.3
2000	15.7	17.5	0.01	33.2

4.2 Emission Reduction Projections

Table 2: Projected CO_2 Emissions and Emission Reductions for the Project Period (2003 – 2017)

	PROJECT GHG EMISSIONS		
	N. Gas Con. (GJ)	GHG Emission Tonnes	GHG Emission Reduction (tCO_2)
2003	175,163	9,827	28,897
2004	181,708	10,194	29,740
2005	257,134	14,425	6,461
2006	317,202	17,795	7,970
2007	325,922	18,284	8,189
2008	334,891	18,787	8,414
2009	344,117	19,305	8,646
2010	353,608	19,837	8,885
2011	363,372	20,385	9,130
2012	373,417	20,949	9,382
2013	383,751	21,528	9,642
2014	394,383	22,125	9,909
2015	405,323	22,739	10,184
2016	416,578	23,370	10,467
2017	428,160	24,020	10,758
TOTAL			**176,674**

5 PROJECT SUMMARY

The following Table presents a summary of key project data.

Proposed mitigation measures	**CO_2 abatement: Fuel switching and energy conservation**: The project involves replacing the existing stand-alone natural gas fired boilers and diesel powered generators with a Combined Heat and Power (CHP) facility. The CHP will be linked to a Vapor Absorption Compression (VAC) system that will supply the entire factory chilling needs utilizing medium pressure steam produced from the CHP.
Project baseline	**Business as usual scenario**: Continued supply of factory power requirements from diesel fuelled generators for the first five years of the scenario period. Thereafter, power will be supplied from stand-alone natural gas fuelled generators. Steam will be supplied from natural gas fuelled on-site boilers. Chilling will continue to be provided on site from electric powered vapor compression chillers (VCC).
Crediting period	**Fifteen years**: The project seeks Certified Emission Reductions (CERs) under three 7-year "renewal" periods depending on baseline development.
Estimated CO_2 reduction	Anticipated Annual Emission reductions (ERs) Order of magnitude estimate: 175,000 tonnes CO_2 over 15 years.
Sources of ERs	Only CO_2 ERs will be achieved through the implementation of the Tri-generation system, which will replace business as usual power, heat and chilling supply options.
Sustainable development impact	**Industrial development project in line with FGN sustainable development plans** • Development target: Provide Cadbury with reliable power • Use an alternative fuel with lower carbon content and as such lower environmental pollution • Socio-economic objective: More profitable commercial activity, hence better profitability
Anticipated sources of revenue	• Sale of electricity to Cadbury Nigeria Plc., under license to NEPA or the yet to emerge Federal Power Regulatory Commission who will determine and administer the power tariffs • Sale of steam at a tariff to be negotiated and agreed with Cadbury Nigeria Plc. • Sale of chilling at a tariff to be agreed with Cadbury Nigeria Plc. • Sale of CO_2 emission reductions (ERs).

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Targeted Industry:

Tower Aluminium, Ikeja, Nigeria

6 PROJECT BACKGROUND

Tower Aluminum Group is a leading industry in Nigeria belonging to the Construction Group of the industrial sector of the country's economy. The company manufactures roofing coils, hollowware products, extrusion profiles etc. The company, which has its head office in the Ikeja Business District, was established in 1958. Energy -- in the forms of electrical power and high temperature process heat -- is a crucial input to the production processes utilized in the factory. This project involves switching both electricity supply and furnaces for process heat production to natural gas.

7 PROJECT DESCRIPTION

The proposed project involves two fuel-switching measures: 1) replacing the Melting Furnaces (MFs) currently fired with Low Pour Fuel Oil (LPFO), and the Annealing Furnace (AF) currently fired with LPG, to natural gas in both cases; and 2) replacing the current diesel-fired power generators and grid-purchased electricity with natural-gas-fired gas engines.

A designated natural gas distribution company, Shell Gas Nigeria Ltd., has already proliferated gas pipeline infrastructure to the industrial estate where the Tower Aluminum plant in Otta is located. The gas distribution company is interested in implementing a Pressure Reducing and Metering System (PRMS) within the Tower Aluminum factory gate at Otta. The Company has not acceded to this, as it is handicapped financially and does not plan to convert to natural gas in the foreseeable future. Discussions with top management of Tower Aluminum indicate that the availability of funds through the CDM process would enhance the ability of the company to take these very important economically and environmentally sound steps. In the absence of CDM, it is unlikely that the company will make the fuel substitution move. Brief elucidations of the various components of the project are presented below.

7.1 Conversion of Burners to Dual Fired Types (natural gas/LPFO or LPG)

This will involve changing the current furnace burners to the type that can fire natural gas. In order to build fuel flexibility into the system, we are considering the use of dual fired burners. For the MFs, burners capable of utilizing natural gas/LPFO will be selected, while natural gas/LPG burners will be prescribed for the AF.

Low Pour Fuel Oil is the fuel utilised in both the Melting and the Holding Furnaces. Table 1 provides quantitative data on the LPFO consumption of these furnaces. The LPFO consumption and the specific consumption at the Billet Casting Plant are presented in Table 2.

Table 1: LPFO Consumption for Caster Production in Melting and Holding Furnaces

	Unit	1999	2000	2001
Annual LPFO Consumption	Litres	1919478	1902570	1329171
Caster Production	Tonnes	11168	11958	9088
Average intensity	Litres/tonne	172	159	146

Note: 2001 data are for the first eight months of the year.

Table 2: Billet Casting Plant Fuel Use

	Unit	1999	2000	2001
Annual LPFO Consumption	Litres	174,550	182,399	166,154
Billets produced	Tonnes	NA	1,109	1,274
Energy/Tonne	Litres/tonne	NA	164	130

Our evaluation of the conversion requirements also indicates that the refractory materials currently being utilized in the furnaces may need to be changed to ones that can withstand the higher temperatures that are likely to accompany the shift to natural gas as the main fuel. Using the furnace thermal fuel consumption during the first eight months of 2001, we have estimated that about 107 million standard ft^3 of natural gas will be required per year. This number does not take into consideration natural gas required for power generation and the expected growth in demand in future years. We have estimated that converting the Melting, Holding, and Annealing Furnaces currently existing in the production factory will cost about US$200,000 (two hundred thousand US dollars).

7.2 Distribution Pipelines to the End-Use Points in the Factory.

Laying pipe from the PRMS of the gas distribution company to the furnaces is another critical investment requirement in this project. A preliminary engineering evaluation of the facilities needed enabled us to sketch a pipe layout. We estimate that about 0.65 kilometres of 4" DIA Pipe with various appurtenances will be needed to bring natural gas to the 2 MF and 2 HF at the Aluminium Rolling Mill, the MF at the Billet Casting Mill, and the AF and the Power Generating Facilities. We estimate that a total of about US$180,000 (one hundred and eighty thousand US dollars) will be required for the in-factory gas distribution network.

7.3 Electricity Supply

Electrical energy is needed drive motive equipment and for lighting. As shown in Table 3, almost 5 million kWh of electric energy was consumed in the factory of Tower Aluminum at Otta during the year 2000. Of this, about 72.5% of this was supplied from the national electric utility, NEPA. The balance (27.5%) was generated on site using diesel generators. In 2000, the on site diesel generator sets consumed about 390.4 kiloliters of diesel fuel.

Table 3 Electricity Consumption (kWh) by Source, 2000

Source	kWh consumed, 2000
From NEPA	3,534,400
Generated on site (diesel)	1,342,159
Total	4,876,559

A 4.5 MVA water-cooled gas engine coupled with a 415 V alternator would suffice to replace both the grid-purchased and diesel-generated electricity supplies. The thermal efficiency of the gas engine has been taken to be 65%. Estimated natural gas consumption is about 25 million standard ft^3.

7.4 Combined Heat and Power Production

As an alternative to the three measures presented above, the project will also evaluate the technical and economic potential of supplying both process heat and electricity requirements with a combined heat and power (CHP) system, utilizing natural-gas-fired combined-cycle gas turbines (CCGT). Although the initial investment capital required for such technology is expected to be higher than the technologies measures described above, it is believed that this solution may result in the highest total system efficiency and, hence, lowest greenhouse-house gas emissions.

8 Contribution to Sustainable Industrial Development

The project will contribute to sustainable industrial development in the following ways. First and foremost, negative impacts arising from irregular fuel supplies due to the regular disruptions in petroleum product supplies will be curtailed. These disruptions have contributed immensely to reduction in industrial sector growth in Nigeria. With this CDM project, fuel supplies will be guaranteed and industrial growth will be enhanced. The resulting improved productivity at Tower Aluminum is also likely to engender capacity expansion and hence employment generation. The shift from LPFO to natural gas will also promote improved environmental performance of industrial operations at the plant.

9 Greenhouse-gas Emissions Abatement

9.1 Project Baseline

The project baseline assumes continued use of existing equipment and fuel supplies, at the year 2000 consumption levels.

9.2 Status Quo CO_2 Emissions

CO_2 emissions from LPFO combustion in the Aluminium Rolling and the Billet Casting Mills of Tower Aluminum during the years 1999, 2000 and the first eight months of 2001 are presented in Table 4.

Table 4: CO_2 Emissions from LPFO and LPG Consumption (Tonnes)

	1999	2000	2001
ARM	507.22	530.03	482.83
Billet Casting	5,577.79	5,528.66	3,862.42
Annealing Furnace	768.18	1,057.01	973.86
Total	6,853.19	7,115.70	5,319.11

Note: 2001 emissions data are for the first eight months of the year

GHG emissions from electricity consumption at Tower Aluminum can be estimated as a sum of the emissions from on site diesel-generated electricity and the emissions at the point of generation of grid electricity. These are presented in Table 5. Per kWh GHG emissions from the grid-based electricity have been estimated using the IPCC protocol, based on the NEPA supply mix.

Table 5 Emissions of CO_2 For Status Quo Power Requirement (Tonnes)

	1998	1999	2000
Purchased Electricity	1840	1948	2020
Generated Electricity	850	1000	1100
Total	2690	2948	3120

9.3 Emission Reduction Projections

Using the IPCC method, we estimate that when natural gas is utilised as the fuel in all the furnaces, CO_2 emission will be about 6,644.5 tonnes/yr. Using a projected 2001 emission of 7979 tonnes as the baseline, a CO_2 emission reduction of about **1335 tonnes per year** can be achieved.

The new electricity supply system would emit approximately 1535 tonnes of CO_2 annually. Using 2000 as a base year, this mitigation measure has the potential to reduce CO_2 emissions by roughly 50%, or as much as **1586 tonnes per year.**

We are currently compiling information on available commercial system configurations for this project. System specification data are being assembled from international system vendors. Once all the information is in place, it is our plan to carry out a techno-economic evaluation of possible alternatives using COMFAR-IV. Output from this exercise will form the basis of the best configuration to be adopted for this project.

10 PROJECT SUMMARY

The following Table presents a summary of key project data.

Proposed mitigation measures	**CO_2 abatement: Fuel switching and energy conservation**: The project involves two mitigation measures: 1) fuel switching from LPFO and LPG to natural gas for all energy consumed in the aluminum rolling and billet casting mills; and 2) replacing grid-purchased and on-site diesel-based electricity supply with natural gas-fired electricity generation.
Project baseline	**Business as usual scenario**: Continuing use of grid-purchased electricity, LPFO, LPG, and diesel fuels.
Crediting period	**Twenty-one years**: The project seeks Certified Emission Reductions (CERs) for three 7-year "renewal" periods depending on baseline development.
Estimated CO_2 reduction	Order of magnitude estimates: Anticipated Annual Emission reductions (ERs): 3 ktonnes CO_2/yr Cumulative Reductions: 61 ktonnes CO_2
Sources of ERs	Ceq. ERs will be achieved through switching to a less carbon-intensive fuel.
Sustainable development impact	• Improved productivity and profitability at the recipient company will contribute to national industrial development; • Employment generation; and • Better environmental performance in terms of reduced industrial pollution.
Anticipated sources of revenue	• .Sale of CO2 emission reductions (ERs). • Reduced fuel costs

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