CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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Annexes

Project Design Document
for

Zafarana Wind Power Plant Project, Arab Republic of Egypt

May 2007

Japan Bank for International Cooperation

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ABBREVIATIONS

CER	Certified Emission Reduction
DANIDA	Danish International Development Agency
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
GHG	Greenhouse gas
JBIC	Japan Bank for International Cooperation
JCF	Japan Carbon Finance, Ltd.
MEE	Ministry of Electricity & Energy
MUS	Mitsubishi UFJ Securities
NREA	New & Renewable Energy Authority
OEP	Organization for Energy Planning
UNFCCC	United Nations Framework Convention on Climate Change

SECTION A. General description of project activity

A.1 Title of the project activity:

Zafarana Wind Power Plant Project in the Arab Republic of Egypt ("the Project" or "the Zafarana Project").

Version 04 – completed 24/05/2007

A.2. Description of the project activity:

The Zafarana Project is a 120MW wind power generation project located in Egypt.

The plant, located in an area with favorable wind conditions, has an expected capacity factor of 43%, resulting in 452,016MWh of electricity annually. The project is to be developed by the New and Renewable Energy Authority (NREA). The minimum plant operating life is 21 years.

The Project is to assist Egypt in its sustainable development in several ways: by providing zero greenhouse gas (GHG) emission power, enabling the country to export the natural gas which would, but for the Project, be combusted for power generation, and enhancing technology transfer.

The wind-generated electricity produced by the Project is to displace the grid electricity contributing to GHG reductions 248,609 tCO_2e (tonnes of carbon dioxide equivalent) per year for the duration of the project activity. In the initial 7-year crediting period, the Project is expected to reduce approximately 1.74 million tCO_2e, generating the equivalent amount of Certified Emission Reductions (CERs).

A.3. Project participants:

Name of Party involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Arab Republic of Egypt (host)	New and Renewable Energy Authority	No
Japan	Japan Bank for International Cooperation Japan Carbon Finance, Ltd.	No

Egypt and Japan are the Parties to the proposed project activity. The project participants as defined by the CDM glossary are as follows.

New and Renewable Energy Authority (NREA)

The Project is to be implemented by NREA. Belonging to the Ministry of Electricity & Energy (MEE), NREA was established in 1986 to introduce and promote renewable energy technologies to Egypt and also to contribute to the abatement of fossil fuel consumption. NREA has to date implemented three wind farms – a 5 MW pilot plant, a 30 MW plant with financing from the Danish International Development Agency (DANIDA) and a 33 MW plant with financing from KfW, the German Development Bank. In addition, the second phase of these plants, similarly financed, are under construction, totalling about 77MW in capacity. These financial arrangements are discussed further in Section B.4.

Japan Bank for International Cooperation

JBIC is a statutory body under the Japanese government, responsible for Japan's external economic policy and cooperation. In recent years, JBIC has begun actively promoting projects that contribute to the reduction of greenhouse gas emissions, by granting special interest rates. It has also invested in the Prototype Carbon Fund, set up by the World Bank to encourage GHG mitigation projects. JBIC will provide NREA with a loan of approximately JPY13,500 million to finance the Zafarana Project.

JBIC is the contact for the project activity.

Japan Carbon Finance, Ltd.

JCF was established through the equity participation by JBIC and other Japanese entities as of November 25th, 2004. Its objective is to purchase certified emission reductions ("CERs") and emission reduction units ("ERUs") from Clean Development Mechanism ("CDM") projects and Joint Implementation ("JI") projects respectively. JCF is expected to promote CDM/JI projects as JBIC's indirect financial instrument. The collaboration between two institutions will contribute to the smooth implementation of CDM/JI projects as JCF's emission reductions purchase from and JBIC's underlying financings to the projects can provide important cash-flow during the construction period and operational period respectively.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The planned plant site is located approximately 200 km southeast of Cairo.

A.4.1.1. Host Party(ies):

Arab Republic of Egypt

A.4.1.2. Region/State/Province etc.:

Zafarana/Suez Governorate

A.4.1.3. City/Town/Community etc:

Zafarana Area (arid area)

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project site is located on the Red Sea coast about 120km south of Suez. The project area starts at a distance of about 1km from the sea and extends about 3.5km inland. One of the point in the project site is located at E32 35' 45", N29 13' 42". To the south the project site is directly adjacent to the NREA/KfW wind parks and to the north it is directly adjacent to the Spanish financed wind park. The site is located in a desert area with favourable wind conditions. There is no human activity in the vicinity of the site, with the nearest commercial activity being several resort hotels approximately 10km from the site. The nearest community is some 30km away.

The proposed site lies in a region of sand dunes. The area is close to sea level.

Figure 1: Map of Egypt and Location of the Zafarana Plant

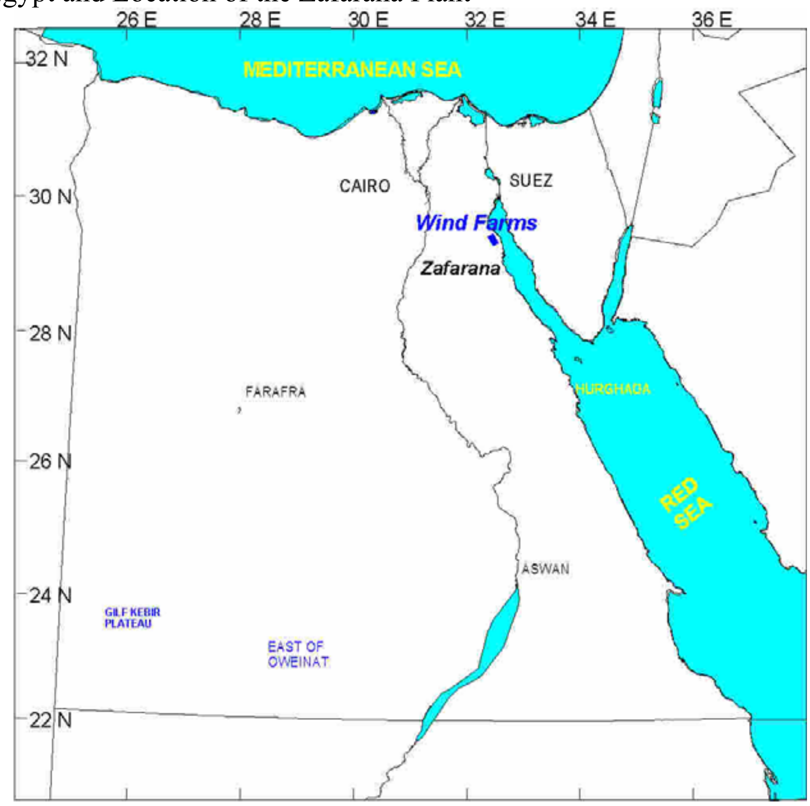

Figure 2: Site Layout of Zafarana Wind Farms

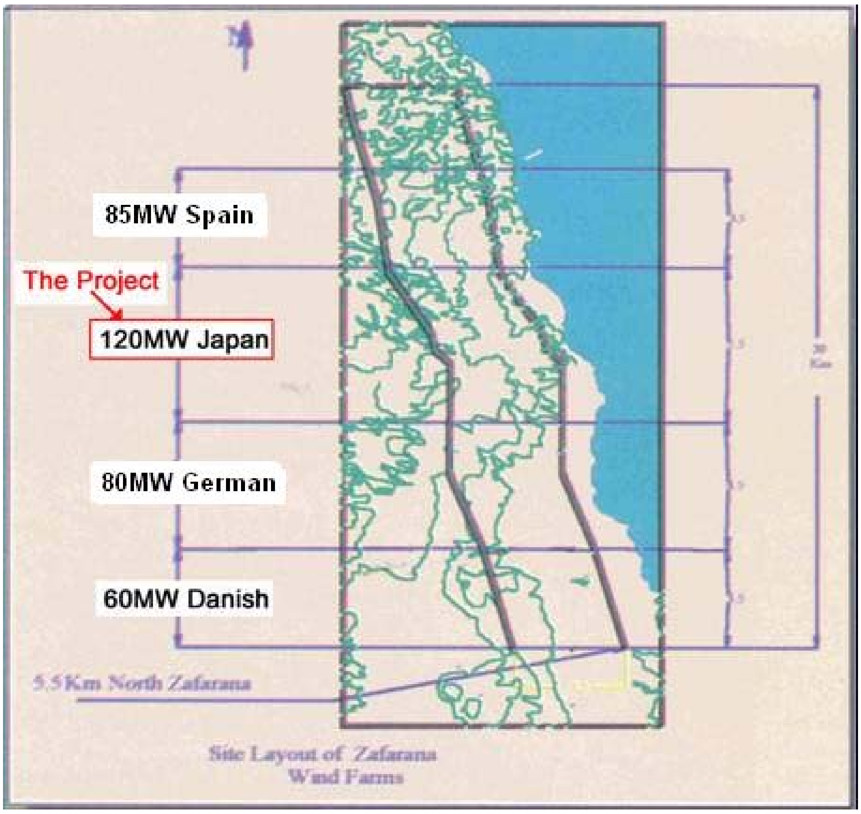

Figure 3: Photo of proposed site

A.4.2. Category(ies) of project activity:

There are currently no defined categories of project activities available from the UNFCCC. Tentatively, the Project will be categorized as follows:

Renewable energy project: Grid-connected electricity generation

A.4.3. Technology to be employed by the project activity:

The wind turbine size is to be between 600kW and 1MW[1]. It is to be a three-bladed machine with a proven track record in other countries. It is yet to be decided whether the turbines will be a pitch-regulated variable-speed, stall-regulated fixed-pitch or active stall-controlled type. State-of-the-art machinery will be procured from among the best international firms.

The Project, along with the wind plants already under operation at Zafarana, will contribute to technology transfer in terms of plant operation. In addition to providing for further operational experience in wind power plant operation, the larger plant size in comparison to the previous two plants in Egypt means that it is a step towards large-scale wind power plant implementation.

It is of note that for wind power machinery, it is common practice to carry out assembly in the general vicinity of the actual plant site. The Project will thus also be a step towards local assembly, which will be a real and significant transfer of technology.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The Zafarana Project will reduce anthropogenic GHG emissions by supplying zero GHG emission power, which will displace predominantly natural gas-fired electricity generation. The Project is expected to be responsible for reducing 24,809tCO_2e annually throughout the entire 7-year initial crediting period, generating a total of approximately 1.74 million units of CERs.

The Project faces significant barriers in its implementation, including the high cost of wind power plants relative to conventional power plants and lack of incentives to promote renewable energy.

Further details are discussed in Section B.3.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

The Project is expected to reduce GHG emissions in the order of 248,609tCO_2e annually or1,740,263 tCO_2e over the 7-year crediting period.

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	248,609
Year 2	248,609
Year 3	248,609

[1] The PDD will assume a turbine size of 600kW with an expected capacity factor of 43%. However, in the interest of conservatism, the additionality assessment of the Project will be carried out based on a turbine size of 1MW with an expected capacity factor of 50%, as the electricity revenue will be higher under this scenario.

Year 4	248,609
Year 5	248,609
Year 6	248,609
Year 7	248,609
Total estimated reductions (tonnes of CO_2e)	1,740,263
Total number of crediting years	7 years (renewable)
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	248,609

A.4.5. Public funding of the project activity:

The financial plans for the Zafarana Project involve public funding from Japan, an Annex I country. In December 2003, the Japan Bank for International Cooperation will provide NREA, the implementing agency, with approximately JPY13,500 million to finance the Project. As delineated in Annex 2, however, this does not result in the diversion of official development assistance and is separate from and is not counted towards the financial obligations of Japan.

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

The approved baseline methodology ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" is applied to the project activity.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology is designed to be applicable to grid-connected renewable power generation project activities, including electricity capacity additions from wind sources and is therefore applicable to the project activity. The Project also meets the two other relevant applicability conditions in that:

- it does not involve switching from fossil fuels to renewable energy at the site of the project activity; and
- the geographic and system boundaries for the Egyptian electricity grid can be clearly identified and information on the characteristics of the grid is available.

B.2. Description of how the methodology is applied in the context of the project activity:

The steps provided in the methodology are to be applied in the context of the Zafarana Project to ascertain the Project's additionality and baseline scenario.

- As the first step, ACM0002 requires the assessment of additionality.

This is discussed in Section B.3 below.

As a result of the assessment in Section B.3, the baseline scenario was determined to be electricity that would otherwise be generated by the operation of grid-connected power plants and by the addition of new generation sources. For such a scenario, ACM0002 deems the combined margin emission factor to be the appropriate baseline emission factor. The combined margin consists of the operating margin and build margin factors, calculated according to the following steps.

Step 1: Calculate the Operating Margin emission factor

The operating margin emission factor is to be calculated according to one of the following four methods.
(a) Simple OM
(b) Simple Adjusted OM
(c) Dispatch Data Analysis OM
(d) Average OM

where Dispatch Data Analysis OM is the first methodological choice. This choice, however, is not selected for the project activity due to there being insufficient data available. Instead, the next methodological choice, the Simple OM is used. The Simple OM method is applicable as the Egyptian grid meets the condition that low-cost / must-run resources constitute less than 50% of the total grid generation in 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production.

The Egyptian electricity grid is predominantly fossil fuel-fired. Renewable energy, consisting of mostly large-scale hydro, is responsible for just under 20% of generation. Apart from the hydro facilities, the existing Zafarana wind facilities comprise this category. The remainder, more than 80% of electricity including those purchased from independent power producers, is produced from conventional plants. Due to the abundance of natural gas in Egypt, approximately 90% of the fossil fuel used in the conventional plants is natural gas and the remaining 10% fuel oil.

As per the methodology ACM0002, hydro power and wind power plants are considered low-cost / must-run resources. The remaining facilities in the operating margin are gas turbine, steam turbine and combined cycle conventional units fuelled by natural gas and fuel oil. These plants will therefore constitute the operating margin. For the list of plants in the Egyptian grid, please refer to Annex 3. The calculation of the operating margin emission factor is carried out in Section E.4.

Step 2: Calculate the Build Margin emission factor

The build margin is selected from the following, whichever comprises the larger annual generation:

- the five power plants that have been built most recently, or
- the power plants' capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently,

The methodology offers two options for the data used in calculating the build margin carbon emission factor. Option 1 involves the *ex ante* calculation based on the most recent information available on plants already built at the time of PDD submission. Option 2 involves the annual updating of the emission factors *ex post*. Here, Option 1 was chosen, whereby the build margin emission factor is determined and fixed *ex ante* based on the most recent information available.

For the Egyptian grid, the most recent capacity additions representing 20% of the system comprises larger annual generation than the 5 most recent plants, and is therefore the chosen build margin sample group. The chosen sample group and resultant build margin emission factor is provided in Section E.4.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

The Project is a grid-connected wind power generation project. The Project will displace fossil fuel-based electricity generation with a zero GHG emission source of electricity, and thus will reduce carbon dioxide emissions associated with the combustion of fossil fuels.

There are several critical factors preventing this Project from being implemented as a BAU project. These are delineated below, using the "Tools for the demonstration and assessment of additionality" (the "Tool" or "Additionality Tool") which is the tool specified in ACM0002. The Additionality Tool is composed of the following steps.

Step 0: Preliminary screening based on the starting date of the project activity
Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Step 2: Investment analysis, and/or
Step 3: Barrier analysis

Step 4: Common practice analysis
Step 5: Impact of CDM registration

The Tool stipulates that either or both Step 2 and Step 3 be completed. The Project will demonstrate additionality through Step 2.

Step 0. Preliminary screening based on the starting date of the project activity

This step is not relevant to the project activity as the starting date does not fall within the stipulated period.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

Alternatives to the project activity include:

- The Project not undertaken as a CDM project activity
- A renewable power project (wind, biomass, hydro, solar)
- A thermal power project (natural gas, heavy oil)
- Continuation of the current situation

The ensuing section discusses which of these alternatives are realistic and credible.

a) The Project not undertaken as a CDM project activity

The Project is a 120MW wind power project for which the return is far too low to be implemented under business-as-usual. Indeed, even with the favourable loans from JBIC, the Project's performance is still below the acceptable threshold for NREA to implement. The Project not undertaken as a CDM project activity is thus not an alternative to the project activity. This is discussed in further detail in Step 2 below.

b) A renewable power project (wind, biomass, hydro, solar)

NREA plans and implements renewable energy projects, including biomass, solar and wind power projects. However, none of these are credible alternatives to the Project due to a combination of technological and financial circumstances. For biomass, no commercial scale grid-connected power generation has been carried out to date. It will not be feasible for NREA to implement a large biomass plant in the order of 50MW – roughly equivalent in generation output to a 120MW wind farm – as its first biomass project. The only solar power plant in Egypt is a solar thermal power plant, which is dependent on natural gas for more than 90% of its generation. This plant, furthermore, was partly financed by the World Bank's Global Environment Facility, which finances the incremental cost of environmentally friendly technologies. That is, the solar thermal plant itself cannot be implemented under BAU. As discussed in Step 4, due to the tightening of lending conditions accompanying the upgrading of the Egyptian country rating, all new wind power projects will suffer under the same obstacles as the Project, and will not constitute realistic alternatives to the project activity. In terms of hydro power, given its high cost and the fact that the irrigation needs of agricultural activities take precedence over power generation[2], it will not be a credible alternative available to the Project.

[2] Hydro power projects do not fall within NREA's mandate, but rather fall under the Hydro Power Projects Executive Authority

It is noted that even where a renewable power project is able to overcome the financial and technological barriers it faces, it will not be a target for displacement by the Project. Consistent with the national policy to increase renewable energy and to thereby increase Egypt's exports of fossil fuel, where possible, both renewable power plants will be built.

c) A thermal power project (natural gas, heavy oil)

Thermal power plants have a much lower per kWh capital cost requirement as compared to renewable technologies. Moreover, technologies for thermal power generation are well established and proven, and the technology risk is considerably lower than the newer, innovative renewable technologies. This makes thermal power generation an attractive alternative to wind power. Indeed, such generation makes up more than 80% of the Egyptian grid and EEHC officials indicate a continuation of the heavy dominance of natural gas- and heavy oil-fuelled power generation.

Despite this, it is not possible to single out a particular type of conventional power plant that the project activity will displace. Egyptian government officials say it is not possible to point to a single plant or a single type of plant that the Project will serve to displace, either currently operating or planned for construction. Therefore, a single thermal power plant or plant type will not be a realistic or credible alternative.

d) Continuation of the current situation

It is clear from the above that in the absence of the Project, the only option available as an alternative to the Project is non-implementation and continuation of the current situation. It is noted that the Egypt's renewable energy strategy targets to satisfy 3% of peak load from renewable resources by 2010. This target has been revised from 5% by 2005 in the 1982 strategy and 3% by 2010 in 1999, illustrating the difficulty in implementing renewable energy projects.

EEHC will make up the shortfall of electricity from non-implementation by absorbing it into the entire electricity system. Thus, the baseline scenario is the electricity that would have otherwise been generated by the operation of grid-connected power plants and by the addiction of new generation sources. It is noted that the inclusion of renewable power plants in the build margin makes this baseline scenario more conservative than the scenario outlined in c) above.

Sub-step 1b: Enforcement of applicable laws and regulations

As identified in Sub-step 1a above, the realistic and credible alternative to the Project is non-implementation of the Project, i.e. the continuation of current practice. There are no relevant laws and regulations applicable to this alternative.

Step 2: Investment analysis

The proposed project activity faces financial barriers that prevent its implementation as business-as-usual. As the Project generates income apart from CDM-related income, Option I (simple cost analysis) given in ACM0002 is not appropriate. Option II (investment comparison analysis) is also not appropriate, there being no project to compare to, given that the alternative to the Project is non-implementation. Here, Option III (benchmark analysis) will be carried out. For detailed information, including related calculation, please refer to Annex 5.

Sub-step 2b – Option III. Apply benchmark analysis

The relevant financial indicator was chosen as the IRR. As stipulated by ACM0002, the IRR will be calculated as project IRR.

The benchmark will be derived from government bond rates. As Egyptian treasury bonds are illiquid, treasury bills are considered a suitable indicator. Treasury bills are auctioned by the government, for which the latest results gave averages of 10.108%, 10.525% and 11.203% for 91-day, 182-day and 364-day bills, respectively[3]. For the purpose of deriving the benchmark, the average of these figures, 10.612%, is used.

Two risks can be identified as relevant to wind power projects in countries such as Egypt. The first is the risk reflecting the project type, a renewable power project. The second is the country risk. However, for the sake of conservatism these will not be applied here to increase the benchmark figure.

Sub-step 2c. Calculation and comparison of financial indicators

The project IRR of the Project based on financing conditions available to NREA was calculated using the following variables and data sources[4].

Item	Value
Project Information	
Costs of equipment and plant (initial investment cost)	LE 684,000,000
Project life	21 years
Electricity tariff	LE 0.14/kWh
Electricity export amount (MWh/year)	525,600 MWh/year
Revenues and Expenses	
Electricity sales	LE 73,584,000
O&M costs/yr	LE 18,810,000
Project IRR	**5.30%**

Based on the above, the project IRR for the Zafarana Project was calculated to be 5.30%. Given that the benchmark calculated in Sub-step 2b is 10.612%, the Project's IRR clearly demonstrates that not only is the Project not feasible for NREA on a commercial basis, but is not feasible even with the generous loans from JBIC.

In addition, the following investment barriers highlight the difficulty in implementing the Project.

[3] http://www.cbe.org.eg/Treasury%20Bill%20Auction%2091-182%20-%20364%20days.htm, last accessed December 2004. Auction results are from November and December 2004.

[4] As briefly noted in Section A.4.3, while it is yet to be decided whether 600kW or 1MW turbines will be installed, for the sake of conservatism, a turbine size of 1MW with an expected capacity factor of 50% is assumed for the additionality assessment. This measure is conservative, as IRR calculations based on the larger turbine return a higher value on the account of larger electricity sales. Therefore, figures in the table, such as electricity export amount, is not consistent with the rest of the PDD, which assumes a smaller turbine size.

Firstly, Egypt does not have the special incentive and subsidy programmes offered in some countries where wind power generation can be promoted on a BAU basis. In Germany, for example, where the total capacity from wind power amounts to some 12,000 MW[5], the government provides a substantial assistance through the Renewable Energy Sources Act.

Secondly, wind power is more capital-intensive than fossil fuel power generation. According to NREA officials, the capital requirement for an Egyptian wind farm, calculated as approximately US¢1.29/kWh is ten times the amount for conventional thermal generation, estimated at US¢0.12/kWh (refer to Annex 3). The large initial investment presents a significant barrier to wind farm investment in a country with chronic shortage of capital. This problem is aggravated by foreign-exchange concerns. As a hard currency loan is borrowed to finance the import of wind farm equipment, the officials are concerned that the payment obligation will grow in the future, given recent recurrent devaluation of the Egyptian pound[6].

Thirdly, the low price for natural gas in Egypt, reflecting abundant domestic supply, favours fossil fuel power generation. In comparison to the international price of approximately 30 piastre/m^3, the domestic price is set at 14.1 piastre/m^3. An analysis of typical power plants in Egypt results in estimated costs per kWh of US¢3.7/kWh for wind power plants and US¢1.4/kWh for conventional power plants, illustrating the difficulty of implementing wind power plants (refer to Annex 3).

From the outset of negotiations, NREA and JBIC have been in agreement to implement the Project under the CDM. Pursuant to this agreement, the methodology for the Project (NM0036) was developed and submitted in November 2003. This methodology was approved as part of the methodology ACM0002, which is applied in this PDD. Subsequently, in December 2003, JBIC signed an agreement with NREA to provide approximately 13,500 million yen in low interest loans for the 120MW Zafarana Project.

It is reiterated that wind power is one of the most expensive modes of electricity generation. Even in developed nations, large government subsidies are necessary to enable commercial operation. Unlike conventional power plants, whose returns are often attractive on a commercial basis, financial support including such low interest loans as offered by JBIC in no way guarantees a solid return for wind power projects. Indeed, the benchmark analysis above shows that the Zafarana Project is not economically feasible, even with the assistance of JBIC's favourable loan.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis was carried out by altering, in turn, the following crucial variables and comparing to the benchmark value. Each represents a more conservative value than the base case.

- Decreasing EPC cost by 10%
- Decreasing running cost by 10%
- Increasing electricity tariff by 5%
- Increasing plant load factor by 2%

Respectively, this had the effect of increasing the IRR to:
- 6.55% (+1.25point)

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[5] German Wind Energy Association, http://www.wind-energie.de/englischer-teil/english.htm, last accessed August 2003.

[6] According to the OECD, the Egyptian Pound experienced a 32% devaluation against the US dollar between June 2000 and January 2002.

- 5.69% (+0.39point)
- 6.06% (+0.76point)
- 5.91% (+0.61point)

It can be seen that the IRR remains low even with the favourable financial assumptions.

Step 3. Barrier analysis

While the Project faces many barriers apart from the investment barrier identified in Step 2 above, in applying the methodology ACM0002, it will not rely on this step for the analysis of additionality. Such barriers are instead only briefly discussed.

There are a number of challenges present in terms of the technology to be used for the Project. The general conditions in Egypt and some site-specific conditions mean that there exist problems related to:

- Sand storms – sand blowing into equipment will hamper normal operation.
- Sea (salt) air – due to the plant site's proximity to the ocean, rusting of equipment occur.
- Hot climate – the intense heat adversely affects the generator and oil.

Equipment for the Zafarana plant requires modification from the standard specifications, such as the introduction of cooling for the engines. Not only do these increase plant costs but also introduces an extra burden in terms of plant maintenance. Proper maintenance is required to prevent the state-of-the-art equipment from falling into disrepair, a problem too often experienced in many developing countries.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity

Several wind power projects have already been implemented in Egypt, all of them at sites adjacent to the Project's site. These power plants were constructed as a result of grants and concessional loans from Denmark and Germany. The Danish-sponsored plants have a total capacity of 60MW, the German-sponsored plants 80MW. The grants had been an extremely important aspect of funding the previous wind power projects in Egypt, as wind power is more capital-intensive than fossil fuel power generation, as stipulated in Sub-step 2b. The capital requirement for an Egyptian wind farm, calculated as approximately US¢1.29/kWh is ten times the amount for conventional thermal generation, estimated at US¢0.12/kWh (refer to Annex 3). Thus, these plants which have been carried out with grant assistance can be considered as common practices in the wind power projects implemented by NREA in Egypt.

Sub-step 4b. Discuss any similar options that are occurring

While the Project will not be the first wind power project to be implemented by NREA, there is an important distinction that makes it different to the existing wind farms.
The previous wind projects, carried out without the CDM, were financed through a combination of concessional loans and substantial grants. For instance, the assistance for the second phase of the Danish-funded wind power plant included DKK 30 million as a grant. The approximately USD 4.7 million grant for the 30MW plant translates to USD 18.8 million for the project.

While the Project will also be financed through concessional loans, it will not receive any grants, reflecting OECD's upgrading of Egypt to a middle income country in recent years. The Project was the first to be affected by this change of financial condition to Egypt.

As explained Sub-Step 4a, the grants had been an extremely important aspect of funding the previous wind power projects in Egypt to fill in the gap between the cost for wind power plants and those for conventional thermal power plants, as wind power is more capital-intensive than fossil fuel power generation, as stipulated in Sub-step 2b. However, the Project is the first of its kind to be carried out without grant assistance. As stated previously, NREA and JBIC agreed to implement the Project without grant but under the CDM. For NREA, it was important that the income from the CDM fill in the gap for the grant. Thus, the Project is clearly different to common practice.

It is pertinent to note that NREA will not receive grants for any of the new planned wind power projects to be financed by Denmark, Germany and Spain. Because of this, NREA considers it essential that subsequent projects are similarly implemented as CDM.

Step 5. Impact of CDM registration

To cope with the increased financial cost resulting from less generous foreign assistance, the government of Egypt plans to implement its new wind farm projects as CDM activities. The value of CERs, although not expected to equal the grants the Project could have received in the past during Egypt's status as a lower income country, will substantially alleviate the financial strain the Project faces. The extra revenue from CERs will help NREA make up for the shortfall in the IRR and facilitate the implementation of the Zafarana Project.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

As per the methodology, the spatial extent of the project boundary includes the plant site and all power plants connected physically to the electricity system that the Project is connected to. The relevant electricity system in this case is the Egyptian national grid. There are no imports to the Egyptian National Grid.

For the baseline determination, the gas and source is CO_2 emissions from electricity generation in fossil fuel-fired power that is displaced due to the project activity.

B.5. Details of baseline information, including the date of completion of the baseline study and the name (s) of person (s)/entity (ies) determining the baseline:

16/05/2006

Clean Energy Finance Committee
Mitsubishi UFJ Securities
Tokyo, Japan
Tel: +81-3-6213-6860
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Mitsubishi UFJ Securities is the CDM adviser to the Project. The firm is not a project participant. It determined the baseline with the concurrence of JBIC and NREA.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/09/2006

The earliest expected date of plant construction is given as the starting date of the project activity.

C.1.2. Expected operational lifetime of the project activity:

The Project will have a minimum operational lifetime of 21 years.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/10/2007

The expected date of commissioning is given as the starting date of the first crediting period. Should the plant construction and subsequent commissioning be delayed, the starting date will also be delayed accordingly.

C.2.1.2. Length of the first crediting period:

Seven (7) years, with the option of two renewal periods.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

The approved monitoring methodology ACM0002: "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources" is applied to the project activity.

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The chosen monitoring methodology is designed to be used in conjunction with the baseline methodology selected in Section B. The methodology applies to electricity capacity additions from wind sources. It also applies to projects connected to a grid where the geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available. The Project is a wind power generation project which is connected to the Egyptian electricity grid which meets the applicability conditions. Therefore, it is appropriate to use this methodology.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

There are no emissions to be monitored for the project activity.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Monitored data will be stored throughout the crediting period and two years thereafter.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. EG_y	Electricity supplied by project to grid	NREA/EEHC	MWh	m	hourly measurement and monthly recording	100%	Electronic	Electricity supplied by the project activity to the grid. Double check by sales receipts.

As per the methodology, all relevant parameters will be required to recalculate the combined margin at any renewal of a crediting period, using steps 1-3 in the baseline methodology ACM0002.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

There are no leakage issues associated with the Project.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1.	Low	These data will be directly used for calculation of emission reductions. Meters will undergo maintenance subject to appropriate industry standards. The meter readings will be checked against power purchase receipts. As there needs to be a consensus between NREA and EEHC – parties with opposing interests – on the amount of electricity exported, the likelihood of error is seen as low.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>

NREA will collect and store relevant data in a systematic and reliable way, evaluate them regularly, generate reports, and ensure the availability of pertinent information for verification. An electronic spreadsheet file will be kept to accumulate all monitored variables, which will be presented to the DOE for verification.

A NREA officer will be designated to be responsible for the collection and maintenance of all data relevant to monitoring. All collected information will be stored electronically. Most data, apart from the amount of electricity generated by the Project, will be based on publicly available information that can be readily verified by the DOE. For the amount of electricity generated, operators at the plant site will be responsible for recording the electricity generated to the grid, which will be double checked by the plant manager. This information will be passed on to the designated NREA officer for centralized data storage.

D.5 Name of person/entity determining the monitoring methodology:

Clean Energy Finance Committee
Mitsubishi UFJ Securities
Tokyo, Japan
Tel: +81-3-6213-6860
E-mail: hatano-junji@sc.mufg.jp

Mitsubishi UFJ Securities is the CDM adviser to the Project. The firm is not a project participant. It determined the monitoring plan with the concurrence of JBIC and NREA.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

As per ACM0002, there are no anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary.

E.2. Estimated leakage:

The methodology ACM0002 identifies activities such as power plant construction as emissions potentially giving rise to leakage for electric sector projects. However, according to the methodology, these need not be considered.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Given that neither direct project emission nor leakage are present, the project activity emission is zero (0).

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Based on the methodology, the baseline is the electricity that would have otherwise been generated by the operation of grid-connected power plants and by the additional of new generation sources. The baseline emission factor is calculated as the combined margin of the grid, consisting of the average of the operating margin and build margin,

The grid's operating and build margin emission factors were derived using the following historical data. For the data on the entire grid, please refer to Annex 3.

Table: Egypt's grid excluding low-cost/must-run[7]

2001/2002

Power Plant	Type of generation[8]	Fuel[9]	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	1,260	7,141	1,686
Cairo West	ST	NG, FO	350	1,563	426
Cairo West ext.	ST	NG, FO	660	3,521	791
Cairo South I	CC(hybrid)	NG, FO	570	3,236	711
Cairo South II	CC	NG, FO	165	1,018	186
Wadi Hof	GT	NG	100	20	8

[7] Annual Report 2001/2002, 2002/2003, 2003/2004, Egyptian Electricity Holding Company

[8] ST = Steam Turbine, CC = Combined Cycle, GT = Gas Turbine

[9] NG = Natural Gas, FO = Fuel Oil

Tebbin	GT	NG, FO	46	103	43
Tebbin	ST	FO	45	7	3
Damietta	CC	NG, FO	1,125	6,736	1,294
Talkha(CC)	CC	NG, FO	283.6	1,410	346
Talkha(ST)	ST	FO	90	1	0.2
Talkha 210	ST	NG, FO	420	1,912	487
Ataka	ST	NG, FO	900	4,634	1,053
Abu Sultan	ST	NG, FO	600	2,879	824
Suez	ST	FO	185	0	0
Suez	GT	NG, FO	17	1	0.1
Shabab	GT	NG, FO	100	73	25
Port Said	GT	NG, FO	64	24	9
Arish	ST	NG, FO	66	356	108
Oyoun Mousa	ST	NG, FO	640	3,655	823
Kafr El Dawar	ST	NG, FO	440	1,411	376
Mahmoudia (G)	GT	NG, FO	180	51	19
Mahmoudia	CC	NG, FO	308	1,898	386
Damanhour 300	ST	NG, FO	300	945	211
Damanhour Ext	ST	NG, FO	195	742	195
Damanhour (CC)	CC	NG, FO	152.8	923	177
Seiuf (G)	GT	NG, FO	200	38	14
Seiuf (ST)	ST	FO	113	355	131
Karmouz	GT	FO	25	1	0.1
Abu Kir	ST	NG, FO	900	3,896	925
Sidi Krir 1,2	ST	NG, FO	640	3,662	765
Matrouh	ST	NG, FO	60	149	41
Walidia	ST	FO	600	2,819	674
Kuriemat	ST	NG, FO	1,245	6,713	1,489
Assiut	ST	FO	90	461	152
TOTAL			13,135.4	62,354	14,378.4

2002/2003

Power Plant	Type of generation	Fuel	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	1,260	7,490	1,753
Cairo West	ST	NG, FO	350	1,559	431
Cairo West ext.	ST	NG, FO	660	3,744	845
Cairo South I	CC(hybrid)	NG, FO	570	3,549	792
Cairo South II	CC	NG, FO	165	1,191	219
Wadi Hof	GT	NG	100	75	31
Tebbin	GT	NG, FO	46	240	101

Tebbin	ST	FO	45	34	13
Damietta	CC	NG, FO	1,125	7,830	1,476
Talkha(CC)	CC	NG, FO	283.6	1,586	381
Talkha(ST)	ST	FO	90	63	39
Talkha 210	ST	NG, FO	420	2,068	525
Ataka	ST	NG, FO	900	4,346	1,028
Abu Sultan	ST	NG, FO	600	2,678	762
Suez	ST	FO	185	16	12
Suez	GT	NG, FO	17	1	0.1
Shabab	GT	NG, FO	100	217	75
Port Said	GT	NG, FO	64	58	22
Arish	ST	NG, FO	66	411	115
Oyoun Mousa	ST	NG, FO	640	3,688	814
Sharm El-Sheikh	GT	FO	179.4		25
El-Hurghada	GT	FO	143.2	104	17
Kafr El Dawar	ST	NG, FO	440	1,469	427
Mahmoudia (G)	GT	NG, FO	180	108	41
Mahmoudia	CC	NG, FO	308	1,836	389
Damanhour 300	ST	NG, FO	300	1,766	412
Damanhour Ext	ST	NG, FO	195	924	263
Damanhour (CC)	CC	NG, FO	152.8	909	186
Seiuf (G)	GT	NG, FO	200	66	28
Seiuf (ST)	ST	FO	113	397	151
Karmouz	GT	FO	25	1	0.3
Abu Kir	ST	NG, FO	900	3,185	797
Sidi Krir 1,2	ST	NG, FO	640	3,557	757
Matrouh	ST	NG, FO	60	254	68
Walidia	ST	FO	600	3,317	781
Kuriemat	ST	NG, FO	1,245	6,167	1,335
Assiut	ST	FO	90	468	155
TOTAL			13,458	65,372	15,266.4

2003/2004

Power Plant	Type of generation	Fuel	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	1,260	7,080.459	1,673
Cairo West	ST	NG, FO	350	1,660.922	449
Cairo West ext.	ST	NG, FO	660	3,586.13	806
Cairo South I	CC(hybrid)	NG, FO	570	3,638.089	807

Cairo South II	CC	NG, FO	165	1,265.255	231
Cairo North	CC	NG, FO	500	209.724	53[10]
Wadi Hof	GT	NG	100	22.526	9
Tebbin	GT	NG, FO	46	110.295	47
Tebbin	ST	FO	45	8.027	3
Damietta	CC	NG, FO	1,125	6,855.343	1,333
Talkha(CC)	CC	NG, FO	283.6	1,621.041	389
Talkha 210	ST	NG, FO	420	2,051.441	521
Ataka	ST	NG, FO	900	4,810.026	1,136
Abu Sultan	ST	NG, FO	600	2,722.383	771
Suez	ST	FO	185	0	0
Suez	GT	NG, FO	17	0.013	0.1
Shabab	GT	NG, FO	100	103.049	35
Port Said	GT	NG, FO	64	21.154	35
Arish	ST	NG, FO	66	439.813	117
Oyoun Mousa	ST	NG, FO	640	4,001.067	874
Sharm El-Sheikh	GT	FO	146	66.73	26
El-Hurghada	GT	FO	143	28.93	12
Kafr El Dawar	ST	NG, FO	440	1,508.211	456
Mahmoudia (G)	GT	NG, FO	135	56.496	23
Mahmoudia	CC	NG, FO	308	1,901.941	410
Damanhour 300	ST	NG, FO	300	1,740.64	405
Damanhour Ext	ST	NG, FO	195	909.949	267
Damanhour	CC	NG, FO	152.8	1,015.73	215
Seiuf (G)	GT	NG, FO	200	36.35	16
Seiuf (ST)	ST	FO	113	319.441	143
Karmouz	GT	FO	25	0.060	0.3
Abu Kir	ST	NG, FO	900	3,447.885	882
Sidi Krir 1,2	ST	NG, FO	640	3,714.442	815
Matrouh	ST	NG, FO	60	267.379	88
Walidia	ST	FO	600	2,455.015	602
Kuriemat	ST	NG, FO	1,245	6,972.342	1,480
Assiut	ST	FO	90	488.526	160
TOTAL			13,789.4	65,136.824	15289.4

Operating margin CO_2 emission factor

[10] Changed from original data as provided in Annex 3. The fuel consumption was found to be disproportionately large, due to the inclusion of fuel consumed for test runs. The fuel consumption was therefore adjusted from 520 x 10^3 toe to 53 x 10^3 toe, based on the fuel consumption rate of 251 toe/GWh subsequently obtained from EEHC.

Of the four methods allowed for calculating the operating margin emission factor, the chosen method was (a) Simple OM, due to the unavailability of dispatch data. The Simple OM method is applicable as the Egyptian grid meets the condition that low-cost/must-run resources constitute less than 50% of the total grid generation in 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production.

The Simple OM emission factor is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants.

CO_2 emissions for the operating margin were obtained using the fuel consumption given in the table above, expressed in tonnes of oil equivalent (toe) as well as the grid fuel composition according to EEHC's annual reports of 2001/2002, 2002/2003 and 2003/2004, as provided in the table below.

Fuel type	2001/2002	2002/2003	2003/2004
	Fuel composition		
Natural gas	89.6%	89.2%	91.8%
Fuel oil	10.4%	10.8%	8.2%
	Fuel consumption (10^3 toe)		
Natural gas	12,883.0	13,617.6	14,035.7
Fuel oil	1,495.4	1,648.8	1253.7

This was used in conjunction with the local carbon emission factors for natural gas and fuel oil, of 20.8 and 15.3tC/TJ, and IPCC default oxidation factors[12]. The following shows the calculation of the grid emission factor for 2001/2002.

CO_2 emission (Natural gas)	=	Fuel consumption over (10^3 toe)	x	Net calorific value (TJ/10^3 toe)	x	C emission factor (tC/TJ)	x	Fraction of C oxidized	x	Mass conversion factor (tCO_2/tC)
	=	12,883	x	41.868	x	15.3	x	0.995	x	44/12
	=	30,108,226	tCO_2							

Repeating for fuel oil, the CO_2 emission is 4,727,261 t/yr, taking the total for 2001/2002 to 34,835,487 t/yr. Then,

CO_2 emission factor for operating margin	=	Sum of CO_2 emission for operating margin (tCO_2)	÷	Total grid electricity generated for operating margin (MWh)
	=	34,835,487	÷	62,354,000

[12] Egypt country values were not available

= 0.559 tCO_2/MWh

This is repeated for all years, with the results summarized in the Table below.

Year	2001/2002		2002/2003		2003/2004		Source
Fuel type	Nat. gas	Fuel oil	Nat. gas	Fuel oil	Nat. gas	Fuel oil	
Total fuel consumption (10^3 toe)	14,378.40		15,266.40		15,289.40		EEHC
Fuel composition (fraction)	0.896	0.104	0.892	0.108	0.918	0.082	EEHC
Fuel consumption per fuel type (10^3 toe)	12,883.0	1,495.4	13,617.6	1,648.8	14,035.7	1,253.7	Calculated
Fuel consumption per fuel type (10^3 t)[13]	11,595.9	1,538.5	12,257.1	1,696.3	12,633.4	1,289.8	Calculated
Fuel consumption per fuel type (TJ)	539,385.4	62,609.4	570,141.7	69,032.0	587,646.7	52,489.9	Calculated
CEF (tC/TJ)	15.3	20.8	15.3	20.8	15.3	20.8	EEHC
OX (fraction)	0.995	0.99	0.995	0.99	0.995	0.99	IPCC
CO2 emissions per fuel type (tCO2/yr)	30,108,226	4,727,261	31,825,023	5,212,189	32,802,144	3,963,198	Calculated
Total CO2 emissions (tCO2/yr)	34,835,487		37,037,212		36,765,342		Calculated
Total electricity generated (MWh/yr)	62,354,000		65,372,000		65,136,824		EEHC
Annual grid CEF	0.559		0.567		0.564		Calculated
3-year grid CEF	**0.563**						Calculated

Build margin CO_2 emission factor

The build margin emission factor is calculated as the generation-weighted average emission factor (tCO_2/MWh) of the sample of build margin plants, where the sample group consists of either:

- the five power plants that have been built most recently, or
- the power plants' capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently,

where the group that comprises the larger annual generation is selected as the sample.

Of the two build margin options available, Option 1 was chosen, whereby the build margin emission factor is determined and fixed *ex ante* based on the most recent information available.

For the Egyptian grid, the most recent capacity additions representing 20% of the system comprises larger annual generation than the 5 most recent plants, and is therefore the chosen build margin sample group:

[13] Back calculated from toe-based fuel consumption given in EEHC's annual reports using local NCV values 1.111toe/t natural gas and 0.972toe/t fuel oil, which is available in "Energy in Egypt 2000 / 2001" by OEP.

Build Margin Plants[14]

Power Plant	Type of generation	Commissioning Date	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Cairo North	CC	04	500	209.724	53[15]
Hurghada	GT	03	146	28.93	12
Sharm El Sheikh	GT	03	143	66.73	26
Port Said East (private)	ST	03	282.5		896
Suez Gulf (private)	ST	02	682.5		903
Sidi Krir 3,4 (private)	ST	02	682.5	12,673	936
Oyoun Mousa	ST	00/01	640	4001.067	874
Zafarana	Wind	00/03/04	140	364.969	0
Matrouh	ST	00	60	267.379	88
Arish	ST	00	66	439.813	117
Sidi Krir 1,2	ST	99/00	640	3714.442	815
TOTAL			3,985.5	21,766.054	4,720

CO_2 emissions for the build margin were obtained using the fuel consumption given in the table above, expressed in tonnes of oil equivalent (toe). The plants were fuelled by 98.6% natural gas and 1.4% fuel oil, on a toe basis[16], or 4,653.9 x 10^3 toe natural gas and 66.1 x 10^3 toe fuel oil. The calculation method is the same as for the OM.

$$\text{CO}_2\text{ emission (Natural gas)} = \text{Fuel consumption for plants } (10^3\text{ toe}) \times \text{Net calorific value } (\text{TJ}/10^3\text{ toe}) \times \text{C emission factor } (\text{tC/TJ}) \times \text{Fraction of C oxidized} \times \text{Mass conversion factor } (\text{tCO}_2/\text{tC})$$

$$= 4{,}653.9 \times 41.868 \times 15.3 \times 0.995 \times 44/12$$

$$= 10{,}876{,}400 \text{ tCO}_2$$

Repeating for fuel oil, the CO_2 emission is 208,892 t/yr, taking the total to 11,085,292. The CO_2 emission factor is then obtained by dividing by the electricity generated by all build margin plants.

$$\text{CO}_2\text{ emission factor for build margin plants} = \text{Sum of CO}_2\text{ emission for build margin plants } (\text{tCO}_2) \div \text{Total grid electricity generated for build margin plants } (\text{MWh})$$

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[14] Annual Report 2003/2004, Egyptian Electricity Holding Company

[15] Changed from original data as provided in Annex 3. The fuel consumption was found to be disproportionately large, due to the inclusion of fuel consumed for test runs. The fuel consumption was therefore adjusted from 520 x 10^3 toe to 53 x 10^3 toe, based on the fuel consumption rate of 251 toe/GWh subsequently obtained from EEHC.

[16] Disaggregated data for individual plant fuel consumption was not publicly available. Also Adjusted for Cairo North

= 11,085,292 ÷ 21,766,054

= 0.509 tCO_2/MWh

The build margin emission factor is therefore 0.509 tCO_2/kWh

Combined margin CO_2 emission factor

Using the emission factors calculated above for the operating and build margins, the combined margin emission factor is calculated using the default OM:BM weighting of 75%:25% as:

CO_2 emission factor for combined margin (tCO_2/MWh)	=	CO_2 emission factor for the operating margin (tCO_2/MWh)	x	75%	+	CO_2 emission factor for the build margin (tCO_2/MWh)	x	25%
	=	0.563	x	75%	+	0.509	x	25%
	=	0.550tCO_2/MWh						

Baseline emission

The CO_2 emission displaced by the project is calculated by multiplying the combined margin CO_2 emission factor obtained above by the amount of electricity produced and exported to the grid by the project activity. The Project's annual electricity output is expected to be 452,016MWh, based on the estimated capacity factor of 43%[17]. The electricity output to be used in the actual calculation of CERs once the Project is implemented will be monitored.

CO_2 emission	=	Electricity produced and exported by project (MWh/yr)	x	CO_2 emission factor (tCO_2/MWh)
	=	452,016	x	0.550
	=	248,609	tCO_2/yr	

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

As there are no project emissions, the emission reduction of the project is equivalent to the baseline emissions.

[17] As briefly noted in Section A.4.3, while it is yet to be decided whether 600kW or 1MW turbines will be installed, for the sake of conservatism, a turbine size of 600kW with an expected capacity factor of 43% is assumed for the estimation of baseline emission. This measure is conservative, as CERs calculations based on the smaller turbine return a lower value on the account of smaller electricity produced and exported by project.

E.6. Table providing values obtained when applying formulae above:

Table: Emission reductions of the project activity

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2007	0	248,609	0	248,609
2008	0	248,609	0	248,609
2009	0	248,609	0	248,609
2010	0	248,609	0	248,609
2011	0	248,609	0	248,609
2012	0	248,609	0	248,609
2013	0	248,609	0	248,609
Total (tonnes of CO_2e)	0	1,740,263	0	1,740,263

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Wind farms are one of the cleanest sources of renewable energy, with no associated emissions and waste products. Adverse impacts from the Project, if any, are far outweighed by the favourable impact it will have by reducing air, water and soil pollution that may be caused by conventional plants.

Impacts from the Zafarana Project are limited to possible noise and visual pollution and change in land use. Another possible impact is its effect on migrating birds. Although minor, these impacts are briefly discussed in the ensuing paragraphs.

Noise pollution

Noise from the rotating blades may be a concern for wind farms. However, operational noise from the Zafarana plant is expected to be minimal due to the higher background noise caused by strong winds, and will not affect residents in any way due to its isolated location. Similarly, noise expected during construction is not a concern due to there being no communities nearby.

Visual pollution

Wind structures are tall, wide, and take up much land relative to the amount of electricity they produce. For this reason, it can be considered as an eye-sore. Again, due to its remote location, the "visual pollution" caused by the Zafarana Project is not a significant concern.

Land use

As the Project site is located in a desert area, there is no concern regarding land use. Taking into account the difficulty of regenerating desert flora once destroyed, care will be taken during construction by erecting protective fences around what little vegetation is present.

Potential impact on migrating birds

A serious potential concern for wind farms is their impact on migrating birds. Overseas experience suggests that migrating birds, in particular the larger and slower birds, are at high risk of flying directly into towers or rotating blades. This is less of a concern for most local birds, which grow accustomed to the presence of the structures.

The Zafarana site was chosen taking into account the potential dangers to migrating birds. It is close to but not within a major pathway for birds migrating between Europe and Central and Southern Africa.

It is noted that birds are attracted to greenery, which they use as shelter, and human activity, which they associate with food scraps, and can be encouraged to divert from their main flight path. The Project has no risk of attracting birds to the plant site and its potential dangers, in that there is little biodiversity and human activity in the area.

Experience with the existing farms at Zafarana indicates that the Project will not impact migrating birds.

An earlier concern, relating to electrocution of birds by non-insulated transformers and transmission facilities, is now avoided through better design.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

According to the Egyptian Environmental Affairs Agency (EEAA) regulations, a wind power plant project is given a “grey” classification, which requires only an Environmental Screening Form (ESF) rather than a more comprehensive Environmental Impact Assessment (EIA).

NREA prepared and submitted an Environmental Screening Form which was subsequently approved by EEAA on August 30, 1999.

As a condition for approval, EEAA stipulated six specific measures to be undertaken by NREA in order to mitigate potential environmental impacts. This includes conditions pertaining to noise levels, safety measures and impacts on migrating birds. NREA will take all measures necessary to fully comply with these conditions.

SECTION G. Stakeholders' comments

G.1. Brief description how comments by local stakeholders have been invited and compiled:

As the area around the plant site is sparsely populated, stakeholder comments were invited through a written survey carried out between December 2004 and February 2005.

A short non-technical summary of the project (Appendix 1) which mentioned the environmental and social effects of the project was prepared and distributed together with a survey form (Appendix 2). This survey asked stakeholders' perception of the Project's environmental performance and the social impacts.

The survey and project description were sent to some beach resorts and tourist villages located near the Project area, which are the closest inhabited areas. In addition, the governmental sector as represented by the Red Sea governorate had received copy of the survey. The Project will be carried out within the governorate's bounds.

Private sector representation:	Fanar De Luna beach resort
	Romance touristic village.
Government sector representation:	Red Sea governorate (Zafarana local unit)

G.2. Summary of the comments received:

Private sector comments

The private sector comments were sought through Fanar De Luna beach resort and Romance touristic village. The responsible persons of both villages had welcomed the Project declaring that the Project has no negative environmental or social impacts. Moreover they confirmed that many of the Project's positive impacts will directly affect both the surrounding area in general and the villages in particular.

The two most important effects of the Project were identified as the increase in supply of safe and stable electricity and job opportunities. Another important impact is that many of the villages surrounding the Project will have the opportunity to gain from increased economic activity in the region due to the investment by both Egyptian and foreign entities.

At a national level, the participants perceived that the Project will provide more experience in new technologies and contribute to the transfer of new technologies and skill sets. They also agreed with the basic aim of the Project which is to reduce fossil fuel consumption and associated GHG emissions, consequently helping the global community in fighting climate change.

Public sector comments

The Red Sea governorate (Zafarana local unit) welcomed the Project and agreed on the construction of the Project in Zafarana area. It confirmed that the Project will not cause any negative environmental effects as it is located in a desert area, about 10 km from the nearest human social community. On the contrary, the governorate saw many favourable environmental and social impacts will be achieved through the implementation of the Project.

The governorate actively encourages such projects which produce more clean electricity for the region and which helps in achieving Egypt's sustainable development goals.

G.3. Report on how due account was taken of any comments received:

All parties, both public and private, from whom comments were sought, gave positive feedback regarding the Project. All stakeholders confirmed the Project's importance and the positive environmental and social impacts deriving from it. In summary, these perceived impacts include: the reduction of GHG emissions and helping to combat climate change, the production of more electricity for the region and job opportunities. All declared that they will not face any harm as the project has no apparent negative impacts.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	

Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

It is confirmed by Japanese government that public funding for the Project does not result in the diversion of official development assistance and is separate from and is not counted towards the financial obligations of Japan.

Confirmation letter from Japanese government was issued by Minister of Foreign Affairs of Japan on January 27, 2006.

Annex 3

BASELINE INFORMATION

Egyptian Grid Data[18]

2001/2002

Power Plant	Type of generation[19]	Fuel[20]	Commissioning Date	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	84/85/88	1260	7141	1686
Cairo West	ST	NG, FO	66/79	350	1563	426
Cairo West ext.	ST	NG, FO	95	660	3521	791
Cairo South I	CC(hybrid)	NG, FO	57/65/89	570	3236	711
Cairo South II	CC	NG, FO	95	165	1018	186
Wadi Hof	GT	NG	85	100	20	8
Tebbin	GT	NG, FO	79	46	103	43
Tebbin	ST	FO	58/59	45	7	3
Damietta	CC	NG, FO	89/93	1125	6736	1294
Talkha(CC)	CC	NG, FO	79/80/89	283.6	1410	346
Talkha(ST)	ST	FO	66/67	90	1	0.2
Talkha 210	ST	NG, FO	93/95	420	1912	487
Ataka	ST	NG, FO	85/86/87	900	4634	1053
Abu Sultan	ST	NG, FO	83/84/86	600	2879	824
Suez	ST	FO	65/91	185	0	0
Suez	GT	NG, FO	91	17	1	0.1
Shabab	GT	NG, FO	82	100	73	25
Port Said	GT	NG, FO	77/84	64	24	9
Arish	ST	NG, FO	99	66	356	108
Oyoun Mousa	ST	NG, FO	00/01	640	3655	823
Zafarana	Wind	Wind	00	63	221	0
Kafr El Dawar	ST	NG, FO	80/84/86	440	1411	376
Mahmoudia (G)	GT	NG, FO	81/82	180	51	19
Mahmoudia (CC)	CC	NG, FO	83/95	308	1898	386
Damanhour 300	ST	NG, FO	91	300	945	211
Damanhour Ext	ST	NG, FO	68/69	195	742	195
Damanhour (old)	ST	NG, FO	60	30	0	0
Damanhour (CC)	CC	NG, FO	85/95	152.8	923	177
Seiuf (G)	GT	NG, FO	81/82/83/84	200	38	14
Seiuf (ST)	ST	FO	61/69	113	355	131
Karmouz	GT	FO	80	25	1	0.1
Abu Kir	ST	NG, FO	83/84/91	900	3896	925

[18] Annual Report 2001/2002,2002/2003,2003/2004, Egyptian Electricity Holding Company

[19] ST = Steam Turbine, CC = Combined Cycle, GT = Gas Turbine

[20] NG = Natural Gas, FO = Fuel Oil

Sidi Krir 1,2	ST	NG, FO	99/00	640	3662	765
Matrouh	ST	NG, FO	00	60	149	41
Sidi Krir 3,4 (private)	ST	NG, FO	02	682.5		
Walidia	ST	FO	92/97	600	2819	674
Kuriemat	ST	NG, FO	98	1245	6713	1489
Assiut	ST	FO	66/67	90	461	152
High Dam	Hydro	Hydro	67	2100	11059	0
Aswan Dam (1)	Hydro	Hydro	60	280	1625	0
Aswan Dam (2)	Hydro	Hydro	85/86	270	1846	0
Esna	Hydro	Hydro	95	90	369	0
Naga Hamady	Hydro	Hydro	98	5	18	0
TOTAL				16639	77492	14378

2002/2003

Power Plant	Type of generation	Fuel	Commissioning Date	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	84/85/88	1260	7,490	1,753
Cairo West	ST	NG, FO	66/79	350	1,559	431
Cairo West ext.	ST	NG, FO	95	660	3,744	845
Cairo South I	CC(hybrid)	NG, FO	57/65/89	570	3,549	792
Cairo South II	CC	NG, FO	95	165	1,191	219
Wadi Hof	GT	NG	85	100	75	31
Tebbin	GT	NG, FO	79	46	240	101
Tebbin	ST	FO	58/59	45	34	13
Damietta	CC	NG, FO	89/93	1125	7,830	1,476
Talkha(CC)	CC	NG, FO	79/80/89	283.6	1,586	381
Talkha(ST)	ST	FO	66/67	90	63	39
Talkha 210	ST	NG, FO	93/95	420	2,068	525
Ataka	ST	NG, FO	85/86/87	900	4,346	1,028
Abu Sultan	ST	NG, FO	83/84/86	600	2,678	762
Suez	ST	FO	65/91	185	16	12
Suez	GT	NG, FO	91	17	1	0.1
Shabab	GT	NG, FO	82	100	217	75
Port Said	GT	NG, FO	77/84	64	58	22
Arish	ST	NG, FO	99	66	411	115
Oyoun Mousa	ST	NG, FO	00/01	640	3,688	814
Sharm El-Sheikh	GT	FO	02	179.4	104	25
El-Hurghada	GT	FO	02	143.2		17
Zafarana	Wind	Wind	00	63	203	0
Kafr El Dawar	ST	NG, FO	80/84/86	440	1,469	427
Mahmoudia (G)	GT	NG, FO	81/82	180	108	41
Mahmoudia (CC)	CC	NG, FO	83/95	308	1,836	389
Damanhour 300	ST	NG, FO	91	300	1,766	412
Damanhour Ext	ST	NG, FO	68/69	195	924	263
Damanhour (CC)	CC	NG, FO	85/95	152.8	909	186
Seiuf (G)	GT	NG, FO	81/82/83/84	200	66	28

Seiuf (ST)	ST	FO	61/69	113	397	151
Karmouz	GT	FO	80	25	1	0.3
Abu Kir	ST	NG, FO	83/84/91	900	3,185	797
Sidi Krir 1,2	ST	NG, FO	99/00	640	3,557	757
Matrouh	ST	NG, FO	00	60	254	68
Walidia	ST	FO	92/97	600	3,317	781
Kuriemat	ST	NG, FO	98	1245	6,167	1,335
Assiut	ST	FO	66/67	90	468	155
High Dam	Hydro	Hydro	67	2100	9,188	0
Aswan Dam (1)	Hydro	Hydro	60	280	1,406	0
Aswan Dam (2)	Hydro	Hydro	85/86	270	1,687	0
Esna	Hydro	Hydro	95	90	388	0
Naga Hamady	Hydro	Hydro	98	5	23	0
Suez Gulf (private)	ST	NG, FO	02	682.5	2,637	551.3
Sidi Krir 3,4 (private)	ST	NG, FO	02	682.5	4,469	934
Port Said East (private)	ST	NG, FO	03	282.5	501	105.2
TOTAL				17,913.5	85,874	16,856.9

2003/2004

Power Plant	Type of generation	Fuel	Commissioning Date	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
Shobra El Kheima	ST	NG, FO	84/85/88	1260	7,080.459	1,673
Cairo West	ST	NG, FO	66/79	350	1,660.922	449
Cairo West ext.	ST	NG, FO	95	660	3,586.13	806
Cairo South I	CC(hybrid)	NG, FO	57/65/89	570	3,638.089	807
Cairo South II	CC	NG, FO	95	165	1,265.255	231
Cairo North	CC	NG, FO	04	500	209.724	520
Wadi Hof	GT	NG	85	100	22.526	9
Tebbin	GT	NG, FO	79	46	110.295	47
Tebbin	ST	FO	58/59	45	8.027	3
Damietta	CC	NG, FO	89/93	1125	6,855.343	1,333
Talkha(CC)	CC	NG, FO	79/80/89	283.6	1,621.041	389
Talkha 210	ST	NG, FO	93/95	420	2,051.441	521
Ataka	ST	NG, FO	85/86/87	900	4,810.026	1,136
Abu Sultan	ST	NG, FO	83/84/86	600	2,722.383	771
Suez	ST	FO	65/91	185	0	0
Suez	GT	NG, FO	91	17	0.013	0.1
Shabab	GT	NG, FO	82	100	103.049	35
Port Said	GT	NG, FO	77/84	64	21.154	35
Arish	ST	NG, FO	99	66	439.813	117
Oyoun Mousa	ST	NG, FO	00/01	640	4,001.067	874
Sharm El-Sheikh	GT	FO	02	179.4	66.73	26
El-Hurghada	GT	FO	02	143.2	28.93	12
Zafarana	Wind	Wind	00/03/04	140	364.969	0
Kafr El Dawar	ST	NG, FO	80/84/86	440	1,508.211	456

Mahmoudia (G)	GT	NG, FO	81/82	180	56.496	23
Mahmoudia (CC)	CC	NG, FO	83/95	308	1,901.941	410
Damanhour 300	ST	NG, FO	91	300	1,740.64	405
Damanhour Ext	ST	NG, FO	68/69	195	909.949	267
Damanhour (CC)	CC	NG, FO	85/95	152.8	1,015.73	215
Seiuf (G)	GT	NG, FO	81/82/83/84	200	36.35	16
Seiuf (ST)	ST	FO	61/69	113	319.441	143
Karmouz	GT	FO	80	25	0.060	0.3
Abu Kir	ST	NG, FO	83/84/91	900	3,447.885	882
Sidi Krir 1,2	ST	NG, FO	99/00	640	3,714.442	815
Matrouh	ST	NG, FO	00	60	267.379	88
Walidia	ST	FO	92/97	600	2,455.015	602
Kuriemat	ST	NG, FO	98	1245	6,972.342	1,480
Assiut	ST	FO	66/67	90	488.526	160
High Dam	Hydro	Hydro	67	2100	9,288.681	0
Aswan Dam (1)	Hydro	Hydro	60	280	1,473.537	0
Aswan Dam (2)	Hydro	Hydro	85/86	270	1,678.305	0
Esna	Hydro	Hydro	95	90	441.173	0
Naga Hamady	Hydro	Hydro	98	5	16.228	0
Suez Gulf (private)	ST	NG, FO	02	682.5	12,673	903
Sidi Krir 3,4 (private)	ST	NG, FO	02	682.5		936
Port Said East (private)	ST	NG, FO	02	282.5		896
TOTAL				18,323.5	91,072.717	18,491.4

Input variables

Source	Variable	Values applied	Reference
Grid electricity generation	Net calorific value (NCV)	Natural gas = 1.111toe/t Fuel oil = 0.972 toe/t (1toe = 41.868GJ)	OEP [21]
	C emission factor	(tC/TJ) Natural gas = 15.3 Fuel oil = 20.8	Calculated as : (Ton CO_2 per ton fuel[21] / NCV) ∗ 12/44
	Fraction of C oxidised	Gas = 0.995 Oil and oil products = 0.99	Table 1-6 IPCC Reference Manual
	Fuel consumption according to generation type (operating margin)	Refer to table above	EEHC
	Electricity generation according to generation type (operating margin)	Refer to table above	
	Fuel consumption for recently built plants (build margin)	Refer to table above	

[21] "Energy in Egypt 2000 / 2001" by OEP

	Electricity generation for recently built plants (build margin)	Refer to table above	
	Electricity exported by project	452,016MWh/yr	NREA

Comparison of typical 100MW wind and conventional power plants (in Egyptian Pound) is shown below. Data for wind and combined cycle power plants were obtained from NREA and EEHC, respectively.

		Wind power plant	**Combined cycle power plant**
A	Expected operating life	20 years	40 years
B	Capacity factor	42%	80%
C	Electricity generated over total plant life (= 100MW x 8760h/yr x A x B)	7,358,400,000 kWh	28,032,000,000 kWh
D	Construction cost	LE 570,000,000	LE 207,000,000
E	Fuel cost per kWh	0	LE 0.0282/kWh
F	Fuel cost over lifetime (= C x E)	0	LE 790,502,400
G	Other costs (e.g. O&M, overhaul) over lifetime	LE 313,500,000 (2% of construction cost/year for O&M, 15% for overhaul)	LE 756,864,000 (LE 0.027/kWh)
H	Lifetime interest payment @ 13% (linear repayment)	LE 741,000,000	LE 538,200,000
I	Total cost over lifetime (= D + F + G + H)	LE 1,624,500,000	LE 2,292,566,400
	Total construction cost per kWh (= D ÷ C)	LE 0.077 USD 0.0129*	LE 0.007 USD 0.0012*
	Total cost per kWh (= I ÷ C)	LE 0.221 USD 0.037*	LE 0.082 USD 0.014*

*Exchange rate used 6LE/1USD
Note: Calculations are not levelized.

Annex 4

MONITORING PLAN

- - - - -

This section supplements the monitoring plan provided in Section D.

1. Project Boundary

Consistent with the Project boundary identified in Section B.4, for the baseline determination, the gas and source is CO_2 emissions from electricity generation in fossil fuel-fired power that is displaced due to the project activity.

2. Monitoring Period

The crediting period is 7 years with the option of renewal. The first crediting period and hence monitoring period is expected to start on October 1st 2007. At the end of each full year, monitored data will be aggregated in preparation for verification by the DOE.

3. Management Structure

NREA will be responsible for the execution of the monitoring plan. It will collect and store relevant data in a systematic and reliable way, evaluate them regularly, generate reports, and ensure the availability of pertinent information for verification. An electronic spreadsheet file will be kept to accumulate all monitored variables, which will be presented to the DOE for verification.

4. On-site Procedures

Project electricity generation will be monitored through the use of on site metering equipment at the substation (interconnection facility connecting the facility to the grid). The Main Metering System equipment will be owned, operated and maintained by EETC, Egyptian Electricity Transmission Company, and Backup Metering System equipment will be owned, operated and maintained by NREA. Both NREA and EETC have the right to read either meter. Both meters will have the provisions to record on memory the accumulated kilowatt-hours. Both meters will be read. The results from the Main Meter will be supplied by EETC to NREA on a monthly basis.

Operation and Maintenance logs

Daily O&M logs will be maintained by each shift leader on a real time basis. They will provide detailed on-the-spot information about the operations at the plant. Any event of significance will be reported.

Operation and Maintenance Report

This report will be developed each month and presented to NREA management. The report will include the following topics:

- Summary
- Accidents and malfunctions
- Safety and environment
- Plant performance and availability
- Meter records
- Fuel report
- Personnel changes

The data relevant to Section D is the electricity supplied to the grid by the Project.

Procedures for calibration of equipment

NREA will carry out equipment calibration according to international standards.

It is important to note that NREA will be required to install and maintain all electricity metering equipment and associated transformers conforming to specifications set by EEHC. The metering equipment is to be sealed in the presence of both NREA and EEHC representatives. The seals can only be broken in the presence of both NREA and EEHC representatives for inspection, testing or calibration.

5. Data Storage and Filing – Electronic Workbook

All relevant data will be monitored and electronically stored.

Annex 5

Information on the demonstration of additionality
(Investment Analysis)

1.Base Case

Data/Assumptions:

Electricity generation	525,600	MWh/year	
Electricity tariff	0.14	LE/kWh	
Initial cost	684,000,000	LE/120MW	
O&M cost	18,810,000	LE/year	(2.75% capital cost/year)

IRR w/o CER (21 years) **5.30%**

Caluculation Sheet

Year	Revenue [LE]		Expense [LE]			Cashflow w/o CER
	Electricity Sales	Total Revenue w/o CER	Capital cost	O&M costs	Total Expense	
0			−684,000,000		−684,000,000	−684,000,000
1	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
2	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
3	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
4	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
5	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
6	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
7	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
8	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
9	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
10	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
11	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
12	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
13	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
14	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
15	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
16	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
17	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
18	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
19	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
20	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
21	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000

2. Case1 Decreasing EPC cost by 10%

Data/Assumptions:

Electricity generation	525,600	MWh/year	
Electricity tariff	0.14	LE/kWh	
Initial cost	615,600,000	LE/120MW	
O&M cost	18,810,000	LE/year	(O&M cost is same as "Base Case")

IRR w/o CER (21 years) **6.55%**

Caluculation Sheet

Year	Revenue [LE]		Expense [LE]			Cashflow w/o CER
	Electricity Sales	Total Revenue w/o CER	Capital cost	O&M costs	Total Expense	
0			−615,600,000		−615,600,000	−615,600,000
1	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
2	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
3	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
4	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
5	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
6	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
7	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
8	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
9	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
10	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
11	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
12	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
13	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
14	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
15	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
16	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
17	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
18	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
19	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
20	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000
21	73,584,000	73,584,000		−18,810,000	−18,810,000	54,774,000

3. Case2 Decreasing running cost by 10%

Data/Assumptions:

Electricity generation	525,600	MWh/year
Electricity tariff	0.14	LE/kWh
Initial cost	684,000,000	LE/120MW
O&M cost	16,929,000	LE/year

IRR w/o CER (21 years) **5.69%**

Caluculation Sheet

Year	Revenue [LE]		Expense [LE]			Cashflow w/o CER
	Electricity Sales	Total Revenue w/o CER	Capital cost	O&M costs	Total Expense	
0			−684,000,000		−684,000,000	−684,000,000
1	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
2	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
3	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
4	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
5	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
6	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
7	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
8	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
9	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
10	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
11	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
12	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
13	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
14	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
15	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
16	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
17	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
18	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
19	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
20	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000
21	73,584,000	73,584,000		−16,929,000	−16,929,000	56,655,000

4. Case3 Increasing electricity tariff by 5%

Data/Assumptions:

Electricity generation	525,600	MWh/year
Electricity tariff	0.15	LE/kWh
Initial cost	684,000,000	LE/120MW
O&M cost	18,810,000	LE/year

IRR w/o CER (21 years) **6.06%**

Caluculation Sheet

Year	Revenue [LE]		Expense [LE]			Cashflow w/o CER
	Electricity Sales	Total Revenue w/o CER	Capital cost	O&M costs	Total Expense	
0			−684,000,000		−684,000,000	−684,000,000
1	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
2	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
3	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
4	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
5	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
6	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
7	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
8	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
9	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
10	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
11	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
12	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
13	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
14	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
15	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
16	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
17	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
18	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
19	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
20	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200
21	77,263,200	77,263,200		−18,810,000	−18,810,000	58,453,200

5. Case4 Increasing plant load factor by 2%

Data/Assumptions:

Electricity generation	546,624	MWh/year
Electricity tariff	0.14	LE/kWh
Initial cost	684,000,000	LE/120MW
O&M cost	18,810,000	LE/year

IRR w/o CER (21 years) **5.91%**

Caluculation Sheet

Year	Revenue [LE]		Expense [LE]			Cashflow w/o CER
	Electricity Sales	Total Revenue w/o CER	Capital cost	O&M costs	Total Expense	
0			−684,000,000		−684,000,000	−684,000,000
1	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
2	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
3	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
4	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
5	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
6	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
7	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
8	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
9	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
10	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
11	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
12	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
13	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
14	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
15	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
16	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
17	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
18	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
19	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
20	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360
21	76,527,360	76,527,360		−18,810,000	−18,810,000	57,717,360

Appendix 1

Zafarana wind power Project

- The project is titled as Zafarana Wind Power Plant Project, in the Arab Republic of Egypt, the project is approximately located 200 km south east of Cairo, on an island side to the highway along the Suez Gulf coast line. It is a desert area with favorable wind conditions where there is no human activity in the vicinity of the site., The nearest community is some 10 km away.
- The project participants will be, Egypt; (the Egyptian government. represented in NREA –New &Renewable Energy Authority- the host country-) and Japan (Japanese Government represented in JBIC- Japanese Bank for international cooperation - provide funding to the project-).
- The project capacity is 120 MW wind power generation, resulting in 441.504 MWh of electricity annually, the project is to assist Egypt in its sustainable development , by providing zero Green House Gases (GHG) emission which will displace predominantly gas – fired electricity generation, the project is expected to reduce 227.375 tCO_2 (tones of carbon dioxide equivalent) annually, in the initial 7 years crediting period, the project is expected to reduce approximately 1.59 million tCO_2 ,generating the equaling amount of Certified Emission Reductions (CERs).

Positive impacts of the project:

- Wind farms are one of the cleanest sources of renewable energy with no cause negative impacts to the environment also because it reduces the air and water pollution caused by using the fossil fuel(conventional plants)
- We can summarize the positive impacts of the project as follows:
  1. Impacts from the project are so limited to possible noise, as it will be established in a desert area it is about 10km far from the nearest human community.
  2. Visual impacts are so limited, also because it is found in an uninhabited area.
  3. The project does not affect the immigration way of the birds.
  4. The project does not cause the change of the land nature as it is a desert land and it is not valid for agriculture purposes.

Social impacts of the project:

- The project helps positively in achieving the sustainable development as
- It produces electricity – about 441.504 kWwh – by using the renewable wind sources and it will save about 90.000 TOE of fossil fuel per year and it reduces about 227,375 tCO_2 per year.
- The project will provide some positive social impacts as follows.
  1. Saving job opportunities.
  2. Encouraging and increasing the foreign investment in Egypt.
  3. Transferring new technologies & experiences.
  4. Economical benefits that comes out from selling CERs.
  5. The project prevents the danger of the climate change.
  6. Saving the fossil fuel.
  7. Saving the electricity necessary for developing the touristic villages near the red sea coast, this area is considered one of the most attracting places for tourism.

Appendix 2

Survey
About
Establishing a wind farm project
Through Clean Development Mechanism.
At Zafarana, Egypt

- Reference to the attached summarized description of the wind farm project at Zafarana area, This project is to be carried out within the frame of the C D M (Clean Development Mechanism), you are kindly requested to fill in the following (both the governmental & private sectors that surround the project area) and also send the filled in survey to the project executive entity (New & Renewable Energy Authority) within 2 weeks.

1. Will the project cause any negative environmental impacts to the surrounders?
   Yes ☐ No ☐
2. If yes, what are these negative impacts ?
   (please mention in details., You may add more pages if necessary.)
   ……………………………………………………………………………………………………
   ……………………………………………………………………………………………………
   ……………………………………………………
3. At the time of carrying out the project through CDM, many positive impacts will appear to be beneficial to the society.
   Please sign (√) for the specified impact (s) which will fall on the surrounders.
   1- Electricity produced by the project. ☐
   2- Saving job opportunities. ☐
   3- Economical investments (Egyptian, foreigner). ☐
   4- Gaining experiences and transferring new technologies. ☐
   5- Reducing GHG (Green House Gases) emissions and creating clean climate. ☐
   6- Saving fossil fuel . ☐
4. Other Comments:
   (Please write down and other Comments or suggestions, you may add more pages if necessary)
   ……………………………………………………………………………………………………
   ……………………………………………………………………………………………………
   ……………………………………………………