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

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SECTION A. General description of project activity

A.1 Title of the project activity:

Essaouira wind power project.

A.2. Description of the project activity:

The project involves the construction of the 60 MW Essaouira wind power project in Cap Sim, Morocco. The Cap Sim region is one of the windiest areas in Morocco. The wind speed registered at a height of 40 meters is 8.9 m /s (source: CDER).The project will enable the use of renewable energy in Morocco and attract foreign and private investment into the power sector in Morocco.

The diversification of energy sources for energy production is one of the objectives of the Moroccan government. The government is particularly in favour of using renewable energy as this will result in a reduced reliance on fossil fuels and results in a reduction of GHG emissions and local air pollution. With its 3500 km of coast Morocco has a great potential of wind energy. The average wind speed is 5.3 m/s at more than 90% of the countries' territory (according to the wind atlas for Morocco developed by CDER). The Essaouira project is in line with the government's objective to increase the use of renewable energy.

The project contributes to sustainable development in the following ways:

- Renewable energy is an energy source that presents various environmental benefits. In contrast to other energy sources wind energy does not result in emissions of pollutants into the atmosphere, not does emits residuals that can have an impact on soil, water etc.

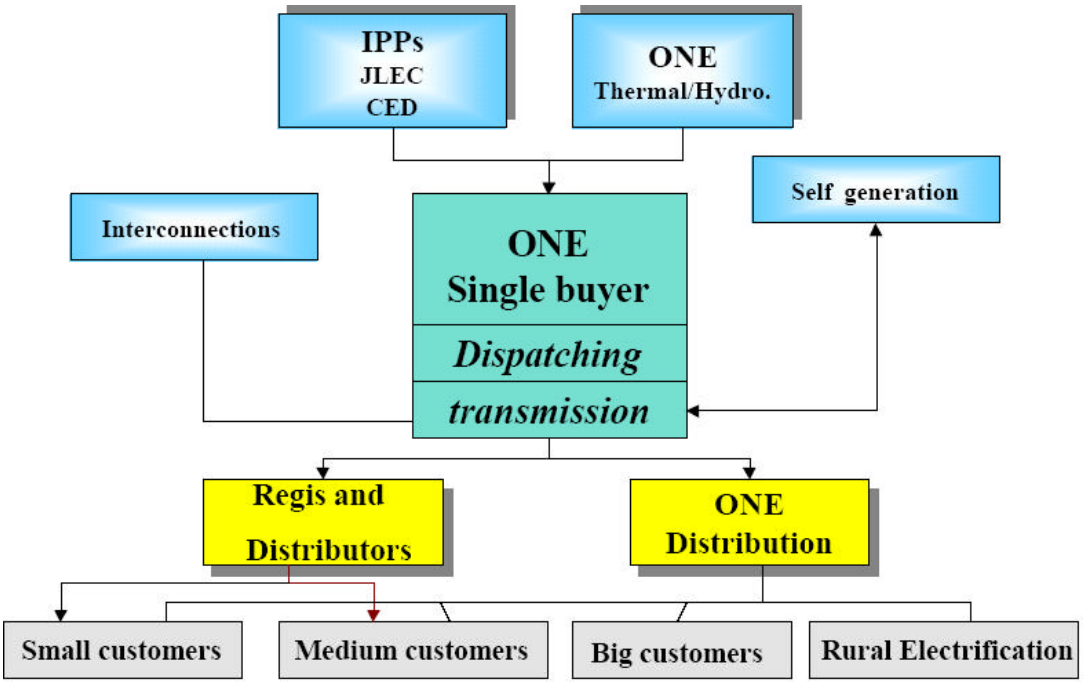
- Wind energy is a renewable energy source that can be used without putting the supply of energy into danger for future generations;

- The project will contribute to a reduction in other emissions than GHG emissions, like emissions of sulfur dioxide, nitrogen oxides, and particulates.
- The project will result in extra employment – the realisation of the wind project will result in increased jobs in the local area, especially during the construction phase. Construction materials for the foundations, cables and access roads will be sourced locally and also local transport will be used.

Background Moroccan Power sector

The Office National d'Electricité is in charge of generation, transmission and distribution (45% of the electricity demand) of electricity in Morocco. Municipal distributors are in charge of the other 55% of energy demand. New actors are now entering the market, including Independent Power Producers like Jorf Lasfar (JLEC) and the wind park Torres Abdelkhalek (CED) and private distributors. The role of ONE is to establish the structures of the market and to guarantee a competitive, transparent and efficient

electricity market. The figure below provides an overview of the actual structure of the power sector in Morocco.



Morocco has limited indigenous oil, gas and hydro resources; as a result, it has historically been depended on imported fossil fuels (oil, coal and diesel) for power generation. The country is the biggest oil importer in the Arab World. Approximately 97% of its energy comes from foreign sources, and the cost weighs heavily on the country's foreign exchange payments. Energy accounts for over 25% of Morocco's total export earnings (Trade Partners UK, 2002). To reduce this dependence, Morocco has diversified its energy sources in recent years.

Morocco has substantial new coal-fired generation capacity, namely four 330-MW units at Jorf Lasfar, two of which were commissioned in 2000. Morocco has developed a substantial hydro-electricity generating capacity, which depends on rainfall to fill the dams where hydro-electrical schemes are installed. In recent years however, drought conditions have substantially reduced the contribution of electricity from hydropower. Having almost fully exploited its hydroelectric resources, Morocco has experimented with developing its wind resources, commissioning a 50 MW wind farm at Koudia al Baïda in 2000 (Abdelkhalek Torres project).

At the national level, the rate of electrification in rural areas reached approximately 62 % at the end of 2003 against 55 % at the end of 2002. In 2003, the rate of urbanisation of the population in Morocco was approximately 56 %. The average annual growth rate of the demand for electricity is estimated to be 6% over the period 2004-2015.

A.3. Project participants:

ONE (Office National d'Electricité) is planning to develop the 60 MW Essaouira wind park in Morocco. So far no other partners have been identified. ONE put out a tender for this project and leaves the constuction of the wind park to the successful bidder in the tender. The exploitation of the park will be done by ONE itself.

Another partner in the project is KfW (Kreditanstalt für Wiederaufbau). KfW will provide a €50 million composite loan to ONE for developing the project. Half of this loan will be provided at a commercial interest rate. The other €25 millions will be provided as a concessional loan of 0.75% over 40 years with 10 years grace period. KfW will not claim any CERs for the loan provided.

Finally, the Ministry of Land-Use Management, Water and the Environment of Morocco is a participant in the project. The Ministry of Land-Use Management, Water and the Environment is acting as the secretariat for the National CDM Council that acts as the Designated National Authority for Morocco.

Further details on the project participants are provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The Essaouira project will be located in Cap Sim in Morocco. Cap Sim is located at about 15 kilometres south of Essaouira close to the village Ouassen.

A.4.1.1. Host Party(ies):

Morocco

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

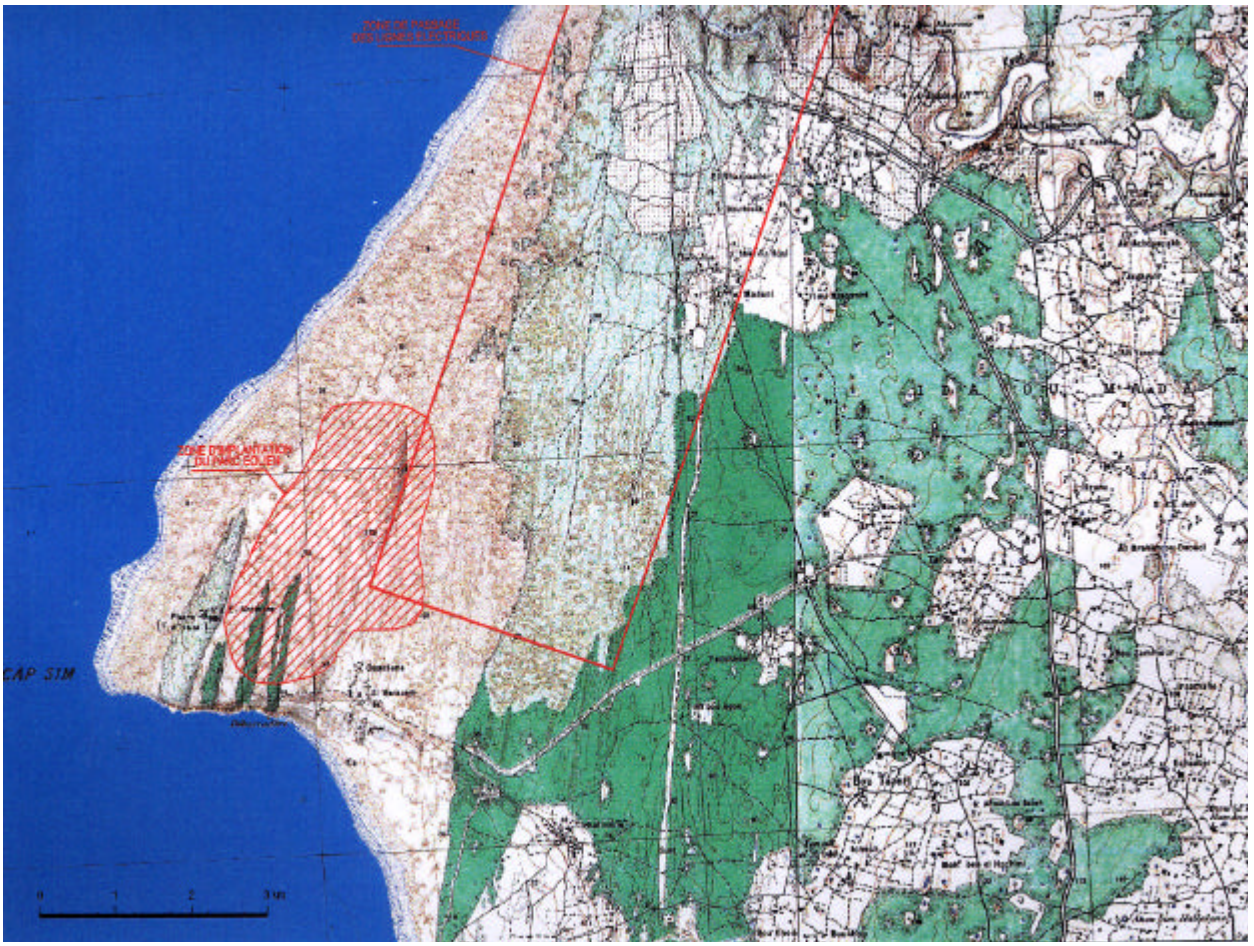
Essaouira

A.4.1.3. City/Town/Community etc:

Cap Sim

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

The nearest village to the project site is Oassen. The main route (P8) from Essaouira to Agadir and then a secondary road in direction of Sidi Kaouki give access to the project location. Then a 3 km long track that is suitable for motor vehicles leads to the site, next to the village of Ouassen.



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

Grid connected power generation. According to Annex of the Kyoto Protocol, this project fits in Sectoral Scope 1, Energy Industries (renewable/non renewable)

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

The project with an installed capacity of 60 MW will use state of the art wind power technology and is estimated to generate 210 GWh per year.

The wind turbines will have a nominal installed capacity of at least 850 kW each. The park will consist of 71 horizontal axis wind turbines maximum, with three blades and tubular tower.

Moreover, the park will consist of the following main equipment:

- Electronic control devices for regulation and protection
- A BT/22 kV transformer at the foot of each turbine
- A 22 kV/ 60 kV transformer to match the voltage of the existing transmission system
- Service tracks within the park to each turbine.

The electricity produced by the Essaouira wind park will be supplied to the 60 kV national electrical grid.

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:

Explanation of how the projects anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity:

The electricity generated by the project is produced by using a renewable and clean energy source. Subsequently the project will not result in any GHG emissions. In the absence of the proposed project activity electricity generation would be produced by the continued use of fossil-fuel-based electricity generators currently operating in the grid.

For sustainable development in Morocco it is necessary to find a balance between economic growth, an effective, sufficient and secure energy supply and a clean environment. The benefits of the project are an increase in energy efficiency and the introduction of new technologies, a reduction in the consumption of fossil fuels, thus recuding the emissions of greenhouse gases and substances that affect the ozone layer and also an increase in the production of renewable energy.

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 government of Morocco would like to diversify the fuel sources to generate energy by increasing the amount of renewable energy sources. This to become less dependent on import of fossil fuels to meet their energy demand. However, the current regulations and price for electricity in Morocco do not favour electricity generation by renewable energy sources like wind. No subsidies or other fiscal incentives are in place to promote renewable energy. The electricity price paid for wind power does therefore not differ very much from the price paid for power generated by coal or fuel oil. At the same time, the costs of electricity production through a wind park are high compared to the costs of electricity production by fossil fuel sources. The banks of Morocco do not want to provide any guarantees for wind power generation projects.

At this moment, a 50 MW wind park and a 3.5 MW project are operational in Morocco - the Abdelkhalek Torres project and the pilot Tanger project. The first started operations in August 2000 and the pilot park in October 2000. The first project has been developed by a consortium consisting of the French utility EDF, the engineering company Cabinet Germa and the bank group Paribas. The wind park is implemented as a BTO project (Build-Transfer-Operate Project). ONE committed itself to buy all electricity produced by the project for a total period of 19 years. The project produces at a higher price per Kwh than the power stations that use conventional fuel sources coal and fuel oil. The financing of the project has been guaranteed by the concessionaires of the project.

It should be noted that the electricity price agreed between the project developer EDF and Paris bas/Germa and ONE is above the market level. Since this is not profitable to ONE, no further projects will be developed under similar conditions, unless there is support from the government (e.g. like tax benefits for wind). The conditions of the Abdelkhalek Torres project can thus not be compared with Essaouira, which will be financed by ONE and where financing has not been guaranteed by the concessionaires like for Abdelkhalek Torrès.

The second project (the pilot project) has been financed by KfW (German financial cooperation).

The construction of another wind park at Tanger (140 MW) has been planned by ONE since 2000, but has not started yet because of financial problems which are related to the costs per KWh versus sales price that can be achieved.

It can be concluded that financing wind projects in Morocco will be difficult without the value of the environmental benefits. The value for the environmental benefits for the Essaouira project have been included in the financial analysis from the start, as have been for Tangier. For Tangier the implementation of the project including the value for emission reductions was still deemed not feasible. In absence of the proposed CDM project, the emission reduction would not be realised.

Further detail on how and why the project reduces GHG emissions in absence of the project is provided in Section B.3 below.

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

It has been estimated that the project will abate over 1.56 million tonnes of CO_2 over the selected crediting period of 10 years. Please refer to section E for a detailed calculation of the emission reductions.

A.4.5. Public funding of the project activity:

ONE will receive a €50 million loan from KfW (Kreditanstalt für Wiederaufbau) of which €25 million is a concessional loan at an interest rate of 0.75% over 40 years. This could be considered public funding. In case this loan was to be identified as public funding it would not result in a diversion of official assistance and not be acounted towards any financial obligations from Germany. KfW does not claim or require any compensation in the form of Certified Emission Reductions for the loan including the favourable rate.

SECTION B. Application of a baseline methodology

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

ACM002. - “Consolidated baseline methodology for grid-connected electricity generation from renewable sources.”

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

The consolidated baseline methodology for grid-connected electricity generation from renewable sources is justified as the proposed project involves an electricity capacity addition using wind energy sources providing power to the grid.

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

The consolidated baseline methodology for grid connected electricity generation projects ACM0002 describes step by step how to apply the methodology to a specific project. This section describes how the emission factor (EF_y) of the Essaouira wind power project has been determined based on the instructions for calculating the emission factors of the operating margin (OM) and build margin (BM).

Step 1 – Calculation of the Operating Margin emission factor (OM)

The ACM0002 consolidated methodology provides four options to calculate the operating margin. For the proposed project activity, option (a) (simple OM) has been chosen. This is because undertaking a dispatch data analysis (the preferred methodological option) cannot be done at a reasonable cost for ONE, since the data is not readily available from the relevant authorities, and the analysis is a very time-consuming task. The simple OM can be used in the case of the proposed project activity since low-cost/must-run sources constitute less than 50% of the total grid (for example, in the year 2003 only approximately 10% of Moroccan power generation was based on must run renewable energy sources – see also Annex 3 below). The simple OM emission factor has been calculated based on a 3-year vintage (2001-2003).

The OM is calculated as the generation-weighted emissions per electricity unit of all generating units serving the system, excluding low-operating cost and must-run power plants. Low-operating cost and must run power plants include typically hydro, low cost biomass and geothermal. The OM is calculated as follows, using a 3-year average:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where

$F_{i,j,y}$ is the amount of fuel (mass or volume) *i* consumed by relevant power sources *i* in year(s) y,

j refers to the power sources delivering electricity to the grid not including low-operating cost and must run plants, including imports to the grid,

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel (tCO_2/mass or volume) taking into account the carbon content of the fuels used by the relevant power sources j and the percent oxidation of the fuel in year(s) *y*, and

$GEN_{i,j}$ is the electricity (MWh) delivered to the grid by source j.

In terms of the Moroccan electricity sector the 3-year vintage OM was calculated using the data of all operational power fossil fuel fired plants providing electricity to the grid for the years 2001, 2002 and 2003. The data of the plants used in the Operating Margin are provided in the tables presented in Annex 3. Sections E.4 and E.6 also provide details on the calculation.

Step 2 – Calculation of the Build Margin (BM)

ACM0002 allows project participants to choose between two given options for calculating the Build Margin for the project. In the case of Morocco, option 1 has been chosen (i.e., calculate the build margin emission factor based on the most recent information available on plants already built at the time of PDD submission).

The sample group of power plants are selected by taking the 5 power plants most recently built. The total of these 5 most recently built power plants have an installed capacity of 833 MW, which is equal to 22% of the overall installed capacity. For Morocco, this would actually result in the same amount of plants if option 2 were selected. In that case, the selection of plants would be identical as the 5 most recently built plants. An overview of the data on the performance of the 5 selected power plants is presented in Annex 3.

The Build Margin emissions factor (*BM*) is calculated as the generation-weighted average emission factor of the 5 most recently built plants, using the following formula:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

The details of calculation of the BM are presented in section E.4 and E.6 below.

Step 3 - Calculation of the baseline emissions factor

The final step in applying the consolidated methodology for the baseline determination of Essaouira is to calculate the baseline emission factor. This has been calculated as the weighted average of the emissions factor of the OM and the BM. The formula that has been used to calculate this weighted average emission factor is as follows:

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$

The emissions factors of the OM and BM in Morocco have been weighed equally, each 50%. Sections E.4 and E.6 below provide details of the calculation and results.

Project Emissions

A next step is to determine emissions that are related to the project operations. For wind this is zero. The emission reductions of the Essaouira project are therefore equal to the baseline emissions. See also Section E. 5 below.

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 determination of the additionality is done by using the Tool for the demonstration and assessment of additionality, as published in Annex 1 of the sixteenth meeting of the Executive Board (EB-16). The CDM consolidated tool for demonstration of additionality, includes the following steps:

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005

The project is only expected to start operation after validation of the PDD and registration of the project as CDM. In any case, as it will be demonstrated in the following steps, CDM revenue has been considered from the early stages of development of the project, and it is an integral part of the financial package of the project.

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

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

The following alternatives to the project have been considered:

Alternative 1: The proposed CDM project activity: construction of a new wind energy plant with installed capacity of 60 MW connected to the local grid.

Alternative 2: Since ONE is a public utility responsible for the electricity generation in Morocco a wide range of plausible technologies can be considered an alternative. Examples of such technologies in Morocco include coal-fired, diesel, oil fired power plants and a hydro plant.

Sub-step 1b. Compliance with applicable laws and regulations:

All the alternatives comply with the laws and regulatory requirements for electricity generation in Morocco.

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method

The option chosen to prove additionality is Option II – "Apply Investment Analysis", since information on costs per KWh is available for the plausible alternatives defined in the previous step. Since ONE is the

project developer and they also have other non-renewable projects in operation, they could have invested in a non-renewable energy project.

Sub-step 2b. Option II – Apply Investment Analysis

The financial indicator chosen most suitable for the project type and decision context is the unit cost of service, which is the production of electricity. This is expressed in US$/MWh.[1] The costs of electricity production for the proposed project activity and the defined alternatives will be compared. The data for the defined alternatives come from the power plants currently operational in Morocco. This implies that cost data from relatively inefficient power plants have been used. Subsequently, the costs of a MWh of electricity are relatively high compared to new more efficient power plants, and can therefore be considered conservative. The data on costs used are the best "real-life" indicator for operating power plants in the context of Morocco.

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

The costs of producing 1 MWh of electricity have been calculated using the following data:

- investment costs per power plant;
- operations and maintenance costs;
- costs for salaries, taxes and insurance

These costs have been identified for a coal fired power plant, a diesel and fuel oil fired power plant, a hydro power plant and for the proposed project activity. The following assumptions have been used to calculate the costs per plant:

- a discount rate of 10%
- a 30-year lifetime for the coal and hydro power plants
- a 19-year lifetime for the diesel/fuel oil fired gas turbines; and
- a 15-year lifetime for the proposed wind power project.
- all investment costs from previous years have been actualised to 2002 figures
- O&M costs are based on average costs of the selected plants over a 5 year period (1998-2002).

All the data have been provided by ONE (Mr. Khatami and Mr. Bouamama, 2004) and the results for the identified scenarios are presented in the table below.

Table B.3.1. Project electricity costs for identified scenarios

Alternative #	Description	Project costs (US$/MWh)
1	Essaouira wind power project	53.64
2a	Mohammedia coal-oil fired plant	39.68
2b	Jerada coal fired plant	43.75
2c	Kenitra oil fired plant	31.33

[1] For ease of comparison, the costs are expressed in US$. The cost data from ONE are provided in Dirham. These have been transferred into US$ using a currency exchange rate from November 2004, see http://www.xe.com/ucc/

2d	Diesel/oil fired gas turbine	34.80
2e	Hydro power plant	10.03

Based on the information provided above, it is clearly demonstrated that all the plants in scenario 2a - 2e operate at lower costs per MWh than the proposed wind power project. Therefore, alternative 2 can be considered the most plausible scenario. Hence, the proposed project activity is not the most likely business-as-usual scenario.

Sub-step 2d. Sensitivity Analysis

A sensitivity analysis was conducted by altering the following parameters:

- A 10% increase in fuel costs for the hydro and thermal project alternatives;
- A 10% increase in operation and maintenance costs;
- Use of a 12% discount rate instead of 10% discount rate;

Financial analyses were performed altering each of these parameters and assessing what the impact on the costs per MWh would be (see Table below). As it can be seen, the service of unit costs for wind remains higher than the alternatives. After the completed investment comparison analysis, it has been clearly demonstrated that the proposed CDM project activity is unlikely to be the most financially attractive course of action.

SENSITIVITY	Mohammedia	Jerada	Kenitra	Gas Turbines	Hydro	Wind
12% discount rate instead of 10%	41.55	45.09	32.21	38.42	11.56	58.74
additonal 10% on fuel prices	42.14	46.71	33.62	35.36	10.03	53.64
10% additional costs for operation and maintena	39.84	43.92	31.41	34.88	10.06	54.64
alteration of all parameters together	44.17	48.23	34.58	39.07	11.58	59.74

Step 4. Common Practice Analysis

4a - Other activities similar to the Essaouira project in Morocco;
As stated in Step 3 above, there are currently two other wind power projects operational in Morocco, including a 3.5 MW pilot wind power project and a 50 MW wind park. Moreover, a 140 MW wind power project is being planned.

4b – Discussion of similar options that occur
The 3.5 MW project is financed by development money by the German KfW. Considering its size, the fact that it is a pilot project and that it is financed by development money it cannot be compared with the Essaouira project and is thus not subject to the same barriers.

The 50 MW Torres project is similar in size and technology to the Essaouira project. It started operations in the summer of 2000. A first distinction between the projects is that both are developed by different partners. The Torres project was not developed by ONE and the project financing was fully guaranteed by its concessionaires. Moreover, the project negotiated a favorable price for the wind energy. Similar price levels cannot be paid anymore by ONE, as it has proved not to be profitable. A similar price can only be

offered if there would be support from the government (e.g. like tax benefits for wind). There is currently no legislation or policy providing for such benefits.

Finally, the 140 MW Tanger project is in the pipeline of ONE. It would also be developed by ONE and is facing the same barriers as the Essaouira wind project. It is therefore also taking CDM into account to overcome existing barriers. The PIN of the project has been approved by the Moroccan DNA as a CDM project in June 2004.

It can thus be concluded that there are essential distinctions between the already operational wind power projects in Morocco and the Essaouira project.

Step 5. Impact of CDM registration

As shown in Step 2 above, the wind project is generating electricity at highest costs compared to other alternatives like hydro, coal or oil/diesel fired power plants. However, ONE does not pay a higher price for electricity generated from wind than for power generated by other alternatives. If the developer was able to sell emission reduction credits from the project activity, the additional revenue generated by carbon sales would make the project more attractive compared to the scenarios of alternative 2.

Moreover, the project will result in trained staff at ONE, reduce the currently risks associated with wind power in Morocco and increase revenues from the project, increasing its IRR.

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

As referred to in ACM0002 the project boundary has to be assessed in terms of the emission sources and spatial extent.

- *Emission sources*: the emissions sources of the project activity have to be taken into account. For wind energy projects like Essaouira these are zero and have not to be taken into account. For the baseline determination only CO_2 emissions from electricity displaced due to the project is accounted for.
- *Spatial extent*: The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the Essaouira power plant is connected to. The Moroccan grid is an interconnected grid system. Therefore, all power plants that can be dispatched to the grid without transmission constraints have to be included in the project boundary. Morocco is importing and exporting electricity to Spain and Algeria. This implies that for Essaouira that the electricity imports from Spain and Algeria have to be taken into account.

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

The entity determining the baseline and participating in the project as the Carbon Advisor is EcoSecurities B.V. (www.ecosecurities.com). The person at EcoSecurities B.V. developing the baseline is Véronique Bovée (nl@ecosecurities.com). The data from ONE used to developing the baseline were provided by Mr. Khatami Azzeddine (khatami@one.org.ma).

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:

The project is expected to start construction in June 2005.

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

The expected lifetime of the Essaouira project is 20 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:

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

A crediting lifetime of 10 years has been selected for the project

C.2.2.1. Starting date:

January 2007

C.2.2.2. Length:

10 years and 0 m

SECTION D. Application of a monitoring methodology and plan

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

Approved Monitoring Methodology ACM0002, which is the consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources.

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

This monitoring methodology is used in conjunction with the approved baseline methodology ACM0002 (Consolidated baseline methodology for grid-connected electricity generation from renewable sources.) and applies to electricity capacity additions from wind energy sources. The geographic and system boundaries for the relevant electricity grid can be clearly identified, information on the characteristics of the grid is available and data to calculate project emissions is also obtainable.

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

Option 2 has been selected, see D.2.2 below

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

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

Not applicable, as Option 2 below has been selected

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

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

Not applicable, as option 2 below was selected.

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
1. EG_y	*Net electricity supplied to the grid*	*Project proponent data*	*MWh*	*Directly measured*	*Continuously*	*100%*	*Both electronic and paper*	*Data will be aggregated monthly and yearly Double check by receipt of sales.*
2.EF_y	*CO_2 emission factor of the Moroccan grid*	*Grid operator data*	*tCO_2/MWh*	*c*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Calculated as the weighted sum of OM and BM emission factors. Given a 10 year crediting period was selected and the use of 3 year vintage data, it will be calculated and recorded just once at the beginning of the crediting period.*

3. $EF_{OM,y}$	*CO_2 OM emission factor of the grid*	*Grid operator data*	*tCO_2/MWh*	*c*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Calculated as indicated in the relevant OM baseline method. Given a fixed 10 year crediting period was selected , it will be recorded just once at the beginning of the crediting period.*
4. $EF_{BM,y}$	*CO_2 BM emission factor*	*Grid operator data*	*tCO_2/MWh*	*c*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Calculated as indicated in the relevant BM baseline method. Given a fixed 10 year crediting period was selected, it will be recorded just once at the beginning of the crediting period.*
5. $F_{i\,y}$	*Amount of fuel consumed by each fossil fuel plant on the grid*	*Grid operator data*	*Mass*	*m*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Obtained from the power producers. Includes the latest local statistics for the selected 3 year vintage per power plant operational. Given a fixed 10 year crediting period was selected it will be recorded just once at the beginning of the crediting period*
6. $COEF_{coal}$	*CO_2 emission coefficient coal plants*	*Data from grid operator*	*tCO_2/MWh*	*m*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Plant specific values as provided by grid operator.*
7. $COEF_i$	*CO_2 emission coefficient of each fuel type i*	*Data from IPCC 1996*	*tC/GJ and TJ/tonne*	*m*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*For diesel and fuel oil fired plants, IPCC default values on net caloric values and carbon emission factors have been used.*
8. $GEN_{j/k/n,y}$	*Electricity generation of each power source/ plant*	*Data from grid operator*	*MWh*	*m*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Obtained from the power producers. Includes the latest local statistics for the selected 3 year vintage per power plant operational. It will be recorded just once at the beginning of the crediting period as a fixed period of 10 years has been selected.*
9a. $GEN_{imports}$	*Electricity quantity*	*Data from grid operator*	*MWh*	*m*	*At the beginning of the crediting period*	*100%*	*Both electronic and paper*	*Includes the latest local statistics on imports for the selected 3 year vintage per power plant operational. It will be recorded just once at the beginning of the crediting period as a fixed period of 10 years has been selected.*

9b. $COEF_{imports}$	*CO_2 emission coefficient imports*	*Data from ACM0002 baseline*	*tCO_2/MWh*	*Pre-defined*	*At the beginning of the crediting period*	*100%*	*Both paper and electronic*	*Emission factor used for imports = 0 t CO_2/MWh, as defined in ACM0002 baseline.*

The electric power generated by the Essaouira wind park will be measured with energy meters with a precision of 02. The data will be stored every 10 minutes by a central system called FAG, which is a metering system type Siemens Landisetgyr. The direction of transportation (DTR – Direction de transport de l'ONE) within ONE is responsible for the monitoring activities. The data are archived in the information system and monthly transferred to the division who stocks the data permanently.

All of the above data collected will be kept until two years after the last issuance of CERs for the Essaouira project activity.

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

Not applicable as the project activity has no emissions.

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

Not applicable as no sources of leakage have been identified.

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

No sources of leakage have been identified.

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.)

$$ER_y = BE_y - PE_y - L_y$$

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. EG_y	*Low*	*This data will be directly used for calculation of emission reductions. The metering equipment will be properly calibrated and checked periodically for accuracy, to ensure that any error resulting from such equipment shall not exceed +0.2% of full-scale rating. To guarantee QC/QA, it will be double checked by receipts of electricity sales.*
All others	*Low*	*Default data (for emission factors) and grid statistics data will be used. All the sources where data where obtained are cited and come from reputable sources.*

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

Not applicable, as no leakage was identified.

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

The monitoring plan was concluded in October 2004. The entity determining the monitoring plan and participating in the project as the Carbon Advisor is EcoSecurities B.V., Netherlands, listed in Annex 1 of this document.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The project boundary is defined to include those emissions that are related to the direct on-site activities. There are no emissions associated with the production of electricity using wind energy.

The total project emissions are also zero, because all other emissions related to the project activity are excluded from the project boundary and thus not further accounted for.

E.2. Estimated leakage:

No potential emission sources of leakage were identified for Essaouira.

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

Given that the project emissions are zero and no leakage has been identified, the result of the sum is zero emissions.

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

The equation for calculating **emissions in the baseline** (BE_y) is:

$$BE_y = EG_y * EF_y$$

Where:

BE: Baseline emissions (t CO_2e)
EG_y : Annual electricity supplied by the project to the grid (MWh)
EF: baseline emission factor (tCO_2e / MWh)
y: refers to a given year

The baseline emission factor calculations will be based on the combined margin using the "Simple Operating Margin", option (a) of the ACM0002.

$$BE_y = w_{OM} * EF_OM_y + w_{BM} * EF_BM_y$$

Where:

EF: baseline emission factor (tCO_2e / MWh)
? $_{OM}$: Operation Margin weight, which is 0.5 by default
EF_OM: Operational Margin emission factor (tCO_2e / MWh)

? $_{BM}$: Build Margin weight, which is 0.5 by default
EF_BM: Build Margin emission factor (tCO_2e / MWh)
y: refers to a given year

The Operating Margin emission factor (EF_OM_y) is calculated using the following equation:

$$EF_OM_y\ (tCO_2 / MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}]}$$

Where:

$F_{i,j,y}$ is the amount of fuel *i* (in GJ) consumed by power source *j* in year *y*;

j is the set of plants delivering electricity to the grid, not including low-cost or must-run plants and carbon financed plants;

$COEF_{i,j,y}$ is the carbon coefficient of fuel *i* (tCO_2/GJ);

$GEN_{j.y}$ is the electricity (MWh) delivered to the grid by source *j*.

Imports from Algeria and Spain have been taken into account. They form between 10 and 12 % of the total electricity produced in the years 2001, 2002 and 2003. See also Annex 3 below. These imports have been taken into account using an emission factor of 0 t CO_2/MWh.

Using the approach above, and the data shown in Annex 3, the baseline emissions will be 156,026 tCO_2e/year or 1,560,256 tCO_2e for the entire 10-year project duration.

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

Given that E.3 is equal to zero, the emission reductions of project activity are equal to E.4.

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

Electricity Generated Emissions Reductions	**Per Year**	**Total Crediting Period (10 years)**
Operating Margin Emissions Factor (in tCO_2/MWh) 2001	0.723	-
Operating Margin Emissions Factor (in tCO_2/MWh) 2002	0.737	-
Operating Margin Emissions Factor (in tCO_2/MWh) 2003	0.741	-
Build Margin Emissions Factor (in tCO_2/MWh)	0.752	-
Baseline Emissions Factor (EF_y in tCO_2/MWh)	0.743	-
Electricity generated by Project (*EG* MWh)	210,000	2,100,000
Baseline Emissions (*BE* tCO_2)	156,026	1,560,256
Project Emissions (*PE* tCO_2)	0	0
Emissions reduction from electricity generation (tCO_2/year)	156,026	1,560,256

SECTION F. Environmental impacts

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

The Moroccan law does not require an environmental impact assessment for this project. However, KfW demanded an extensive assessment on the environmental impacts, especially regarding the effect the project has on migrating birds.

The implementation of the project requires activities that can be divided into two phases that are both taken into account in the environmental impact assessment:

- the construction phase involves activities to put the necessary infrastructure in place
- the exploitation phase starts when the plant is operational and extends over the entire lifetime of the project.

ONE (Office National d'Electricité, the Moroccan national utility company) and KfW commissioned IDOM-CID to perform an environmental impact assessment of the Essaouira wind project. As KfW demanded, this was an extensive study based on guidelines from international financial institutions (notably the World Bank), the rules of the German financial cooperation and also on the Spanish rules in this matter.

The environmental impact assessment study allows for an estimate of the effects on the human population, the flora and fauna, water, air, climate, landscape and the structure and functioning of the ecosystems in the area that are expected to be affected. The analysis covers both the wind park itself and the connection lines associated with the project.

The preliminary report of the environmental impact assessment for the Essaouira wind project was carefully studied by ONE and the final report will be submitted.

In addition a study on bird migration, financed by the German financial cooperation, has been performed in the autumn of 2003 and the spring of 2004, since these are the relevant periods for bird migration. The results from both studies indicate that there are no major conflicts for migrating bird. Some rather general recommendations concerning the technical layout of the wind park were recommended and will be taken into account.

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:

The simultaneous assessment of the magnitude and importance of both the positive and negative impacts of the project leads to the conclusion that the benefits (energy improvements and benefit from exploitation of the wind park) surpass the negative environmental disturbances. This justifies the realization of the

project if the environmental restrictions connected to the importance of the ecosystems in the construction zone of the project are considered.

The programme of preventive and corrective measures that will be implemented was developed to reduce the level of negative impacts to acceptable levels in general, and moderated with regard to the disturbances in fauna and vegetation.

The programme of environmental monitoring established will make it possible to supervise the correct implementation of measures and to check their effectiveness.

SECTION G. Stakeholders' comments

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

On 19th of November 2003 ONE organised a stakeholder consultation meeting. The objective of the meetings was to inform interested stakeholders on the environmental and socio-economic impacts of the projects for purpose of the CDM. A presentation has been given on the fact that the Essaouira project is being developed as a CDM project under the Kyoto Protocol, including an explanation of the concept of the CDM.

The following issues have been addressed:

- impact on the physical environment during the construction phase
- impacts on the natural environment
- risks and damage that project may lead to
- impacts on the landscape
- Socio-economic impacts including impacts on labour, telecommunications, infrastructure, the community

The summary of the results of the environmental and socio-economic impact indicate that:

- there will be no significant impacts on the local population, human habitat or infrastructure;
- the impact on the use of the ground are significant but the damage is limited;
- the impact on the landscape are insignificant;
- the impact on the natural environment are reduced to an acceptable level due to corrective measures that will be taken;
- the socio-economic impacts on the region are positive;
- the impacts of the project on noise are not significant and will be avoided by taking into account measures like constructing the wind park at a minimum distance of the inhabitants.

G.2. Summary of the comments received:

After the presentation of the project and the results of the impact study a discussion and round of questions started in which the following points were discussed:

1. The geographical situation of the wind park and the surface that will be occupied by the total size of the wind park;
2. the activities of the local population;
3. the noise generated by the blades;
4. the electrification of the village Ouassen by the wind park. A feasibility study is currently being completed. The village will be directly electrified either by the power generated by the park or through the grid.

Moreover, the delegation of ONE visited the Secretary General of the province of Essaouira in which they presented the results of the study and the stakeholder meeting. The Secretary General has expressed his support of the project, on behalf of the region Essaouira, concluding with two essential comments:

a. the wind mills should be placed far from the inhabitants to about noise impacts for the local population
b. it will be necessary to build an access road from the entrance of the park to the village.

The participants that were present at the stakeholder meeting of 19th of November are:

Participants	Organisation
M Moksir Mohammed	Conservator of Essaouira
M haddioui Abdellatif	Eaux et forêts
M Saidi Charaf	ONEP
M Mohammed Hasni	DPA/Essaouira
M Taoufik Ouardane	Delegation habitat and urbanisation of Essaouira
M Chafik Belgacem	Forum on sustainable development of Essaouira
Mme Amina El Marhoum	D U A
M saad El Haffari	ENDA Maghreb
M Sahraoui Abdelaziz	DPE of Essaouira
M Jilali Bouaalba	Director of electricity and renewable energy of the (province of Essaouira)
Mme Latifa Amana	Director DAT/province
M. A.Tahiri	ONE/DTI/EQ
M. A. Khatami	ONE/DTI/EQ
M. S.Tabai	ONE/DTI/EQ
M. J.Salhi	ONE/DTI/Th
M.B.Hamadia	ONE/DDI/Essaouira

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

As stated under G.2 no major concerns have been raised by the stakeholders present at the stakeholder consultation meeting. The answer provided by ONE satisfied the participants. ONE will ensure that the wind mills will be placed in such a way that noise impacts for the local population will be minimised.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

Annex 3

BASELINE INFORMATION

Table 1: Data on fuel consumption for plants in the Operating Margin

Fuel Source	Fuel Consumption 2001 in tonnes	Fuel Consumption 2002 in tonnes	Fuel consumption 2003 in tonnes
Coal			
Jerada	340,994	358,494	436,821
Mohammedia	556,849	588,932	630,277
Jorf Lasfar	3,272,748	3,370,411	3,272,748
	4,170,591	4,317,837	4,339,846
Oil			
Jerada	3,199	2,772	1,397
Mohammedia TG	161,799	237,513	275,364
Kenitra	105,255	151,725	221,052
Tantan	3,258	4,238	5,510
Tit Mellil	9,411	13,440	9,709
Tetouan	4,000	7,062	7,554
Agadir	245	168	444
Tanger	434	23	228
Laayoune	3,980	1,529	1,061
Ed Dakhla	-	3,513	6,952
	291,581	421,983	529,271
Diesel			
Distribution factories	9,025	6,755	4,373
Mohamemedia TG	120	129	108
Tan Tan	75	126	163
Tit Mellil	193	224	269
Tetouan	175	147	95
Agadir	7	22	14
Tanger	55	15	25
Laayoune	742	576	377
	10,392	7,994	5,424
Total			

Source: Office Nationale d'Electricité (ONE)

Table 2: CEF Calculation for the Operating Margin in 2001, 2002 and 2003

Fuel consumption data (2002)	MWh produced	MWh produced	MWh produced	CEF (t CO2 / MWh)	CEF (t CO2 / MWh)	CEF (t CO2 / MWh)
Fuel Source	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**
Coal						
Jerada	636,455	708,176	880,094	1.123	1.123	1.123
Mohammedia	1,372,383	1,423,242	1,495,510	0.938	0.938	0.938
Jorf Lasfar	9,041,585	9,386,881	9,375,155	0.788	0.788	0.788
Oil						
Jerada						
Mohammedia TG	621,556	904,111	1,070,937	0.767	0.774	0.758
Kenitra	361,996	521,920	753,133	0.857	0.857	0.865
Tantan	9,145	12,100	15,202	1.050	1.032	1.068
Tit Mellil	27,723	39,593	29,454	1.000	1.000	0.972
Tetouan	11,587	21,931	22,233	1.017	0.949	1.001
Agadir	627	409	983	1.152	1.211	1.331
Tanger	2,315	83	527	0.553	0.817	1.275
Laayoune	20,679	8,907	6,039	0.567	0.506	0.518
Ed Dakhla		25,846	30,373		0.401	0.675
Diesel						
Distribution factories	35,102	40,233	46,376	0.825	0.539	0.303
Mohamemedia TG		26	66		15.92	5.25
Tan Tan						
Tit Mellil						
Tetouan						
Agadir						
Tanger						
Laayoune						
Import (from Algeria and Spain)	1698568.000	1533380.000	1582047.000			
CEF (inlcuding import)				0.723	0.737	0.741
Total	**13,839,721**	**14,626,838**	**15,308,129**			

Table 3: Plants included in the Build Margin

Plant Name	MW	Year operational	Accumulated capacity	
			MW	%
Ahmed El Ansali	92	2003	92	0.02
Ait Messaoud	6.4	2003	98.4	0.03
Ed Dakhla	21	2002	119.4	0.03
TORRES wind	54	2000	173.4	0.05
Jorf Lasfar	660	2000	833.4	0.22

Table 4: Carbon Emissions Factor of the Build Margin

Name of plant	Technology	Fuel	MWh in 2003	% of total output	CEF	Weighted average CEF (t
Ahmed El Ansali	hydro	hydro	224,010	2.3%	0.000	0.000
Ait Messaoud	hydro	hydro	18,000	0.2%	0.000	0.000
Ed Dakhla	gas turbine	diesel	30,373	0.3%	0.675	0.002
Torres	wind	wind	202,752	2.1%	0.000	0.000
Jorf Lasfar	steam	coal	9,375,155	95.2%	0.788	0.750
Total			9,850,290	100%		0.752

Table 5: Conversion Factors used for calculating the CEF (NCV in TJ/ kilotonne)

Gasoline	44.8
Natural Gas	52.30
Gas/ Diesel Oil	43.33
Residual Fuel Oil	40.19
LPG	47.31
Jet Kerosene	44.59
Shale oil	36.00
Ethane	47.49
Naphtha	45.01
Bitumen	40.19
Lubricants	40.19
Petroleum Coke	31.00
Refinery Feedstock	44.80
Refinery Gas	48.15
Other Oil Products	40.19

Source: IPCC, 1996a

Table 6: Fuels Carbon Emission Factor (tC/TJ)

Gasoline	18.9
Natural Gas	15.3
Gas/ Diesel Oil	20.2
Residual Fuel Oil	21.1
LPG	17.2
Jet Kerosene	19.5
Ethane	16.8
Naphtha	20.0
Bitumen	22.0
Lubricants	20.0
Petroleum Coke	27.5
Refinery Feedstock	20.0
Shale oil	20.0
Refinery Gas	18.2
Other Oil Products	20.0

Source: IPCC, 1996a

Table 7: Results of CO2 emission reductions

	Annual Emissions in tonnes of CO_2	**Total over 10 years in tonnes of CO_2**
Operating Margin	154,116	1,541,164
Build Margin	157,935	1,579,348
Combined Margin	156,026	1,560,256

Annex 4

MONITORING PLAN

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Please refer to Section D