**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

**CONTENTS**



**Annexes**

## SECTION A. General description of project activity

### A.1. Title of the project activity:

>> Prony and Kafeate wind-farms, New Caledonia

History of the PDD:

| | | |
|---|---|---|
| PDD version 0.1 | Date : 28 October 2008 | Prepared for GS pre-assessment |
| PDD version 1.0 | Date : 16 January 2009 | Prepared for validation |
| PDD version 2.0 | Date : 31 July 2009 | PDD prepared according to Non-conformities report. Yaté wind-farm has been deleted from the PDD. 2nd submission to DOE. PDD used for the stakeholder feedback round. |

### A.2. Description of the project activity:

>> The project activity involves six wind farms located in two different sites (Kafeate and Prony) in New Caledonia (NC). These wind-farms are owned and operated by Aerowatt a French based company. Between the years 2003 and 2009, Aerowatt installed 116 wind turbines at these two sites providing a total capacity of circa 31 MW with an estimated yearly production of 40 GWh. The generated electricity is exported to the New Caledonian grid. The project therefore replaces grid electricity that is at 80% produced by fossil-fuel power plants.

New Caledonia is located in a cyclonic area of the globe, therefore the wind turbines used are the GEV MP and GEV 26/220 wind-turbines manufactured by Vergnet SA in France which can be tilted down in the event of a cyclonic alert.

The project contributes significantly to the region's sustainable development. The specific goals for the project are to:

- Reduce the greenhouse gas emissions in New Caledonia by replacing fossil fuel power generation,
- Contribute to the development of the wind energy sector in New Caledonia,
- Create local employment during both the construction and operational phases,
- Stimulate technology and know-how transfer,
- Contribute to the reduction of pollutants such as sulphur dioxide, nitrogen oxides and particles resulting from the electricity generation from fossil fuels in New Caledonia, and
- Reduce the dependency on energy imports.

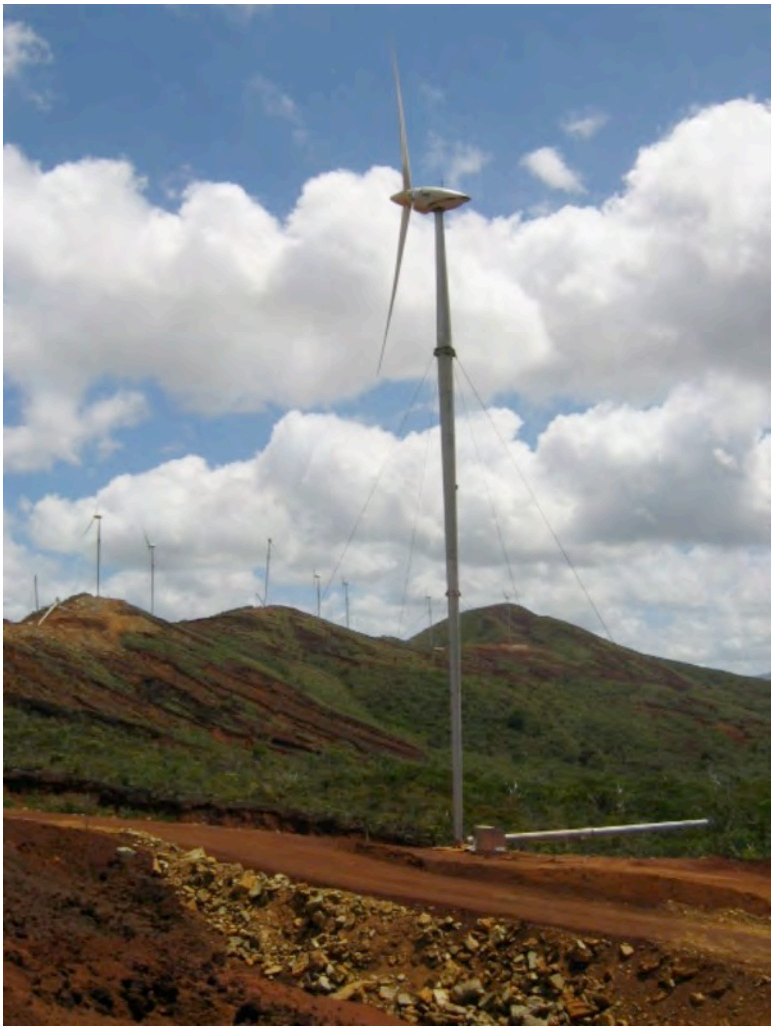


**Figure 1 : GEV 26/220 wind-turbine in Prony.**

Moreover, the Pacific islands region faces increasing environmental and socioeconomic pressures exacerbated by global climate change and climate variability. Under the United Nations Framework Convention on Climate Change (UNFCCC), small island developing states are recognized as being particularly vulnerable to climate change. Even without climate change, Pacific island countries are already severely affected by climate variability and extremes, and they remain extremely vulnerable to future changes in the regional climate that could increase the risks.

Unfortunately, several factors, such as the limited size of projects, the low knowledge of CDM, and/or the detachment, have so far limited the development of CDM activities in the Pacific region (only one CDM has been developed in Fiji). The development of this first GS-VER project activity is therefore also seen by the project participants as a strong positive signal for future emission reduction projects in the Pacific region.

**A.3. Project participants:**

>>

| Name of Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| New Caledonia (Host) | Aerowatt SA (private entity) | No |
| Switzerland | South Pole Carbon Asset Management Ltd. (private entity) | No |

**A.4. Technical description of the project activity:**

**A.4.1. Location of the project activity:**

>>

**A.4.1.1. Host Party(ies):**

>> New Caledonia

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

>> South Province and North Province

**A.4.1.3. City/Town/Community etc.:**

>> Village of Mont Dore; Village of Koné

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

>>

The Prony site is located in the South province of New Caledonia in the village of Mont Dore. The Kafeate site is located in the North province in the village of Koné.

The following table indicates the GPS position for the sites.

| Site | Capacity (kW) | Town | GPS Position (Google Earth) |
|---|---|---|---|
| Prony | 19,195 | Mont Dore | 22°19"S ; 166°49"E |
| Kafeate | 11,550 | Koné | 20°57” S ; 164°41” E |

The locations are depicted in the picture below.

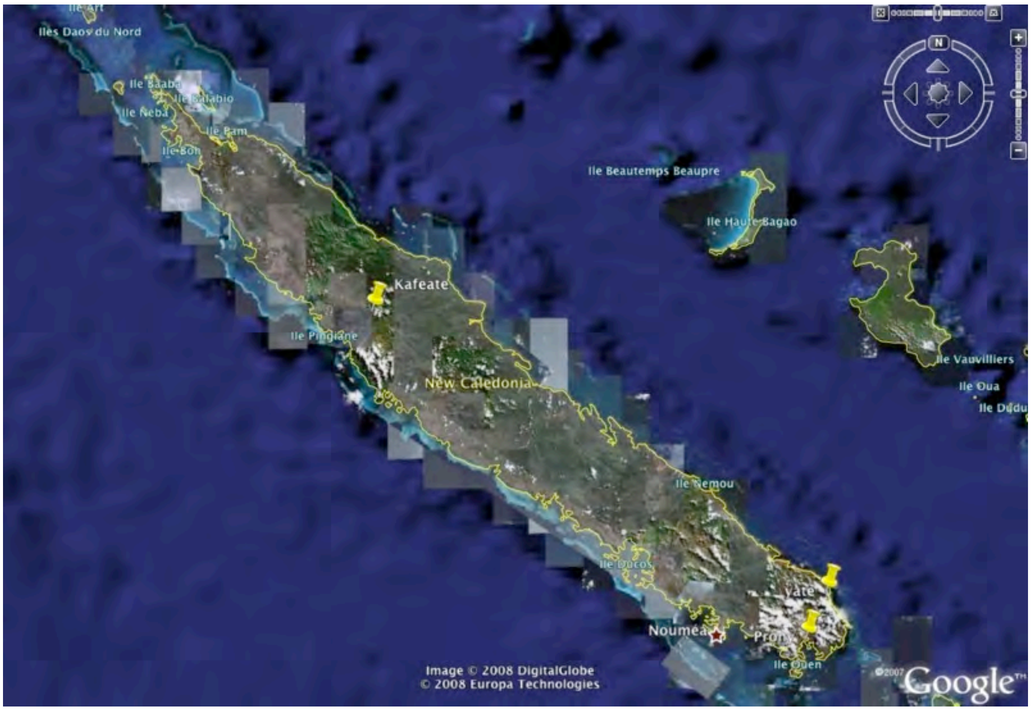



**Figure 2. Location in New Caledonia**

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

>> Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

Type I : Renewable energy projects.

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

>> The project activity involves the generation of renewable energy from wind. It thereby displaces grid electricity that is at 80% produced by fuel-based power plants. The wind-driven blades are connected to an electricity generator, which produces electrical energy and supplies it to the grid without storage. Vergnet, a French turbine manufacturer, has been selected as technology provider due to the quality of its products in terms of high reliability, low maintenance requirements, grid-friendliness and overall for the robustness of the wind turbines which can sustain hurricane winds.

Each wind-farm is built in different phases, which are owned and operated by a dedicated subsidiary of Aerowatt. Each subsidiary is incorporated in NC.

| Name | Site | Subsidiary | Total Nominal Power (kW) | Number of machines | Model | Operation start |
|---|---|---|---|---|---|---|

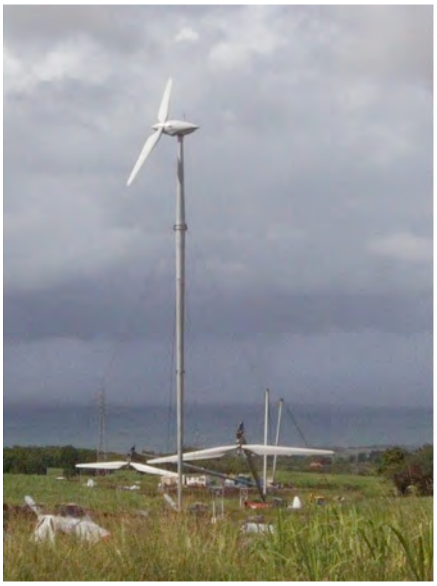
| | | | | | | |
|---|---|---|---|---|---|---|
| Prony II | Prony | Eole Prony II | 4,620 | 21 | Vergnet GEV 26/220 | 2003/12 |
| Kafeate I | Kafeate | Eole Kafeate | 6,050 | 22 | Vergnet GEV MP | 2005/03 |
| Kafeate II | Kafeate | Eole Kafeate II | 5,500 | 20 | Vergnet GEV MP | 2005/11 |
| Prony III | Prony | Eole Prony III | 5,500 | 20 | Vergnet GEV MP | 2006/12 |
| Mont Mau | Prony | Eole Mont Mau | 4,125 | 15 | Vergnet GEV MP | 2007/12 |
| Touongo | Prony | Eole Touongo | 4,950 | 18 | Vergnet GEV MP | 2009/01 |
| **Total** | | | **30,745** | **116** | | |

New Caledonia is in a cyclonic area. The wind turbines used are the Vergnet GEV MP and Vergnet GEV 26/220 wind-turbines manufactured by Vergnet SA in France which can be tilted down in the event of a cyclonic alert.

| | GEV MP | GEV 26/220 |
|---|---|---|
| Nominal power | 275 kW | 220 kW |
| Number of blades | 2 | 2 |
| Tower height | 55 m | |
| Total weight | 20 t | |
| Rotor diameter | 32 m | 26 m |
| Swept area | 804 m2 | 507 m2 |

**Table 1. Wind turbine characteristics**

The GEV MP and the GEV 26/220 are light, collapsible and robust. They can resist even very violent winds.



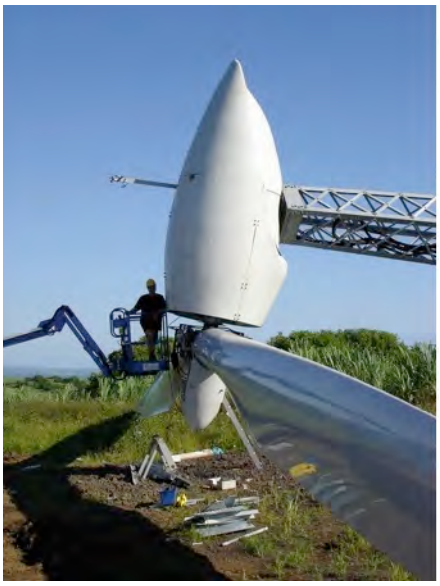


**Figure 3. GEV MP 275kW in operation and tilted down for maintenance.**

The 275-kW GEV MP and the GEV 26/220 are used for wind farms with capacities between 1 and 10 MW. These machines have a mast height between 55 and 60 meters, which allows them to rise very high when "searching" for winds. Blade diameter varies from 26 to 32 meters, in inverse proportion to the average wind speed at the site. They produce respectively 275 kW and 220kW at 50 or 60Hz. Thanks to their guyed mast, they can be lowered quickly and easily in case of violent winds (cyclones, typhoons…), eliminating the risk of equipment destruction.

To facilitate installation and maintenance, as in the event of a cyclonic alert, GEV MP and GEV 26/220 devices are light, easy to transport, and can be erected by two technicians without using any heavy-duty lifting apparatus.

**Figure 4. Kafeate (left) and Prony (right) wind farms**

The choice of the VERGNET S.A. constructor for the wind turbine is motivated by the hurricane-proof characteristic. VERGNET S.A. is the only company constructing wind turbines adapted to very high wind-prone areas and able to sustain up to Category 5 hurricane winds.

**A.4.4. Estimated amount of emission reductions over the chosen crediting period:**

>>

| **Year** | **Annual estimation of emission reduction [$tCO_2$]** |
|---|---|
| 2007 (01/01/2007 to 31/12/2007) | 26'114 |
| 2008 (01/01/2008 to 31/12/2008) | 25'358 |
| 2009 (01/01/2009 to 31/12/2009) | 32'205 |
| 2010 (01/01/2010 to 31/12/2010) | 36'464 |
| 2011 (1/01/2011 to 31/12/2011) | 36'464 |
| 2012 (1/01/2012 to 31/12/2012) | 36'464 |
| 2013 (1/01/2013 to 31/12/2013) | 36'464 |
| Total emission reductions [$tCO_2$] | 229'532 |
| Total length of crediting period (years) | 7 |
| Annual average of estimated reductions over the crediting period [$tCO_2$] | 32'790 |

**A.4.5. Public funding of the project activity:**

>>

The project activity's financing plan contains some subsidies from the French and Caledonian governments[1]. As New Caledonia is not part of the DAC list[2], the subsidy coming from the French government cannot be considered as ODA.

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[1] A clear and transparent financial plan will be disclosed to the DOE during validation upon request.

[2] http://www.oecd.org/dataoecd/62/48/41655745.pdf

## SECTION B. Application of a baseline and monitoring methodology

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

>>

The approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 09) has been used.

The methodology was applied with the following tools:

- "Tool to calculate the emission factor for an electricity system" (Version 01.1)
- "Tool for the demonstration and assessment of additionality" (Version 05.2)

For more information about the methodology, the emission factor tool and the additionality tool please refer to the website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

>>

The methodology referenced above is applicable to this project activity because it fulfils the required criteria:

- The project consists of a wind power electricity capacity addition and is a grid-connected electricity generation project;
- The project does not involve switching from fossil fuel use to renewable energy at the site of the project activity; and
- The geographic and system boundaries for the relevant electricity grid can be clearly identified (New Caledonian Grid) and 3 years of information on the characteristics of the grid is available (from the New Caledonian Electricity producer: ENERCAL).

### B.3. Description of the sources and gases included in the project boundary:

>>

According to the methodology ACM0002, since the proposed project is a grid connected wind power project, only $CO_2$ emissions from fossil fuel-fired power plants in the baseline scenario need to be considered.

| | Source | Gas | Included/ Excluded | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Fossil fuel-fired power | $CO_2$ | Included | Main emission source |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| Project Activity | On-site fuel combustion to the project activity | $CO_2$ | Excluded | Excluded. It is a clean energy project. |
| | | $CH_4$ | Excluded | Excluded. It is a clean energy project. |
| | | $N_2O$ | Excluded | Excluded. It is a clean energy project. |

The spatial extent of the grid is as defined in the "Tool to calculate the emission factor for an electricity system". The PDD will discuss the spatial extent of the grid in detail in section B.6 below.

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

According to the description in the approved baseline methodology ACM0002, for project activities that consist of the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> *"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

The definition and description of the combined margin that supports the baseline scenario is shown below in section B.6.

**B.5. 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 (assessment and demonstration of additionality):**

>>

As prescribed by the Gold Standard the projects' additionality is demonstrated through use of the Tool for the demonstration and assessment of additionality (version 05.2).

## Additionality section for Kafeate I and II

Kafeate I and II were planned and built in parallel. They occupy the same site and share the same substation and permits. There are legally two distinct companies but are parts of the same project. Therefore, we will group the wind-farms of Kafeate I and II for this additionality demonstration.

### *STEP 1. Identification of alternatives to the project activity consistent with current laws and regulations*

This step involves the definition of realistic and credible alternatives to the project activity that can be part of the baseline scenario.

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

Aerowatt is a company created and entirely dedicated to renewable energy (wind and more recently PV) projects. In a situation where the proposed project activity would not be implemented, the shareholders of Aerowatt do not have any alternative investment option, which generates a similar amount of electricity production as the proposed VER project activity. The only alternative to the project activity, therefore, would be "no action" from the project participants.

Considering the above, the following alternatives have been identified, for the generation of the amount of electricity generated by the project activity:

> ***Alternative A*** wind-farm is built without VER credits
>
> ***Alternative B*** The same amount of electricity is produced by other facilities not under the control of project participant (No action from the investors). Aerowatt focuses its activities in France where more than 75% of its activities are located.

***Sub-step 1b. Enforcement of applicable laws and regulations***

The mandatory preliminary permits have been obtained for the project activity, showing that it is in compliance with the current laws and regulations.

All the alternatives to the project outlined in Step 1a above are in compliance with applicable laws and regulations.

For the demonstration of additionality, we choose to conduct an investment analysis.

***Step 2. Investment Analysis***

**Sub-step 2a. Determine appropriate analysis method**

As the project activity and the alternative identified in Step 1 do have related financial benefits other than VERs; a benchmark analysis (Option III) is used.

As alternative B does not include any investment nor revenues, no benchmark analysis will be applied. Only alternative A will further undergo a benchmark analysis together with the project activity.

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

The economic indicator most suitable for the project type and decision context is the project IRR.
A relevant benchmark for a project's IRR can be derived from the New Caledonian government who considers 12% as a minimum IRR for renewable energy projects in New Caledonia[3].

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

The key economic indicators of the project activity (project IRR) are based on information available in the request for subsidies[4] formulated by Aerowatt for each wind-farm. Each request for subsidies contains all technical and financial data available just before Aerowatt decided to invest in the project.

Only revenues from electricity from Kafeate I have been slightly modified, to take into account the fact that between the submission of the subsidy request and its acceptance, the NC government voted a new feeding-tariff. At the date of investment, the new grid tariff was therefore known and considered by Aerowatt[5].

The IRR of Kafeate is 11.9% without VERs and 16.1% with VERs.

In accordance with benchmark analysis (Option III), the financial indicator of Kaféate is below the benchmark and appears not to be economically attractive.

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[3] Communication from the local renewable energy agency in NC. 12% to 13% is the IRR targeted by the government to determine the future grid-tariff for renewable energy in NC. As a conservative approach we choose 12%.

[4] This request for subsidies is submitted to the French Ministry of Finance and is called "agreement folder" (Dossier d'agrément").

[5] The subsidy request for Kafeate I was sent 27/10/2003 and the turbines ordered 15/03/2004 but the law relative to the grid-tariff has been officially published 16/12/2003.

**Sub-step 2d. Sensitivity analysis**

The project IRR could significantly vary when certain parameters are changed. In the following sensitivity analysis, electricity revenues and the operator investment are increased and decreased by 5% and 10%.

| Investment cost | IRR % | O&M | (IRR %) | Generation | (IRR %) |
|---|---|---|---|---|---|
| -10% | 13.9% | -10% | 14.1% | -10.0% | 7.5% |
| -5% | 12.8% | -5% | 13.0% | -5.0% | 9.7% |
| 0% | 11.9% | 0% | 11.9% | 0.0% | 11.9% |
| 5% | 11.0% | 5% | 10.7% | 5.0% | 13.9% |
| 10% | 10.2% | 10% | 9.5% | 10.0% | 15.8% |

**Table 2: IRR sensitivity analysis for Kafeate**

Although the IRR of Kafeate could potentially pass the benchmark if investment, operation and maintenance or electricity generation are increased or decreased, none of these scenarios is likely to happen:

Increase of the electricity generation is very unlikely as grid problems limit the capacity of Kafeate I & II to 8.2 MW instead of 11.55 MW. Enercal, the grid operator, has committed itself to reinforce the grid to allow the normal operation of the wind-farms. But in the mean-time this grid problem results in a 5 to 6% net production loss for Aerowatt. Moreover, underperformance of these two wind-farms during the first years of operation is very high: 31% for Kafeate I and 18% for Kafeate II.

According to Castalia's report, average operation and maintenance costs could decrease in the future but are for the moment significantly higher than originally planned. With an average in the two first years circa 716,000 Euros[6] (instead of 656,000), O&M costs are unlikely to be lower than originally forecasted.

It has been shown that the actual total cost of the project has come in very close to what was originally planned (see Castalia report table 3.10: actual cost for Kafeate I was 12,807,764 Euros against a planned cost of 12,807,796; actual cost for Kafeate II was 11,228,975 Euros compared to planned cost of 11,228,928). Moreover, the subsidies obtained are lower than what was expected. Therefore it is very unlikely that the total investment from Aerowatt can be decreased.

[6] See Castalia report : table 3.17 page 86

In conclusion, it is impossible to have all sensitivity parameters at the most favourable values at the same time. The project IRR is therefore very unlikely to be above the benchmark, the project is therefore additional. Additional revenues from the sale of the emission reductions could mitigate this high risk profile and low profitability of the project.

### *Step 4: common practice analysis*

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

The list of all wind-farms built in NC and connected to the grid is provided below:

**Table 3 : Wind Farms in New Caledonia in 2008[7].**

| Name | Total Nominal Power (kW) | Number of machines | Owner | IPP[8] | Operation start date |
|---|---|---|---|---|---|
| Mont Négandi | 4500 | 20 | EEC-Suez | No | 1999/12 |
| Prony I | 2200 | 10 | Aerowatt | Yes | 2002/12 |
| Prony II | 4620 | 21 | Aerowatt | Yes | 2003/12 |
| Kafeate I | 6050 | 22 | Aerowatt | Yes | 2005/03 |
| Kafeate II | 5500 | 20 | Aerowatt | Yes | 2005/11 |
| Prony III | 5500 | 20 | Aerowatt | Yes | 2006/12 |
| Mont Mau | 4125 | 15 | Aerowatt | Yes | 2007/12 |

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

Only two wind power plants with comparable installed capacities can be identified; which are Mont-Négandi, built in 1999, and Prony I, built in 2002.

Mont-Négandi wind-farm is not comparable to the proposed project activities for the following reasons:

- Mont-Négandi uses a Vestas technology not adapted to the cyclonic area (the wind-farm was partially destroyed in 2003 by tropical storm Erica)
- The investment cost per MW installed is lower (due to the technology choice) and was financed differently (at the time of construction, the tax-exemption system was not yet enforced)

[7] http://www.thewindpower.net/liste-champs-eoliens-988-nouvelle-caledonie.php

[8] Independent Power Producer

- The wind-farm was built and is operated by EEC-Suez which is not an IPP in NC as it operates a part of the grid with Enercal.

Prony I uses a similar technology and financing model (based on tax exemption) but is very different from the other wind-farms built by Aerowatt, as it benefited from a more profitable grid-tariff (13 CFP/kWh indexed on inflation instead of 11CFP/kWh not indexed for the other wind-farms built by Aerowatt). Prony I is facing several barriers but benefits from a better grid-tariff than the other wind-farms included in this bundle.

Therefore the proposed project activities cannot be defined as common practice in NC.

**Conclusion of the additionality section**

Kafeate is not likely to be financially attractive and is not a common practice in New Caledonia, it is therefore considered as additional.

**Additionality section for Prony II**

### *STEP 1. Identification of alternatives to the project activity consistent with current laws and regulations*

As for Kafeate step 1 (see above).

For the demonstration of additionality, we choose to conduct a barrier analysis.

***Step 3. barrier analysis***

Prony II was constructed and designed in parallel with Prony I in 2002. Prony I and II share the same location, substation and can be considered as the first of their kind for several reasons:

- Prony I and II wind-farms are the first applications of the Vergnet GEV-26-220 turbines in the world[9]. This turbine is also new technology as it is the first Vergnet turbine above the 100kW threshold: older turbines built by Vergnet were smaller.
- Prony I and II are also the first IPP wind-farms built in NC

Prony II has been therefore been on of the field test for the Vergnet's technology, it hence amply suffered from the lack of experience and track records for wind-farms in tropical areas using Vergnet technology. Prony II has faced many technical and institutional problems since the start of its operation. All these problems have been amply described by Castalia in 2007 in their report (See pages 28 to 30). This had a huge consequence on the profitability of the project which is estimated to 4.1% (see page 91), which is definitely lower from what could be expected from an energy project in NC.

As stated by the Methodological panel, if "a project activity is "first-of-its-kind", it is clear that implementation of the specific technology is not yet "common practice". If a project activity is "first-of-its-kind", no additional assessment steps are undertaken to confirm additionality."

***Step 4. Common practice analysis***

Not required as the project has successfully proved to be the first of its kind.

***Conclusion of the additionality section***

As Prony II has successfully proved to be the "first of its kind", it is considered as additional.

[9] http://www.thewindpower.net/fiche-eolienne-204-vergnet-gev-26-220.php

## Additionality section for Prony III and Mont Mau

Prony III and Mont Mau are located at the same place, share the same substation, construction permit and PPA. These two projects are indeed two phases of the same wind-farm.

### *STEP 1. Identification of alternatives to the project activity consistent with current laws and regulations*

As in Kafeate step 1 (see above).

For the demonstration of additionality, we choose to conduct an investment analysis.

***Step 2. Investment Analysis***

**Sub-step 2a. Determine appropriate analysis method**

As for Kafeate (see above).

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

The key economic indicators of the project activity (project IRR) are based on information available in the request for subsidies[10] formulated by Aerowatt for each wind-farm. Each request for subsidies contains all technical and financial data available just a few months before Aerowatt decided to invest in the project.

The IRR of both Prony III and Mont-Mau projects is 6.9% without VERs and 9.7% with VERs.

In accordance with benchmark analysis (Option III), the financial indicators for Prony III and Mont-Mau are below the benchmark and appear not to be economically attractive.

**Sub-step 2d. Sensitivity analysis**

The project IRR could significantly vary when certain parameters are changed. In the following sensitivity analysis, electricity revenues and the operator investment are increased and decreased by 5% and 10%. The results are presented below.

| Investment cost | IRR % | O&M | (IRR %) | Generation | (IRR %) |
|---|---|---|---|---|---|
| -10% | 8.6% | -10% | 8.2% | -10.0% | 3.7% |
| -5% | 7.7% | -5% | 7.6% | -5.0% | 5.3% |
| 0% | 6.9% | 0% | 6.9% | 0.0% | 6.9% |
| 5% | 6.1% | 5% | 6.2% | 5.0% | 8.3% |
| 10% | 5.4% | 10% | 5.4% | 10.0% | 9.7% |

**Table 4: IRR sensitivity analysis for Prony III and mont-Mau**

[10] This request for subsidies is submitted to the French Ministry of Finance and is called "agreement folder" (Dossier d'agrément").

The IRR of both Prony III and Mont Mau is not likely to pass the benchmark if investment costs, O&M or electricity generation are decreased or increased respectively.

The project IRR is therefore very unlikely to be above the benchmark, and the project is therefore additional. Additional revenues from the sale of the emission reductions could mitigate this high risk profile and low profitability of the project.

### *Step 4 : common practice analysis*

As for Kafeate common practice analysis.

**Conclusion of the additionality section**

Mont-Mau and Prony III project is not likely to be financially attractive and is not a common practice in New Caledonia, it is therefore additional.

**Additionality section for Touongo**

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

As for Kafeate (see above)

For the demonstration of additionality, we choose to conduct an investment analysis.

***Step 2. Investment Analysis***

**Sub-step 2a. Determine appropriate analysis method**

As for Kafeate (see above).

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

The economic key indicators of the project activity (project IRR) are based on information available in the request for subsidies[11] formulated by Aerowatt for each wind-farm. Each request for subsidies contains all technical and financial data available just before Aerowatt decided to invest in the project.

The IRR of Touongo is 9.0% without VERs and 11.7% with VERs.

In accordance with benchmark analysis (Option III), the financial indicators of Touongo are below the benchmark and appear not to be economically attractive.

**Sub-step 2d. Sensitivity analysis**

The project IRR could significantly vary when certain parameters are changed. In the following sensitivity analysis, electricity revenues and the operator investment are increased and decreased by 5% and 10%. The results are presented below.

| Investment cost | IRR % | O&M | (IRR %) | Generation | (IR |
|---|---|---|---|---|---|
| -10% | 10.9% | -10% | 10.1% | -10.0% | |
| -5% | 9.9% | -5% | 9.6% | -5.0% | |
| 0% | 9.0% | 0% | 9.0% | 0% | |
| 5% | 8.2% | 5% | 8.4% | 5.0% | |
| 10% | 7.4% | 10% | 7.8% | 10% | |

**Table 5: IRR sensitivity analysis for Touongo**

The IRR is not likely to pass the benchmark if investment costs, O&M or electricity generation are decreased or increased respectively.

[11] This request for subsidies is submitted to the French Ministry of Finance and is called “agreement folder” (Dossier d’agrément”).

The project IRR is therefore very unlikely to be above the benchmark, and the project is therefore additional. Additional revenues from the sale of the emission reductions could mitigate this high risk profile and low profitability of the project.

### *Step 4 : common practice analysis*

As for Kafeate common practice analysis

**Conclusion of the additionality section**

Touongo wind-farm is not likely to be financially attractive and is not a common practice in New Caledonia, it is therefore additional.

***Conclusion of the additionality demonstration***

All the proposed project activities of this bundle prove not to be financially attractive and cannot be considered as common practice in New Caledonia.

The alternative B (no action from the PPs and the development of Aerowatt's activities in France and other French overseas territories) is a less risky option for Aerowatt. Aerowatt and many project developers are working in France (but also in the French territory overseas included in the EU, like EDF-énergies-nouvelles and SEC) where several hundreds of MW are installed every-year and where investing in wind-farms is less financially risky and considered now as business as usual. Aerowatt is the only wind project developer in NC; a more attractive context would have encouraged competitors coming from France or the Pacific area to conquer this market.

VER revenues help the project activity to overcome these barriers by reducing the overall risk profile of the project through an improved financial feasibility.

The emissions reductions from the proposed Project are therefore additional to what would have occurred in absence of the project activity.

**B.6. Emission reductions:**

**B.6.1. Explanation of methodological choices:**

>>

According to the methodology ACM0002 version 07, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

*Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

Therefore :

$$\mathbf{ER_y = EF_{grid,CM,y} * El_y} \qquad \textbf{Equation 1}$$

Where :

| | |
|---|---|
| $EF_{grid,CM,y}$ | Combined Margin Emission Factor in year 2007 |
| $El_y$ | Net electricity delivered to grid by the Project |
| $ER_y$ | Emission reduction in year 2007 |

**B.6.2. Data and parameters that are available at validation:**

| **Data / Parameter:** | **$EG_y$** |
|---|---|
| Data unit: | MWh |
| Description: | The net electricity generation excluding the low-cost must-run (2003-2007) |
| Source of data used: | Data provided by the New-Caledonian energy statistics center "Observatoire de l'énergie" |
| Value applied: | Table 6 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The net electricity generation excluding the low-cost must-run has been determined by subtracting from the total gross generation the hydro, nuclear, wind and biomass power. |
| Any comment: | |

| **Data / Parameter:** | **$FC_{i,y}$** |
|---|---|
| Data unit: | ton or $m^3$ |
| Description: | Total amount of fossil fuel type i consumed by power plants/units in year y |
| Source of data used: | Data provided by the New-Caledonian “Observatoire de l’énergie” |
| Value applied: | Table 7 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | **$NCV_{i,y}$** |
|---|---|
| Data unit: | TJ/kt or TJ/milion $m^3$ |
| Description: | Net calorific value of fossil fuel type i in year y |
| Source of data used: | IPCC: *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, P1.23 and P1.24 in Chapter one. |
| Value applied: | Table 7 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | **$EF_{CO2,i,y}$** |
|---|---|
| Data unit: | $tCO_2/TJ$ |
| Description: | $CO_2$ emission factor of fossil fuel type i in year y |
| Source of data used: | The lower limits of the 95% confidence interval stated in the “2006 IPCC Guidelines for National Greenhouse Gas Inventories”, Volume 2, Chapter 1 (energy) Table 1.4. |
| Value applied: | Table 7 |
| Justification of the choice of data or description of measurement methods and procedures actually | |

| | |
|---|---|
| applied : | |
| Any comment: | |

| **Data / Parameter:** | **m** |
|---|---|
| Data unit: | - |
| Description: | Cohort of power plants to include in the build margin |
| Source of data used: | Communication from ENERCAL. A copy of the original excel file will be provided to the validator. |
| Value applied: | Table 9 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | $EF_{CO2,m,i,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Average $CO_2$ emission factor of fuel type *i* used in power unit *m* in year *y* |
| Source of data used: | The lower limits of the 95% confidence interval stated in the "2006 IPCC Guidelines for National Greenhouse Gas Inventories", Volume 2, Chapter 1 (energy) Table 1.4. |
| Value applied: | Table 9 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | $EF_y$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | Emission factor of New Caledonia |
| Source of data used: | calculated |
| Value applied: | 0.906 |
| Justification of the choice of data or | The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin. |

| | |
|---|---|
| description of measurement methods and procedures actually applied : | |
| Any comment: | The emission of the build and operating margin are calculated according to the ex-ante option. |

### B.6.3. Ex-ante calculation of emission reductions:

The following formula is adopted for calculating emission reductions generated by the project activity:

$$ER_y = BE_y - (PE_y + LE_y)$$ **Equation 2**

where,

$ER_y$: Annual emission reduction generated by the project activity in the year y (in t CO2-eq/year)

$BE_y$: Baseline emissions in the year y (in t CO2-eq/year)

$PE_y$: Project emissions in the year y (in t CO2-eq/year)

$LE_y$: Leakage Emissions in the year y (in t CO2-eq/year)

The project activity is the generation of power with a wind farm. Hence, the project activity emissions are considered to be zero:

$$PE_y = 0$$

Moreover, leakage emissions are considered to be zero:

$$LE_y = 0.$$

Thus: $PE_y + LE_y = 0$

The baseline emissions are calculated according to equation 1.

According to Section B.6.1, the combined baseline emission factor of the project is 0.906 $tCO_2/MWh$. At full capacity, the expected annual electricity export to the grid is 107,968 MWh/year. $BE_y$ is calculated as follows:

$BE_y = EI_y \times EF$ = 40,243 MWh/year × 0.906t $CO_2e/MWh$ = 36,464 $tCO_2e/year$

As previously mentioned, there are no GHG project and leakage emissions. Thus, the amount of generated emission reductions by the project activity equals to that of the baseline emissions.

$ER_y = BEy$ = 36,464 $tCO_2e/year$

| | | | |
|---|---|---|---|
| $El_y$ | Net electricity delivered to grid by the project at full capacity | 40,243 | MWh |
| $ER_y$ | Emission reduction from project | 36,464 | tCO2e |

**B.6.4 Summary of the ex-ante estimation of emission reductions:**

| Year | Estimation of project activity emission reductions (tonnes $CO_2$e) | Estimation of baseline emission reduction (tonnes $CO_2$e) | Estimation of leakage (tonnes $CO_2$e) | Estimation of emission reductions (tonnes $CO_2$e) |
|---|---|---|---|---|
| 2007 (01/01/2007 to 31/12/2007) | 0 | 26'114 | 0 | 26'114 |
| 2008 (01/01/2008 to 31/12/2008) | 0 | 25'358 | 0 | 25'358 |
| 2009 (01/01/2009 to 31/12/2009) | 0 | 32'205 | 0 | 32'205 |
| 2010 (01/01/2010 to 31/12/2010) | 0 | 36'464 | 0 | 36'464 |
| 2011 (1/01/2011 to 31/12/2011) | 0 | 36'464 | 0 | 36'464 |
| 2012 (1/01/2012 to 31/12/2012) | 0 | 36'464 | 0 | 36'464 |
| 2013 (1/01/2013 to 31/12/2013) | 0 | 36'464 | 0 | 36'464 |
| **Total** | **0** | 229'532 | **0** | 229'532 |

## B.7. Application of the monitoring methodology and description of the monitoring plan:

### B.7.1. Data and parameters monitored:

As per methodology ACM0002, the baseline emission factor of the project activity is based on an ex-ante calculation using the Combined Margin approach, which is based on the results of Operating Margin and Build Margin values.

The only parameter required to be monitored and measured is the net amount of electricity exported by the project to the grid.

| **Data / Parameter:** | $EI_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Net electricity exported to the grid in the year y |
| Source of data to be used: | Measured and verified against electricity sale receipts. The calculation of emission reductions in the monitoring protocols shall be based on the measured electricity meter values as main data source. |
| Value of data | sum 2007: 28'820<br>sum 2008: 27'986<br>prevision 2009: 35'543<br>prevision 2010: 40'243<br>prevision 2011: 40'243<br>prevision 2012: 40'243<br>prevision 2013: 40'243<br><br>Source : DIMENC + Touongo FSR |
| Description of measurement methods and procedures to be applied: | Measured continuously by a kilowatt meter and recorded monthly by monitoring personnel.<br>Only the net electricity exported to the grid shall be taken into account. This means that the monitoring measurement method shall exclude electricity imported from the grid by the project activity and possible transmission losses. |
| QA/QC procedures to be applied: | • Exported electricity to the grid is measured by a kilowatt meter which is controlled by the power grid company<br>• Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter<br>• Meters will be calibrated periodically according to national standards<br>• Data is measured by meters and will be crosschecked by electricity sales receipts. In sales receipts, incomes not deriving from electricity production but declared as electricity supplied to grid because of limitations of accounting |

| | |
|---|---|
| | system shall be identified and subtracted. If differences still occur, the more conservative amount shall be used. |
| Any comment: | Refer to B.7.2. for a description of the monitoring plan |

**B.7.2. Description of the monitoring plan:**

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project owner is mainly responsible for the implementation of the monitoring plan, and the Grid Company will cooperate with the project owner.

The proposed project applies "Approved consolidated baseline and monitoring methodology ACM0002" Version 7 for preparing the monitoring plan.

**1. Monitoring Objective**

The baseline emission factor of New Caledonia is fixed during the first crediting period by ex-ante calculations. Hence, the monitoring plan does not provide further monitoring work for baseline emissions. For project emissions, project participant will monitor the net annual electricity generation. As per ACM0002, there is no need of leakage calculation or monitoring for this kind of activity.

**2. Monitoring Organization**

ENERCAL is responsible for the main meters of :

- Kafeate (ENERCAL has only one meter for Kafeate I+ II)

EEC-Suez is responsible for the main meter of :

- Prony I+II (only one meter for both wind-farms)
- Prony III and Mont-Mau (only one meter for both wind-farms)
- Touongo

AEROWATT collects electricity receipts for the power delivered to the grid. Physical documentation is collected and stored in Aerowatt's office in New Caledonia.

**3. Monitoring Equipment and program**

The main meters will be operated by ENERCAL or EEC-Suez according to their own procedures.

The electric energy metering equipment includes an electric energy meter (or kilowatt meter) and other electric energy metering devices. The amount of electric power supplied to the power grid is measured by the electric energy meter. At least one electric energy meter is installed at the physical metric point jointly determined by the project owner and the grid company according to the electricity sales/purchase contract. If more than one meter is available, the meter used by the grid company to determine the amount of electricity exported to the grid shall be used.

**4. Data Collection:**

ENERCAL and EEC-Suez are responsible for operation of their electric energy meters, and guarantee that the measuring equipments are in good operation and completely sealed.
The main monitoring process is as follows:

- Aerowatt sells the electricity to ENERCAL;
- ENERCAL reads and checks the electric energy meters and records the data periodically;
- AEROWATT compiles the recorded data of the supplied electricity to the grid monthly and provides the monthly balance sheet of electricity sales to ENERCAL;
- ENERCAL confirms the amount of electricity exported by the project owner after verification;
- ENERCAL provides the payment and an electricity receipt confirmation to AEROWATT which collects the electricity receipts.

The meter reading will be readily accessible for the verification entity.

**5. Calibration**

The verification of the electric energy metering equipment is periodically carried out by ENERCAL and EEC-Suez. After every meter verification process, the electricity metering equipment is sealed, stamped and closed with other measures. Either party shall not unseal, change the structure, layout or connecting wires of the electric metering equipment nor manipulate the electricity meter.

**6. Data Management**

The project owner properly keeps the electronic spreadsheets and printouts of the monthly records of the amount of supplied electricity to the grid. Besides that, the project owner collects electricity receipts for the power delivered to the grid as a cross-check. At the end of each crediting year, a monitoring report is compiled by South Pole Carbon Asset Management Ltd.

Physical documentation of relevance for the monitoring process, such as paper-based maps and diagrams, are collected in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results are indexed. All paper-based information is stored by the project owner.
All data records will be kept for a period of 2 years following the end of the crediting period.

**B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):**

The baseline and monitoring methodology were elaborated by François Beaurain and Sophie Tison from South-Pole Carbon Asset Management Ltd. in Zurich. The main contact person is:

Dr. François Beaurain,
South Pole Carbon Asset Management Ltd.
Technoparkstrasse 1, 8005 Zurich, Switzerland

Phone: +41 44 633 78 70
Fax: +41 44 633 14 23
Mail : f.beaurain@southpolecarbon.com

Date of completion of baseline study and monitoring plan: 28 October 2008.

## 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:

According to the glossary of CDM terms[12] the project start date is chosen as "the earliest date at which either the implementation or construction or real action of a project activity begins".

For each wind-farm the starting date of the project activity is chosen as the turbine order agreement.

| | event | | | | |
|---|---|---|---|---|---|
| Wind-farm | Subsidy request ="proof of early consideration" | Subsidy agreement | Turbine order agreement = "project start date" | PPA signature | Operation start |
| Prony II | 13/12/2002 | 28/03/2003 | 15/11/2002 | 8/12/2003 | 2003/12 |
| Kafeate I | 27/10/2003 | 15/01/2004 | 15/03/2004 | 16/11/2004 | 2005/03 |
| Kafeate II | 28/04/2004 | 27/07/2004 | 13/12/2004 | 13/01/2005 | 2005/11 |

[12] §67 of EB41 report

| | | | | | |
|---|---|---|---|---|---|
| Prony III | 4/05/2005 | 24/03/2006 | 10/03/2006 | 06/12/2006 | 2006/12 |
| Mont-Mau | 5/05/2006 | 18/04/2007 | 16/04/2007 | 11/12/2007 | 2007/12 |
| Touongo | 20/07/2007 | 24/07/2008 | 10/10/2007 | Not signed yet | Expected in 2009/10 |

According to the guidance on the demonstration and assessment of prior consideration (version 1)[13], Prony II, Kafeate I and II, Prony III, Mont-Mau and Touongo wind-farms have their start date before the 2nd of august 2008 and shall be considered as "existing project activities".

Prony and Kafeate wind-farms:
Awareness of CDM can be assessed in two different manners; as a company strategy but also individually for each wind-farm:

- Proof of CDM considerations can be found in the request for subsidy formulated to the French ministry of finance by Aerowatt for each of the projects located in New Caledonia. A reference to the Kyoto's Protocol and its environmental and economical benefit is explicitly formulated. Carbon credits volumes and benefits generated by each wind-farm are also estimated monetarily taking the EUA spot-price as a reference (or some OECD sources for the earliest projects). As a consequence each reference to carbon credits in the subsidy request sent to the French government can be considered as a clear and third party approved proof of prior consideration to the CDM. Each of these subsidy requests is dated before the project start date (except Prony II for which the subsidy request has been sent one month after the turbine order sheet, these two events in this case can be considered as simultaneous).

- As a company strategy, Aerowatt started its reflexion about carbon credits started at a very early stage as soon as 2002. But at that time, carbon credits were still a very abstract concept. The first concrete step to seek environmental credits has been concretely taken later in 2004). A board decision dated from 22nd January 2004 detailed Aerowatt's decision to register Prony II and all future projects (undertaken In NC or elsewhere) as a "CDM project" Unfortunately, the ineligibility of New Caledonia to CDM and then the immaturity of the VER market finally encouraged Aerowatt to seek for green certificates, another form of environmental credit. In 2006, Aerowatt became a member of RECS[14] and started the registration of all its projects under this program (the first request for registration of a wind-farm was sent the 9th February 2006). Today, all wind-farms operated by Aerowatt in France are producing Green certificates. Unfortunately this system is difficult to apply in New Caledonia[15]. In 2007, aware of the developing VER market, Aerowatt started to look at VER opportunities. But it is only in 2008 that South Pole, encouraged by the eligibility of the project to the Gold Standard and the opportunity to group all these "small" wind-farms, expressed some interest for this bundle of wind-farms. The ERPA between Aerowatt and South Pole was signed in August 2008.

As a conclusion, motivated by the high-risk profile of wind-energy in NC, Aerowatt, since 2002, has seriously taken into account all forms of environmental credits such as carbon credits and green certificates. The reference to the financial benefits of carbon credits made in all request for subsidy sent to

[13] See EB report 41 annex 46 : http://cdm.unfccc.int/EB/041/eb41_repan46.pdf

[14] Renewable Energy Certificates System : http://www.recs.org

[15] To be registered as green certificate projects, RECS France requires an electricity purchase agreement from EDF (Electrictié De France; the historical power producer in France). The electricity purchase agreements with Enercal are therefore not recognized by RECS.

the French Ministry of Finance and Aerowatt's quest for green-certificates are clear third-party evidence of "prior consideration of CDM".

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

The expected operational lifetime of the project activity 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:

1 January, 2007, or 2 years before the expected registration date of the proposed project as a GS-VER activity, whichever is earliest.

#### C.2.1.2. Length of the first crediting period:

7 years

### C.2.2. Fixed crediting period:

Not applicable

#### C.2.2.1. Starting date:

Not applicable

#### C.2.2.2. Length:

Not applicable

# SECTION D. Environmental impacts

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

For each wind-farm, an Environmental Impact Assessment (EIA) has been conducted on a voluntary basis (there is no law or regulations that bind Aerowatt to conduct an environmental assessment in NC) by an independent engineering company in collaboration with the local equivalent of the environment agency. All EIAs include a description and analysis of[16]:

- the site before the construction of the wind-farm (hydrologic, human activities, security, cultural inheritance, landscape and natural resources),
- the permanent or temporary potential impact of the wind-farm on the landscape, human activities, security etc…,
- the choice of the site, and
- the actions to take to reduce and compensate for impacts from potential projects

The conclusions of all EIAs were positive and no major environmental issues were raised. Only in some rare cases, the EIA encouraged Aerowatt to modify slightly the position of the wind turbines to respect some flora and noise issues. These considerations have always been taken into consideration (see section D.2) in the project design of the plant.

**D.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:**

As described in section D1, Aerowatt has modified the project design of its wind-farms to take into account concerns raised during the EIA:

- Noise concerns in Kafeate has lead to the relocation of some turbines,
- In Prony some turbines were also relocated in order to limit the impact of the wind-farm on the local oak forest,

## SECTION E. Stakeholders' comments

>>

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

>>

[16] See "Audit de la Filière éolienne en Nouvelle Calédonie" realized by Castalia for the Ministry of energy and industry of NC, September 2007; page 97

1- Official stakeholders' consultations (called "mission consultatives") have been organized for all wind-farms included in the bundle. All received an official positive feedback, which is a requirement to get the construction permit.

2- On top of the official stakeholders' consultation, Aerowatt organizes for all its projects several informational meetings with the local population and authorities. As an example, a Stakeholders' consultation has been organized by Aerowatt on the 21st of July 2008 in the Municipal building of Yaté for the construction of their new wind-farm. The members of the town council and the representatives of the 2 local tribes were invited officially by letter. The invitation was received and accepted by the Mayor[17].

During the meeting, Aerowatt provided the attendees with a document including a presentation of the company, the technology employed, the site location and access, the state of the administrative process and how environmental concerns are taken into account during the different phases of the project development. The attendees positively welcomed the project, and no negative comments were received during the meeting.

3- Communication and acceptance by the local community are part of Aerowatt's global strategy. Site visits for schools or open house day are regularly organized. For instance, Prony was opened for visitors on 15/06/2007 just after it started to operate; the event was announced in the "Nouvelles Calédoniennes" local newspaper (link to newspaper webpage: http://www.info.lnc.nc/articles/article_70535_59376_2898.htm. Other articles referring to site visits can be found at the following links; http://www.info.lnc.nc/articles/article_70535_51456_2743.htm, http://www.info.lnc.nc/articles/article_70535_41749_2512.htm).

Moreover, site visits can be organized on request, see : http://fee.asso.fr/espace_particuliers/visiter_un_parc_eolien.

[17] Letter on 10th of July from Yaté's Mayor to Aerowatt, available on request

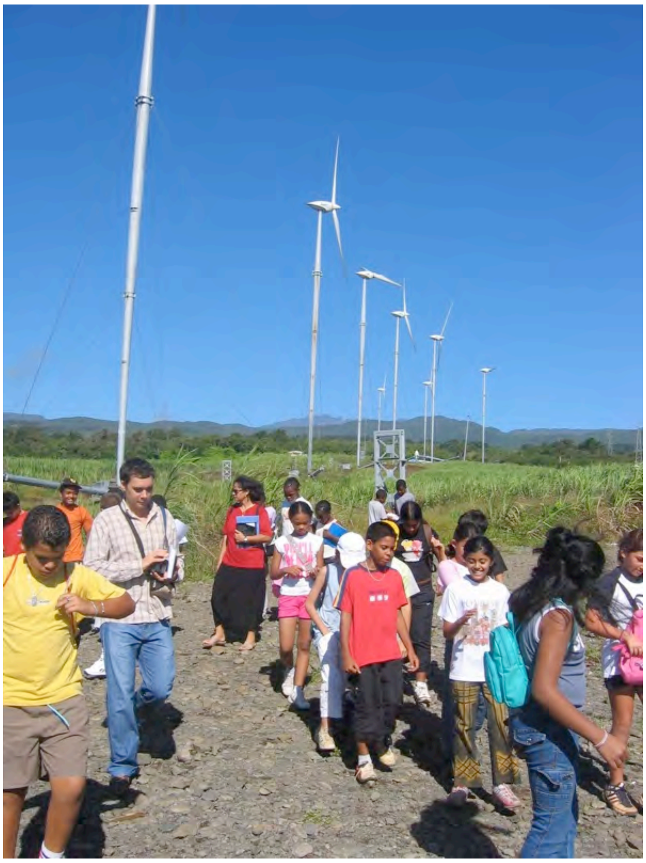

**Figure 5 : Aerowatt regularly opens its wind-farms to visitors and schools. This is a photo of a site visit organized in 2006 in S^te^ Suzanne, Reunion Island.**

4- In 2007, Castalia, an independent consultancy group, audited all Aerowatt wind-farms in New Caledonia[18] and interviewed the local representative of the cities of Voh, Nouméa, Mont-Dore and the local environment and energy agency (ADEME). This consultation confirmed that:

- no complaints and/or negative comments were made by the inhabitants living close to the wind-farms,
- there was no demonstration against the wind-farms, and
- the local authorities were consulted and informed before construction and gave their consent to build the wind-farms.

Castalia also checked the archive of the local newspaper "les nouvelles calédoniennes" and did not find any negative articles on wind-energy in New Caledonia.

[18] See "Audit de la Filière éolienne en Nouvelle Calédonie" conducted by Castalia for the Ministry of energy and industry of NC, September 2007; page xviii and xix

In conclusion, it is clear that Aerowatt has always had a pro-active and open attitude towards communication and the local population. Communication is a key point for Aerowatt which has a long term strategy in New Caledonia and wants to develop several wind-farms.

**E.2. Summary of the comments received:**

>> Official stakeholders' consultations (called "mission consultatives") reports are unfortunately not available.

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

>> Official stakeholders' consultations (called "mission consultatives") reports are unfortunately not available.

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

| | |
|---|---|
| Organization: | AEROWATT |
| Street/P.O.Box: | 6 rue Henri Dunant |
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| FAX: | +33 2 38 88 64 66 |
| E-Mail: | aerowatt@aerowatt.fr |
| URL: | www.aerowatt.fr |
| Represented by: | Jerôme Billerey |
| Title: | President |
| Salutation: | Mr. |
| Last name: | Billerey |
| First name: | Jerôme |
| Personal e-mail: | j.billery@aerowatt.fr |

| | |
|---|---|
| Organization: | South Pole Carbon Asset Management Ltd. |
| Street/P.O.Box: | Technoparkstrasse 1 |
| City: | Zurich |
| Postcode/ZIP: | 8005 |
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| Represented by: | François Beaurain |
| Title: | |
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| Last name: | Beaurain |
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## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

Information regarding the Public Funding will remain in commercial confidence and will be disclosed to the DOE.

## Annex 3

## BASELINE INFORMATION

The emission factor of New Caledonia is calculated according to the "Tool to calculate the emission factor for an electricity system" (Version 01.1).

***STEP 1. Identify the relevant electric power system***

A *project electricity system* is defined by the *spatial extent* of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

New Caledonia is an island with no cable connection with the continent; the spatial extent of the Project Boundary is defined as the insular electricity grid of New Caledonia operated by ENERCAL.

In New Caledonia energy statistics are provided by the "Observatoire de l'Energie" from the DIMENC, Direction de l'Industrie, des Mines et de l'Energie de Nouvelle Calédonie (which is the equivalent of the ministry of energy and mines for New Caledonia).

They provide power plant data net generation of all power plants and the fuel consumption from 2003 to 2007.

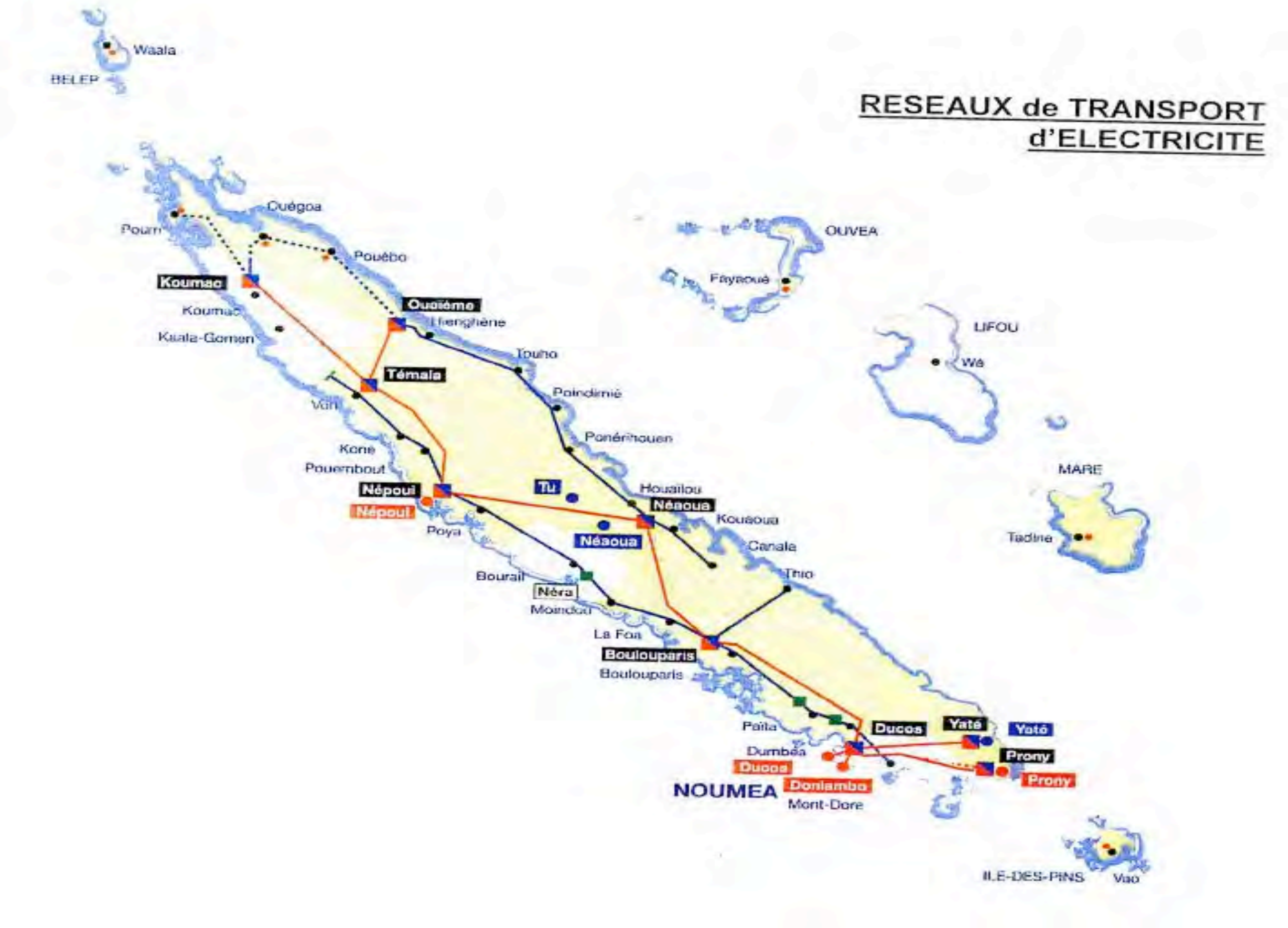


**Figure 6. New Caledonian Grid power system (source ENERCAL)**

New Caledonia is an island, it does not have any transmission line with its neighbouring countries and islands (Ouvea, Lifou, Ile des Pins or Maré), therefore electricity imports or exports will not be considered in the following calculations.

***STEP 2. Calculation of the Operating Margin ($EF_{OM,y}$)***

There is no nuclear power plant in New Caledonia, therefore only hydro, biofuel and wind power plants are included as low-cost/must-run resources, hereafter referred as lc-mr, which turns out to be between 16.74% and 22.28% of the total electricity generation on average during years 2003 to 2007:

| Type | unit | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Thermal | MWh | 1,403,823 | 1,313,317 | 1,516,533 | 1,544,994 | 1,488,477 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Hydro | MWh | 317,714 | 324,061 | 338,368 | 287,631 | 389,081 |
| Wind farm | MWh | 1,370 | 11,351 | 17,271 | 23,033 | 37,691 |
| Biofuel | MWh | 0 | 0 | 207 | 53 | 1 |
| Net generation excl lc-mr | MWh | 1,403,823 | 1,313,317 | 1,516,533 | 1,544,994 | 1,488,477 |
| **Share of lc-mr** | **%** | **18.52%** | **20.34%** | **19.01%** | **16.74%** | **22.28%** |

**Table 6. Share of low-cost/must-run resources**

The baseline methodology allows a choice among four methods for the calculation of OM emission factor;

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM

Since the average share of electricity generation by lc-mr plants for five most recent years is found to be less than 50%, option (a) is chosen. The simple OM emission factor can be calculated using either of the two data vintages:

- *Ex-ante option*, where a 3-year generation-weighted average based on the most recent data is used. Monitoring and recalculation of the emission factor is not required, or
- *Ex-post option*, where the data of the year is used, in which the project activity displaces grid electricity. Yearly update of the emission factor is required.

The *ex-ante option* is selected to carry out the baseline methodology for the Project.

***STEP 3. Calculate the operating margin emission factor according to the selected method***

The Simple OM emission factor is calculated as the generation weighted average $CO_2$ emissions per unit net electricity generation of all generating power plants serving the system, excluding lc-mr sources using one of the following approaches;

- Option A: Based on data on fuel consumption and net electricity generation of each power plant/unit, or

- Option B: Based on data on net electricity generation and the average efficiency of each power unit and the fuel types used in each power unit, or
- Option C: Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The fuel consumption and net electricity generation of each power plant/unit are available. DIMENC can furnish them. Option A can thus be used.

According to the "Tool to calculate the emission factor for an electricity system":

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_y}$$ **Equation 3**

where :

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year *y* (tCO2/MWh)
$FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$ = Net electricity generated and delivered to the grid by power plant / unit *m* in year *y* (MWh)
m = All power plants / units serving the grid in year *y* except low-cost / must-run power plants / units
i = All fossil fuel types combusted in power plant / unit *m* in year *y*
y = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The parameters used for the operating margin calculation are summarized in the following table:

| Parameter | Fuel Oil | Diesel Oil | Kerosene |
|---|---|---|---|
| NCV i (GJ/t fuel) | 40.4 | 43.0 | 43.8 |
| EF CO2,i (kg/TJ) | 0.0774 | 0.0741 | 0.0720 |
| density (kg/l) | | 0.82 | 0.82 |

| | | | |
|---|---|---|---|
| **COEF i** | **3.13** $tCO_2/t$ | **2.61** $tCO_2/m^3$ | **2.58** $tCO_2/m^3$ |

**Table 7. CO2 emission coefficient of fuel i, COEF i (source IPCC 2006[19] and http://www.simetric.co.uk/si_liquids.htm)**

The detailed table for the calculation of the operating margin is presented here below.

[19] *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, P1.18 and P1.19 in Chapter one.

**Table 8 : summary of the electricity statistics provided by the NC government and details of the OM calculations. In blue, the data provided by the government, in yellow our calculations and in red our extrapolations. * means "not connected to the main grid" and ** not on main island.**

| Plant names | Capacity (MW) | included in : | | Fuel used | Commissioning date | EGm,y (MWh/year) | | | FCi,m,y (tonnes for fuel or m3 for diesel and kerosene) | | | Emission (tCO2) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OM | BM | | | | | | | | | | | |
| | | | | | | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 |
| **Thermal stations** | **260.0** | | | | | 1'498'405 | 1'526'386 | 1'468'957 | 471'247 | 482'716 | 468'407 | 1'471'336 | 1'505'494 | 1'461'444 |
| Doniambo (Enercal) | 160.0 | 1 | | fuel oil | 1971 | 1'081'875 | 1'103'393 | 1'042'788 | 381'055 | 389'820 | 375'602 | 1'191'544 | 1'218'952 | 1'174'492 |
| Népoui 1 (Enercal) | 24.0 | 1 | 1 | fuel oil +diesel oil | 1993 | 405'839 | 403'968 | 409'493 | 86'129 | 85'733 | 86'905 | 269'323 | 268'082 | 271'748 |
| Népoui 2 (Enercal) | 29.0 | 1 | 1 | fuel oil +diesel oil | 1999 | | | | 82 | 82 | 83 | 215 | 214 | 217 |
| Nouméa 1 (Enercal) | 20.0 | 1 | | kerosene | 1973 | 10'691 | 19'025 | 15'626 | 3'980 | 7'082 | 5'816 | 10'254 | 18'246 | 14'986 |
| Nouméa 2 (Enercal) | 25.6 | 1 | 1 | kerosene | 2003 | | | | | | | - | - | - |
| Yaté (groupe de récupération) | | 1 | 1 | diesel oil | 2007 | | | 1'050 | | | | | | |
| Others** | 1.4 | | | diesel oil | | 17'713 | 18'501 | 19'518 | | | | | | |
| **Biofuel station** | **0.3** | | | | | | | | | | | | | |
| Ouvéa (biofuel)* | 0.3 | | | copra oil | 2003 | 207 | 53 | 1 | | | | | | |
| **Hydro power stations** | **77.9** | | | | | 338'368 | 287'631 | 389'081 | 0 | 0 | 0 | | | |
| Yaté | 68.0 | | | | 1958 | 300'974 | 252'304 | 352'552 | | | | | | |
| Néaoua | 7.2 | | | | 1982 | 29'447 | 28'327 | 27'086 | | | | | | |
| TU | 2.2 | | | | 1991 | 7'123 | 6'169 | 8'564 | | | | | | |
| micro hydro power stations | 0.5 | | | | | 825 | 831 | 879 | | | | | | |
| **Wind farms** | **28.7** | | | | | 17'031 | 22'838 | 36'558 | 0 | 0 | 0 | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **and PV** | | | | | | | | | | | | | | |
| Prony - wind farm | 12.3 | | | | 2005 | 9'322 | 10'146 | 16'818 | | | | | | |
| Kafeate - wind farm | 11.6 | | | | 2005 | 2'895 | 6'929 | 14'003 | | | | | | |
| Négandi - wind farm | 3.4 | | 1 | | 1996 | 4'814 | 5'764 | 5'737 | | | | | | |
| Lifou - wind farm* | 0.5 | | | | 2001 | 221 | 65 | 42 | | | | | | |
| Ile des pins - wind farm* | 0.2 | | | | 1999 | 19 | 129 | 17 | | | | | | |
| PV** | 0.7 | | | | 1996 | | | 1'074 | | | | | | |
| **Total** | 366.6 | | | | | 1'853'805 | 1'836'855 | 1'894'596 | 471'247 | 482'716 | 468'407 | 1'471'336 | 1'505'494 | 1'461'444 |

The yearly and average emission factors are the following:

| | 2005 | 2006 | 2007 |
|---|---|---|---|
| EFOM,y | 0.982 | 0.986 | 0.995 |

**$EF_{grid,OM,y}$ =(0.982+0.986+0.995) /3 = 0.988 tCO2e/MWh**

***STEP4. Identify the cohort of power units to be included in the build margin***

In this step, a generation-weighted average emission factor is calculated based on a sample of power plants, which have been taken into operation recently. The sample group of power plants/units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

In terms of vintage of data, project participants can choose between one of the following two options:

*Option 1*. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

*Option 2*. For the first crediting period, the build margin emission factor shall be updated annually, *ex- post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

For the project activity, because the crediting period is fixed, we calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.

For the project activity, the plants included in the build margin are the set of five power units that have been built most recently (Cf Table 9).

***Step 5. Calculate the build margin emission factor***

The build margin emissions factor is the generation-weighted average emission factor ($tCO_2/MWh$) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

**Equation 4**

Where:

| | |
|---|---|
| $EF_{grid,BM,y}$ | =Build margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$) |
| $EG_{m,y}$ | =Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| $EF_{EL,m,y}$ | = $CO_2$ emission factor of power unit *m* in year *y* ($tCO_2/MWh$) |
| m | =Power units included in the build margin |
| y | =Most recent historical year for which power generation data is available |

For the calculation of $EF_{EL,m,y}$ there are two options. We chose option 1 for our calculation as the fuel consumption data are available.

<u>Option 1</u>: If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

**Equation 5**

Where:

| | |
|---|---|
| $EF_{EL,m,y}$ | =CO2 emission factor of power unit *m* in year *y* ($tCO_2/MWh$) |

| | |
|---|---|
| $FC_{i,m,y}$ | =Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit) |
| $NCVi_{,y}$ | =Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit) |
| $EF_{CO2,i,y}$ | =CO2 emission factor of fossil fuel type *i* in year *y* ($tCO_2$/GJ) |
| $EG_{m,y}$ | =Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| m | =All power units serving the grid in year *y* except low-cost / must-run power units |
| i | =All fossil fuel types combusted in power unit *m* in year *y* |
| y | =Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2 |

Diesel consumption of Yaté is not available and therefore is neglected, which is conservative.

| **Power plant** | **Capacity** | **Type** | **Commissioning date** | **Electricity generation (EGm,y)** | **Kerosene consumption** | **fuel oil consumption** | **diesel oil consumption** | **Emission (EFEL,m,y)** |
|---|---|---|---|---|---|---|---|---|
| | MW | | | GWh | tons | tons | m3 | tCO2 |
| Yaté (groupe récup) | | diesel oil | 2007 | 1'050 | | | | 0 |
| Négandi | 3 | wind farm | 1996 | 5'737 | | | | 0 |
| Nouméa 2 (Enercal) | 26 | kerosene | 2003 | 8'772 | 3'265 | | | 8'413 |
| Népoui 1 (Enercal) | 24 | fuel oil | 1993 | | | | | |
| Népoui 2 (Enercal) | 29 | fuel oil | 1999 | 409'493 | | 86'905 | 83.2 | 271'966 |
| total | 82 | | | 424'002 | | | | 280'379 |
| | 22.56% | | | 22.22% | | | **$EFB_{M,y}$** | **0.661** |

**Table 9. Calculation of the build margin**

**$EF_{grid,BM,y}$ = 280'379/ 424002 = 0.661 tCO2e/MWh**

***Step 6. Calculate the combined margin emissions factor***

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

**Equation 6**

Where:

$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,OM,y}$ =Operating margin CO2 emission factor in year *y* (tCO2/MWh)

$w_{OM}$ =Weighting of operating margin emissions factor (%)

$w_{BM}$ =Weighting of build margin emissions factor (%)

The following default values should be used for $w_{OM}$ and $w_{BM}$:

- Wind and solar power generation project activities: $w_{OM}$ = 0.75 and $w_{BM}$ = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

The Baseline Emission Factor ($EF_y$) is thus **$EF_y$ = 0.988*0.75 + 0.25 * 0.661 = 0.906t$CO_2$e/MWh**.

**Annex 4**

**MONITORING INFORMATION**

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