CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

>>
Solar Water Heater Programme in Tunisia
Version 6
16/02/2011

Version	Date	Comment
Version 1	22/04/2008	Submitted to the Tunisian DNA for approval
Version 2	16/01/2009	Submitted to the DOE for validation
Version 3	21/06/2010	Modified to address validation findings
Version 4	30/09/2010	Modified to address validation findings
Version 5	20/12/2010	Modified to address validation findings
Version 6	16/02/2011	Modified to address findings from the DOE's Certification Body

A.2. Description of the small-scale programme of activities (PoA):

>>
The small-scale programme of activities (hereafter referred to as "the PoA") is a programme for the installation of domestic solar water heaters (hereafter referred to as "SWH") in households throughout Tunisia. The objective of the PoA is to support the development of solar energy for water heating in Tunisia, in line with the 11th Plan set by the Tunisian government[1].

The PoA is a voluntary action, not required by law, launched in January 2007 by the Tunisian National Agency for Energy Conservation (Agence Nationale pour la Maîtrise de l'Energie – ANME) and is undertaken in conjunction with a nation-wide loan support solar programme known as "Prosol 2 – Residential"[2]. The stated goal of the PoA is to install around 30,000 SWH per year in households, thereby displacing carbon intensive electricity from the grid and fossil fuels currently used to provide hot water in the households.

The ANME is the coordinating and managing entity of the PoA and acts as a coordinator between the different stakeholders involved in the PoA[3]:

- The households willing to install a SWH
- The SWH suppliers and installers certified by the ANME
- The Société Tunisienne de l'Electricité et du Gaz (STEG - Tunisian Electricity and Gas Company), and
- The Tunisian government, granting a subsidy for the purchase of SWH

The ANME processes the households' applications for the purchase of a SWH under the PoA. This includes the management of the loan support programme. The ANME signed in 2007 an agreement with the STEG, which plays the role of intermediary between the households and Attijari bank. Attijari bank

[1] Ministère du Développement et de la Coopération Internationale (*Ministry of Development and International Cooperation*) – March 2006 - Note d'orientation du XIème Plan et de la décennie 2007-2016

[2] ANME – Prosol 2 - http://www.anme.nat.tn/index.asp?pId=115

[3] This is the current set-up of the programme. The exact involvement of each stakeholder might slightly evolve but this will not impact the structure and objective of the PoA and the CPAs.

grants a loan to the households wishing to benefit from the loan support programme and the STEG allows the households to reimburse the loan through its electricity bill over 5 years. This is done through a form part of the application package submitted to the ANME by the households. As such, households only interact with the ANME and do not need to interact directly with the STEG and the Bank to take part in the programme and enjoy the benefits it offers.

The ANME also examines the requests for certification of SWH suppliers as well as SWH models under the PoA, thereby ensuring that high quality equipment is used. After the installation of the SWH, the ANME also deals with maintenance requests and actions for SWH that have a failure. In addition, the PoA will also include the implementation of activities aimed at strengthening the solar water heating sector in Tunisia, such as technical workshops with professionals of the sector, solar certifications such as “Key mark” and “Quali-sol” and communication and awareness campaigns in order to intensify the demand for solar water heating in Tunisia. The ANME thus ensures the smooth running of the PoA as well as its constant improvement.

In the view of the project participants, the PoA contributes to sustainable development by

- providing households with a clean, practical and convenient way to meet their daily hot water demand
- improving the indoor air quality of the households
- mitigating greenhouse gas (GHG) emissions and helping to decrease the households’ and country’s dependence on fossil fuels
- strengthening the SWH sector in Tunisia by providing state-of-the art technology, creating job opportunities in the manufacturing, supply, installation, operation and maintenance fields as well as stimulating the interest of new investors in the solar energy sector.

A.3. Coordinating/managing entity and participants of SSC-POA:

>>

The coordinating and managing entity of the PoA is the Tunisian National Agency for Energy Conservation (Agence Nationale pour la Maîtrise de l'Energie – ANME).

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)
Tunisia	Agence Nationale pour la Maîtrise de l'Energie (ANME)	No
France	ORBEO	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the small-scale programme of activities:

>>

The PoA is a programme for the installation of domestic SWH in the residential sector throughout Tunisia.

A.4.1. Location of the programme of activities:

>>
The PoA is located all across Tunisia.

A.4.1.1. Host Party(ies):

>>
Tunisia

A.4.1.2. Physical/ Geographical boundary:

>>
The boundary of a PoA is defined as the geographical area within which all the small-scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented.
All the SWH comprised in the SSC-CPAs included in the PoA will be installed in Tunisia. Therefore, the boundary of the PoA is defined as Tunisia.

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

>>
A typical CPA consists of a group of SWH over a period of six months. The total number of installed square meters of collectors of each individual CPA will remain below the small-scale threshold of 64,000 m^2 applicable to solar energy projects, as per Appendix B to the decision 21/cp.8 of the document FCCC/CP/2002/7/Add.3[4].

The SWH will displace fossil fuels and carbon intensive electricity from the grid, thereby reducing GHG emissions. In addition, the project will provide households with a flexible and in-house supply of hot water. It will also support the unstable Tunisian SWH sector and promote new investment in renewable energy projects.

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

>>
A typical SSC-CPA employs state-of-the art and recognised solar water heating technology, which converts solar radiation into thermal energy for the heating of domestic water.

All SWH in a typical SSC-CPA are produced either by domestic companies or by foreign companies and imported by Tunisian companies. They are installed by Tunisian companies experienced in handling and operating this kind of equipment.

Several types of systems (including thermosiphon and forced circulation systems) and collectors (including flat plate and evacuated tube collectors) are used in the CPAs.

SWH installed in a typical SSC-CPA (see fig. A.1.) consist of the following main parts:

[4] Appendix B of the Simplified modalities and procedures for small-scale clean development mechanism project activities – A. General guidance - version 12.1 - http://cdm.unfccc.int/methodologies/SSCmethodologies/history/guid_ssc_meth/guid_ssc_v12_1.pdf 'For thermal applications of solar energy projects, 'maximum output' shall be calculated using a conversion factor of 700 Wth/m^2 of aperture area of glazed flat plate or evacuated tubular collector i.e. eligibility limit in terms of aperture area is 64000 m^2 of the collector.'

- solar collector(s) that capture solar radiation
- circulating fluids that absorb the energy collected[5]
- a storage tank where the energy from the fluid is transferred to the water and where the heated water is stored until use.

The typical capacity of the storage tank ranges from 200 to 300 litres and the typical surface of the collector between 2 and 4 m^2. The capacity and surface vary according to the household's choice and demand. SWH installed in a typical SSC-CPA are certified by the ANME and must meet certain requirements, as defined in the latest version of the Prosol 2 Specifications[6]. These requirements deal with:

- compliance with relevant Tunisian and international standards
- minimal energy performance
- specific technical characteristics of the SWH
- modalities for the installation of the SWH.

SWH suppliers and installers as well as the SWH themselves are certified by the ANME according to best practice criteria[7]. This ensures that only high quality equipment and service are provided to households taking part in the SSC-CPA.

Figure A.1. Example of solar water heaters
that can be installed in a typical SSC-CPA (*Source:* ANME)

[5] This is mostly glycol (see Annex 2, p5 of the *Prosol - Specifications for the eligibility of suppliers to the programme*), which is commonly used as coolant fluid all over the world. It is also used as antifreeze in the cooling fluids used in engines. According to the Decree number 2005-1991, regarding the environmental impact assessment and specifying the categories of units subject to the specifications (Ministry of Environment and Sustainable Development), SWH do not require an environmental impact assessment, which shows that these fluids are considered not to have any significant impact on the environment.

[6] Programme de Promotion de l'Utilisation du Chauffe-eau Solaire en Tunisie – Prosol Tunisie- Cahier des charges relatif à l'éligibilité des fournisseurs au programme (*Prosol - Specifications for the eligibility of suppliers to the programme)* – latest version.

[7] Programme de Promotion de l'Utilisation du Chauffe-eau Solaire en Tunisie – Prosol Tunisie- Cahier des charges relatif à l'éligibilité des fournisseurs au programme (*Prosol - Specifications for the eligibility of suppliers to the programme)* – latest version.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

>>
Based on section E.5.1. it is assumed that all SWH installed in households in Tunisia under the PoA, and hence SSC-CPAs which are going to be included in the registered PoA, are additional.

This implies that a SSC-CPA is eligible for inclusion in the PoA, provided all the SWH under the SSC-CPA fulfil the following criteria:

Eligibility criteria	Check of the eligibility[8]
All SWH under the CPA are installed after signature of a Prosol 2 contract between the household installing the SWH and the ANME in order to be included in the PoA	Prosol 2 database
All SWH under the CPA are eligible and certified systems under Prosol 2, as defined in the latest version of Prosol 2 Specifications	Prosol 2 database & Prosol 2 Specifications
All SWH under the CPA are provided by suppliers certified under Prosol 2	Prosol 2 database & Prosol 2 database
All SWH under the CPA are installed by installers affiliated to a supplier certified under Prosol 2	Prosol 2 database & Prosol 2 Specifications
All SWH under the CPA are installed in households in Tunisia	Prosol 2 database
All SWH under the CPA are new equipment.	Prosol 2 database

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

This section demonstrates that the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA. This constitutes the demonstration of the additionality of the PoA as a whole.

The following is demonstrated in this section:
(i) The proposed PoA is a voluntary coordinated action
(ii) It would not be implemented in the absence of the PoA

(i) The proposed PoA is a voluntary coordinated action
The PoA is an action voluntary coordinated and implemented by the ANME in order to support the objective of developing the use of renewable energies in the country, including solar energy for hot water, set by the Tunisian government in their 11th Plan[9]. The table below summarises the policies and incentives applicable to SWH in Tunisia.

---

[8] These sources are indicative. Other documents/databases/sources of information can be used to confirm a SWH meet the eligibility criteria.
[9] Ministère du Développement et de la Coopération Internationale (*Ministry of Development and International Cooperation*) (Mars 2006) Note d'orientation du XIème Plan et de la décennie 2007-2016

Table A.1. Policies and incentives applicable to SWH in Tunisia

Source	Policy / Incentive	Impact on the PoA
Tunisian government's 11th Plan (2007 – 2016); 03/2006	Mentions the government's support to the installation of solar water heaters but no mention of specific support measures	None
Law n°2005-82 ; 15/08/2005, on the creation of an energy management fund	Sets that subsidies will be granted for the installation of residential SWH but does not mentioned the actual amount of the subsidy	None
Decree n°2005-2234, article 1c; 22/08/2005, applying Law n°2005-82 Decree n°2009-362, article 1 -7a; 09/02/2009, replacing Decree n°2005-2234	Decree n°2005-2234: 20% of the cost of the SWH (maximum of 100 TND[10]/m2) granted to the supplier Decree n°2009-362, that replaces Decree n°2005-2234 200 TND for SWH that have a collector surface between 1 m² and 3 m² 400 TND for SWH that have a collector surface between 3 m² and 7 m²	The ANME is in charge of applying the Decree and grants the government subsidy to the households. This subsidy, which gives a comparative advantage to SWH over more emissions-intensive technologies, was implemented after 11 November 2001. As such it does not need to be taken in the demonstration of additionality (here in the investment barrier), in line with EB 22, Annex 3 and with the additionality tool.
Decree n°95-744 ; 24/05/1995	No VAT for SWH manufactured in Tunisia No VAT and minimum import taxes for SWH manufactured outside Tunisia No VAT and minimum import taxes for SWH components manufactured outside Tunisia that cannot be manufactured in Tunisia	These measures are reflected in the price of the SWH paid by the household. As discussed in section E.5.1 of the PoA-DD, this price, even taking these measures into account, represents an investment barrier for the households. This Decree does not impact the PoA and the demonstration of additionality.

As shown in the table above, there is no mandatory requirement for the installation of SWH and no sectoral/national policies or incentives impact the PoA. The SWH implemented in a typical SSC-CPA under the PoA are purchased by households who apply voluntarily to the PoA. It is shown in section E.5.1 that without the PoA households would not install SWH, i.e. that a typical SSC-CPA is additional.

(ii) It would not be implemented in the absence of the PoA

In accordance with Attachment A of Appendix B of the simplified modalities and procedures for small-scale CDM project activities, additionality is demonstrated by showing that the PoA would not have occurred anyway due to the existence of the following barriers: financial and managerial/organizational, technological and due to prevailing practice.

[10] Tunisian Dinar

Financial and Managerial/organizational barriers

Several programmes promoting solar water heating have been implemented in Tunisia over the past 20 years (please see section E.5.1. for details on these programmes). The first SWH programme in Tunisia was funded exclusively by the state and took place between 1985 and 1993. It was a failure in terms of number of SWH installed and of the quality of equipment and maintenance service provided[11]. All subsequent successful actions or programmes have only been implemented with grants and support from external organisations such as the Global Environment Facility (GEF), the United Nations Environment Programme (UNEP) and the Italian government through the Mediterranean Renewable Energy Programme (MEDREP).

There is therefore no evidence of a SWH programme in Tunisia that was sustainable in the long-term without the involvement of donor organisations. This shows that external support is crucial to the success of such programmes in Tunisia and that without such programmes Tunisian households do not purchase SWH (see the demonstration of the additionality for a CPA in section E.5.1).

The proposed PoA does not benefit from external support and only relies on funding from the Tunisian government, planned to run until 2011. The PoA requires the ANME to fulfil a number of crucial tasks, such as:

- Process the applications of households wishing to install a SWH
- Process the applications of SWH suppliers and installers as well as SWH models in order to guarantee a high standard of quality of the service and equipment installed
- Coordinate the actions between the different stakeholders involved in the PoA (households and professionals of the solar sector but also STEG and the government)
- Replace the Mediterranean Renewable Energy Centre (MEDREC) grant provided by the Italian government to complement the government subsidy given to the households in order to maintain the current growth of 300 L SWH[12]
- Enhance the on-site spot checks of SWH
- Process the complaints for incidents with SWH and organise the maintenance of the faulty SWH
- Organise workshops with professionals of the solar water heating sector in order to build capacity and to put in place a maintenance network that ensures the constant improvement of the technologies installed and their monitoring.
- Support the development of the market by implementing solar certifications such as “Key mark” and “Quali-sol” for the SWH.
- Organise communication and awareness campaigns in order to intensify the demand for solar water heating in Tunisia

Only the processing of the applications is covered by the government money, planned to run until 2011, which represents a small part of the total costs that the ANME will incur. The CDM is crucial for ensuring that the ANME can bear the costs associated to the other tasks and that these tasks are implemented throughout the lifetime of the PoA, including after Prosol 2 ends in 2011. The continued support provided by the CDM will contribute to creating a stable mature SWH market in Tunisia.

Technological barrier

The network of skilled and properly trained labour to maintain the SWH is still weak in Tunisia as a result of the lack of dedicated tools for maintenance in previous support programmes[13]. The risk of disrepair and

[11] Alcor – Axenne (2003) Agence Nationale des Energies Renouvelables. Etude stratégique pour le développement des EnRs en Tunisie - Bilan des réalisations - Rapport final (*National Agency for Renewable Energies – Strategic Study for the development of Renewable Energies in Tunisia - Final Report)*.

[12] In accordance with Law 2005-82 and Decree 2234/2005 which set energy conservation measures.

malfunctioning for equipment installed in previous programmes was high. As a result, households' awareness and perception of the SWH is still fairly bad, despite past communication efforts. This can be explained by previous programmes resulting in a high proportion of SWH not operating and the low competitiveness of SWH compared to conventional water heaters, which have a shorter payback period[14]. As highlighted before, the CDM is a crucial part in ensuring that this technological barrier is overcome and that the PoA is implemented and successfully maintained over its lifetime, thereby ensuring that the benefits of the PoA percolate to the end-users, the households.

Prevailing practice

There are no other similar programmes in Tunisia targeting the installation of SWH in households. As discussed, previous programmes with a similar target implemented in the past 20 years are different from the proposed PoA, and the PoA is unique considering the source of funding, its magnitude, and the quality of equipment and service provided to the households.

The analysis above shows that the ANME faces many barriers to the implementation of the PoA. The additional revenue stream from the sale of the CERs and other attendant benefits, such as increased confidence in the PoA from crucial stakeholders (Attijari bank, STEG) due to international support to the PoA, help alleviate the before mentioned barriers. Using the CDM to support a domestic SWH programme was considered from the start as shown in the table below.

CDM actions	Date
Minutes from the Restricted Ministerial Council about alternative energies mentioning the CDM to support a domestic SWH programme	March 2006
Project Information Note for the Programme submitted to the Tunisian DNA[15]	April 2006
Project Information Note for the Programme approved by the Tunisian DNA[16]	May 2006
First contact between ANME and EcoSecurities	October 2006
The ANME via GTZ contracted EcoSecurities as a consultancy company in order to assist them in the CDM process[17]	December 2006
Signature of the programme convention (start date of the programme)	January 2007
Call for interest for DOEs	November 2007
Choice of a DOE	January 2008
Submission of the PoA PDDs to the Tunisian DNA	April 2008

[13] Menichetti, E. & Touhami, M. – UNEP (2007) Creating a credit market for solar thermal: the PROSOL project in Tunisia

[14] Alcor – Axenne (2003) Agence Nationale des Energies Renouvelables. Etude stratégique pour le développement des EnRs en Tunisie - Bilan des réalisations - Rapport final *(National Agency for Renewable Energies – Strategic Study for the development of renewable energies in Tunisia –Final Report)*

[15] ANME (April 2006) Note d'Information sur le Projet MDP Changement d'échelle du marché du chauffe-eau solaire en Tunisie (*Information Note on the CDM project Upscaling the solar water heater market in Tunisia)*

[16] Ministry of Environment and Sustainable Development (06 Mai 2006). See Project Information Notes approved by the Tunisian DNA http://www.mdptunisie.tn/fr/mdp_tunisie.php?s_rub=11

[17] GTZ – EcoSecurities contract (22/12/2006)

Signature of a contract with the DOE	January 2009
Submission of the PoA for validation	January 2009
Following the EB decision (EB47-§72) on the starting date of the CPA, a Clarification Request was sent to Secretariat by ANME on the definition of the first CPA period (2007 or 2008)[18]	July 2009
Response from the Secretariat and decision that the first CPA will cover the 1st semester of 2008[19]	January 2010
Sending of the list of the CPA with a starting date previous to the Commencement of validation to EB and DOE [20]	January 2010

This shows that the CDM was a decisive factor in the decision to proceed with the PoA, and that continuing and real actions were taken to secure CDM status for the PoA in parallel with its implementation.

Since the programme commenced validation prior to 31 December 2009 and in accordance with EB47 paragraph 72, it benefits from an exemption to paragraph 5(d) of the "Procedures for registration of a programme of activities as a single CDM project activity and issuance of certified emission reductions for a programme of activities" version 3 (equivalent to paragraph 7(d) of version 4.1 of the same procedures). Following EB47 paragraph 72, a list of CPAs with a starting date between 22 June 2007 and the commencement of validation of the PoA was sent to the validating DOE and UNFCCC Secretariat prior to 31 January 2010.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

>>
The following arrangements have been made by the ANME to ensure a reliable operation and management of the PoA:

(i) A record keeping system for each CPA under the PoA

A database (hereafter referred to as "Prosol 2 database") has been set up by the ANME technical team for the PoA. It includes the following information for each SWH installed in a SSC-CPA:

- Name of its owner
- Location of the installation
- Installation date
- Supplier and type
- Serial number

[18] ANME - Clarification Request sent to Secretariat (30/07/2009)

[19] Mail Janet Thomsen / UNFCCC Secretariat – Answer to the Clarification Request (11/01/2010)

[20] ANME – Submission of the list of CPAs (28/01/2010)

- Contract between the ANME and the owner of the SWH mentioning that the SWH programme benefits from the CDM.

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA or including a SWH that has already been included in another CDM project activity, another CPA of the proposed PoA or of another PoA.

The database presented in (i) ensures that all SWH in a CPA are uniquely defined and are included in one CPA only, thereby avoiding double counting of emissions reductions generated by the CPA.

(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

The Guidelines on assessment of de-bundling for SSC project activities (version 3 – EB54) is used to demonstrate that the SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

The maximum surface of each of the SWH collectors included in the SSC-CPA is below 10 m^2, which is less than 1% of the small scale threshold defined by AMS.I.C (1% of 64,000m2 = 640 m^2 > 10m^2).
In accordance with the Guidelines on assessment of de-bundling for SSC project activities, since each of the independent subsystems (i.e. SWH collectors) included in the CPA of the PoA is no greater than 1% of the small scale thresholds defined by the methodology applied, the SSC-CPA is exempted from performing de-bundling check, i.e. the SSC-CPA is considered as being not a de-bundled component of a large scale activity.

(iv) The provisions to ensure that those operating the SWH included in the CPA are aware of and have agreed that their activity is being subscribed to the PoA

The contract that is signed between the ANME and the households for the purchase of a SWH under the PoA mentions that the SWH programme benefits from the CDM and that the revenues generated by the CDM go to the ANME[21].

A.4.4.2. Monitoring plan:

>>
For each CPA all parameters included in section E.7.1 will be monitored according to the monitoring plan set in section E.7.2. The ANME will store the data.

The ANME will also record the verification status of each CPA, ensuring that no double counting occurs.

A.4.5. Public funding of the programme of activities (PoA):

>>
The Italian government through the Mediterranean Renewable Energy Centre (MEDREC) provided funding to the programme Prosol first generation in 2005. The remainders of this funding[22] are given to

[21] See the “Fiche de prise en charge CES” signed by the household, the ANME and the SWH installer.

[22] 70,000€ remained at the end of Prosol 1 out of the 800,000€ granted by the Medrec to pilot projects in Tunisia, including Prosol. See http://www.medrec.org/en/highlights_suite.php?code=42

the households participating in the PoA until its exhaustion to complement the subsidy granted by the government and raise it from 20% of the capital cost of the SWH up to 100 TND/m^2 of collector[23]. Even if this funding is channelled through the ANME, it goes directly to the households and is not used to buy the CERs generated by the PoA or to run the PoA. As a result it can be concluded that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH is also involved in the PoA in that it finances the work of EcoSecurities as a Carbon Adviser for the PoA. This funding goes directly to the EcoSecurities and is not used to buy the CERs generated by the PoA or to run the PoA. As a result it can be concluded that that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>>
23/01/2007 (start of implementation[24])

B.2. Length of the programme of activities (PoA):

>>
28 years

SECTION C. Environmental Analysis

>>

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

Environmental analysis as per requirements of the CDM modalities and procedures is undertaken at the PoA level, since the impacts of all CPAs will be similar. In addition, the relevant impacts are the ones from all the SWH installed under the PoA together rather than the impacts of a certain group of SWH of a defined CPA.

1. Environmental Analysis is done at PoA level X
2. Environmental Analysis is done at SSC-CPA level ☐

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

[23] This does not impact additionality, as discussed in section A.4.3.

[24] Signature of the Prosol 2 conventions between the ANME and STEG and STEG and Attijari Bank – see STEG website (2007) : http://www.steg.com.tn/convention/convention_fr.html

The negative environmental impacts of a SWH and a group of SWH are not considered significant. The positive impacts include:

- Decreased air pollution linked to the use of fossil fuels
- Displacement of fossil fuels and GHG emission reductions
- Decrease dependency on fossil fuels.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

>>
The installation of SWH, and hence the SSC-CPAs and the PoA, do not require an environmental impact assessment to be carried out, in accordance with Decree 2005-1991 which stipulates the requirements for environmental impact assessment in Tunisia[25].

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level X
2. Local stakeholder consultation is done at SSC-CPA level ☐

As the geographical boundary of the PoA is the country and the PoA is coordinated on a national level by the ANME, the project participants considered appropriate to carry out the local stakeholder consultation at PoA level.

Please see section D.2. of the SSC-PoA-DD for information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>
Since the PoA is implemented all over Tunisia, the stakeholder consultation process consisted of various nationally targeted initiatives. The ANME organised and participated in several events to inform a wide range of stakeholders about the programme, such as:

- Events organised around the National Day for Energy Conservation on 07 April 2007. These included an exhibition at the Information Gallery in Tunis from 02 to 07 April 2007, open days at the ANME on 03 and 04 April 2007, events in different Tunisian regions from 06 to 28 April 2007, international conference on "Financing energy conservation" on 24 and 25 April 2007 in Hammamet
- Presentation of Prosol 2 at the International conference on energy conservation in April 07
- Presentation of Prosol 2 at the conference on Energy conservation on 28 and 29.12.2007 in Tunis with development and environment NGOs as well as trade unions organisations.

[25] Décret n° 2005-1991 du 11 juillet 2005, relatif à l'étude d'impact sur l'environnement et fixant les catégories d'unités soumises à l'étude d'impact sur l'environnement et les catégories d'unités soumises aux cahiers des charges - Ministère de l'Environnement et du Développement Durable – *Decree number 2005-1991, regarding the environmental impact assessment and specifying the categories of units subject to the specifications – Ministry of Environment and Sustainable Development*

The ANME also published several articles regarding the programme in the press, such as:

- An article entitled "CDM, 47 projects implemented in the energy sector" by Néjib Osman published in the Tunisian Journal of Energy 69 – February 2007.
- An article entitled "A new impetus to Prosol" by the ANME published in the Tunisian Journal of Energy 69 – February 2007.
- An article entitled "Contribution of the Prosol programme to the national effort in energy conservation" published in Tunisian newspapers (La Presse and Le Renouveau) in March 2007.
- An article entitled "Financing the dissemination of solar water heaters in Tunisia, the Prosol programme" by Sami Marrouki, published in the Journal of the North African economist in April 2007.

In addition, the ANME informs the stakeholders about the programme on its website. Materials are available and can be downloaded[26]. These include an explanation of Prosol 2, applications forms for households wishing to purchase a SWH, the latest version of the Prosol 2 Specifications, the list of certified suppliers and installers, the application form for certification of suppliers and SWH.

Moreover, the ANME organised a stakeholder consultation on its website from 1 February 2008 to 17 March 2009, calling for comments from the public on Prosol 2 and the CDM (see the notice in Annex 5 of the PDD).

Finally, the ANME organises inspections of a sample of SWH each month in order to control the installations all over Tunisia. Customer feedback is received directly during these visits. Inspection entails visiting households, talking to customers about system performance and use, and identifying any problems with the SWH. Problems, if any, are registered and solutions administered promptly.

D.3. Summary of the comments received:

>>

No comments have been received by the ANME following the call for comments on their website.

D.4. Report on how due account was taken of any comments received:

>>

N/A.

[26] See http://www.anme.nat.tn/index.asp?pId=115

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>>

According to Appendix B of the UNFCCC's Simplified modalities and procedures for small-scale clean development mechanism project activities, the type and category of a SSC-PA included in the PoA are:

Type: I - Renewable Energy Projects

Category: I.C -Thermal energy production with or without electricity

The approved SSC baseline and monitoring methodology AMS.I.C. Thermal energy production with or without electricity, version 17, approved at EB 54, is thus applied to each SSC-CPA included in the PoA.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>

AMS.I.C version 17 is applicable to a SSC-CPA since a SSC-CPA meets the applicable requirements set out in the methodology:

- A SSC-CPA comprises renewable energy technologies that supply residential users with thermal energy, namely SWH
- A SSC-CPA displaces fossil fuel use, namely electricity from the fossil-fuel intense Tunisian grid, Liquefied Petroleum Gas (LPG) and natural gas
- A SSC-CPA individually does not exceed the applicable SSC threshold: for each SSC-CPA the total installed thermal energy generation capacity of the SSC-CPA equipment is equal to or less than 45 MW thermal since the total number of installed square meters of a SSC-CPA is equal or less to 64,000 m^2 [27].
- The heat produced by the SWH in the SSC-CPA is used by the household where the SWH is installed. As such, the heat produced by the SSC-CPA is not delivered to another facility or facilities within the project boundary.

E.3. Description of the sources and gases included in the SSC-CPA boundary

>>

As defined in AMS.I.C, the project boundary is the physical, geographical site of the project equipment producing the renewable energy. Hence the boundary for a SSC-CPA is the geographical area over which SWH are installed comprising the physical site of each SWH of the SSC-CPA. As SWH displace electricity from the Tunisian grid, the project boundary also includes all the power plants connected to the Tunisian grid.

Table E.3.1 below summarises the emissions sources and gas included in the SSC-CPA boundary.

[27] Appendix B of the Simplified modalities and procedures for small-scale clean development mechanism project activities – A. General guidance - version 12.1 - http://cdm.unfccc.int/methodologies/SSCmethodologies/history/guid_ssc_meth/guid_ssc_v12_1.pdf 'For thermal applications of solar energy projects, 'maximum output' shall be calculated using a conversion factor of 700 Wth/m^2 of aperture area of glazed flat plate or evacuated tubular collector i.e. eligibility limit in terms of aperture area is 64000 m^2 of the collector' (with 700 $Wth/m^2 * 64,000\ m^2 = 44,800,000\ Wth = 44.8\ MWth$).

Table E.3.1. Emission sources and gases included in the SSC-CPA boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Fuel consumption of the technologies that would have been used in the absence of the project activity	CO_2	Yes	According to AMS.I.C, only CO_2 emissions from fuel consumption should be accounted for.
		CH_4	No	According to AMS.I.C.
		N_2O	No	According to AMS.I.C.
	Tunisian grid electricity production	CO_2	Yes	According to AMS.I.C which refers to AMD.I.D and thus the "Tool to calculate the emission factor for an electricity system", only CO_2 emissions from electricity generation should be accounted for.
		CH_4	No	According to AMS.I.C.
		N_2O	No	According to AMS.I.C.
SSC CPA	Solar water heaters thermal energy production	CO_2	No	According to AMS.I.C.
		CH_4	No	According to AMS.I.C.
		N_2O	No	According to AMS.I.C.

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

>>

The baseline is identified in section E.5. as the fuel consumption of the technologies that would have been used in the absence of the project activity (please see section E.5. for details).

In Tunisia, domestic hot water is currently provided by[28]:

- water heaters (LPG, natural gas, electric, SWH);
- other means (water heating in pots/pans on the cooker/fire using different fuel sources, such as LPG, natural gas, electricity; public bath houses ("hammam")

For each CPA, the mix of baseline fuels used to heat up water before the SWH is installed is recorded in the Prosol 2 database. From the database it can be seen that from beginning of 2008 to mid 2010, at least around 70% of households purchasing a SWH had a water heater previously. In some of the remaining households, water heating in pots, visits to the public bath houses and other traditional means were used to heat water. However these do not provide an output/service (hot water) with the same quality and properties as traditional and solar water heaters. This lack of water heaters is often caused by income or infrastructure constraints. The energy profile of consumers without a water heater thus does not reflect real demand for hot water. The CDM programme will help to alleviate this unmet demand by facilitating access to domestic hot water through the subsidy and the loan support system part of the programme.
As a result, the baseline for these households is defined as the energy consumption of the technologies that would have been used in the absence of the PoA in order to meet the real demand for hot water. This is calculated as the weighted average of the water heaters replaced in the households previously owning a

[28] STEG – Direction des Etudes et de la Planification – Département Demande d'Electricité (2005) Enquête auprès des clients résidentiels de la STEG 2004 (*Survey of STEG clients from the residential sector 2004*)

water heater in the CPA, including SWH (see sectionE.6.2). This approach is considered conservative since it only takes into account technologies chosen by typical homes that have access to modern and efficient water heaters, and it leads to fewer emissions than the approach that includes traditional water heating means.

Therefore, as defined in AMS.I.C, the baseline scenario is the following:
- *For SWH that displace technologies using fossil fuels*: the fuel consumption of the technologies that would have been used in the absence of the PoA times an emission factor for the fossil fuel displaced.
- *For SWH that displace electricity from the grid*: as per AMS-I.D, the amount of grid energy displaced by the SWH expressed in MWh of electricity multiplied by the emission factor for the grid. The emission factor for grid electricity is calculated as per the procedures detailed in AMS.I.D, which refers to the "Tool to calculate the emission factor for an electricity system".

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

>>

A typical SSC-CPA comprises numerous SWH, each installed in a household. The project participants thus consider that the appropriate level for the demonstration of additionality is the SWH/household level, rather than the SSC-CPA level. If each and every SWH of the CPA is additional, then the SSC-CPA is deemed additional.

According to the Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities, evidence to why the SWH would not have been installed and thus proposed SSC-CPA would not have occurred anyway due to barriers is presented below.

First realistic and credible alternatives to the purchase of a SWH under the PoA are identified and second an analysis of the barriers (investment, technological, due to prevailing practice) faced by each alternative is carried out below. The most plausible scenario will be the one with the fewest barriers; this will be defined as the baseline scenario.

Realistic and credible alternatives to the purchase of a SWH under the PoA
As discussed in Section E.4, in Tunisia domestic hot water is currently provided by:

- water heaters (LPG, natural gas, electric and solar water heaters);
- water heating in pots/pans on the cooker/fire using different fuel sources, such as LPG, natural gas, electricity;
- public bath houses ("hammam") [29].

The realistic and credible alternatives to the purchase of a SWH under the PoA are the following:

Alternative 1: continuation of the current scenario – no new purchase, the water would continue to be heated up by the technology used in the household

Alternative 2: purchase of a SWH without being included in the PoA

[29] STEG – Direction des Etudes et de la Planification – Département Demande d'Electricité (2005) Enquête auprès des clients résidentiels de la STEG 2004 (*Survey of STEG clients from the residential sector 2004*)

Alternative 3: purchase of a natural gas water heater
Alternative 4: purchase of an electric water heater
Alternative 5: purchase of a LPG water heater
Alternative 6: water heating in pots/pans on the cooker/fire
Alternative 7: public bath houses

All these alternative investments are in compliance with mandatory applicable legal and regulatory requirements in Tunisia. Besides, neither direct programmes/regulations limiting the future use of LPG, gas natural or electricity, nor initiatives that are mandatory requiring the use of SWHs exist.

As discussed in Section E.4., Alternatives 6 and 7 provide the same output/service as a SWH (domestic hot water), but this output/service is not of comparable quality:

- *Alternative 6* (water heating in pots/pans on the cooker/fire) does not provide a flexible and constant supply of hot water similar to what water heaters provide.
- *Alternative 7* (public bath houses) does not provide hot water directly in the household, like a water heater does, but in another building where the members of the households have to go in order to get hot water.

These two alternatives are thus not considered comparable to the purchase of a SWH and are thus not further examined in the assessment of additionality.

Investment barrier

The high up-front cost of a SWH is an investment barrier for most Tunisian households. As illustrated in Table E.5.1. below, up-front costs of a SWH are more than 5 times higher than for a conventional water heater and represent between 26 and 35% of the Tunisian average Gross National Income (GNI) per capita[30]. Since most households spend a large share of their income on basic needs, they cannot afford, for meeting their hot water demand, to opt for a technology with high up front costs, even when considering the absence of fuel costs. Therefore, without the additional support of the programme, households would not go for a SWH but rather for a cheaper conventional water heater (as highlighted in the "Prevailing practice" barrier below). Therefore, CPAs would not be implemented without being included in the PoA and are therefore considered additional.

Table E.5.1. Prices of solar and conventional water heaters

	Average price (TND)	**Sources**
SWH		
200 L	1,015	Database developed by the ANME
300 L	1,340	
LPG/natural gas water heaters		
10 L (equivalent to a 200 L SWH)	160	Survey of the main LPG/natural gas water heater suppliers[31]
13 L (equivalent to a 300 L SWH)	200	
Electric water heaters		
200 L	220	Survey of the main electric water heater

[30] World Bank – Data - GNI per capita, Atlas method (current US$) - Tunisia. The GNI (formerly GNP) reflects the average income of a country's citizens. The annual GNI per capita in Tunisia is 3,210 US$ = 3,862 TND.

[31] ALCOR November 2007 - Results of water heaters prices survey

300 L	310	suppliers[32]

Table E.5.2. Fuel costs associated with the use of conventional water heaters

	Fuel price (TND/kg, TND/m^3 or TND/kWh)	Annual fuel consumption (kg, m^3, or kWh)	Annual fuel costs (TND) (standing charge + unit rates)
LPG (kg)	0.455	112.2	51.1
Natural Gas (m^3)	0.237	145.3	34.7
Electricity (kWh)	0.113	1,207	143.3
Sources	STEG and the Ministry of Industry, Energy and Small and Medium Enterprises	STEG – Survey of STEG clients from the residential sector 2004	STEG and the Ministry of Industry, Energy and Small and Medium Enterprises

Technological barrier

Without support and subsidies, the SWH market is quasi non-existent in Tunisia, as highlighted in the history of the Tunisian SWH sector presented below and in Figure E.5.3. below[33].

- **1980 – 1996**: The Tunisian SWH market is organised around two companies part of or supported by state-owned companies: SIAME and then Serpet Energie Nouvelle (SEN). Advantageous financial and investment conditions (attractive credit conditions, favourable conditions for the import of raw materials for manufacturing SWH, high tax on foreign SWH imports) are put in place to support the manufacturing and installation of SWH in the country. Nevertheless the quality of the SWH manufactured is low, and the maintenance network weak. As a result, the rate of installation of SWH is low and the SEN defaults. The collapse of the SEN strongly influences the perception of the stakeholders towards the SWH: households' trust in the technology is undermined and STEG's interest in the market annihilated.

- **1996 – 2002**: the Global Environment Facility (GEF) programme

The national government's willingness to support the SWH market is still significant and translates into the launch of a new SWH programme, supported by the GEF. Through this programme, direct subsidies are granted to households purchasing a SWH, and capacity building is provided to national stakeholders involved in the SWH sector. This programme is a reasonable success. It boosts the SWH market: 50,000 m^2 of SWH are installed mainly in the domestic sector from 1996 to 2002, and a network of manufacturers, importers and installers of SWH is created[34]. However, when the programme and the related subsidies cease to exist in 2002, the effects are immediate and the sales of SWH drop sharply (see Figure E.5.3. below).

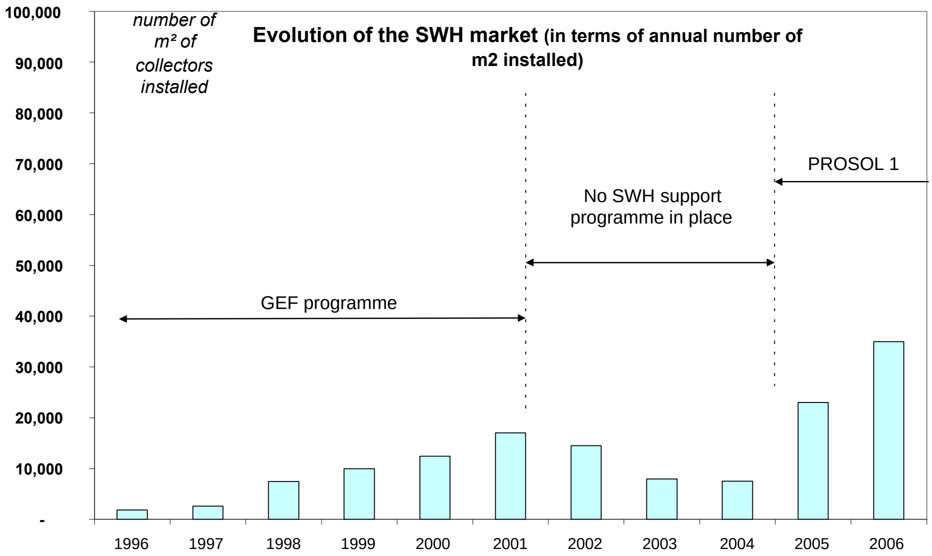
- **2005 – January 2007:** Programme Prosol first generation

[32] ALCOR November 2007 - Results of water heaters prices survey

[33] Alcor – Axenne (2003) Agence Nationale des Energies Renouvelables. Etude stratégique pour le développement des EnRs en Tunisie - Bilan des réalisations - Rapport final (*National Agency for Renewable Energies – Strategic Study for the development of Renewable Energies in Tunisia - Final Report)*.

[34] No maintenance service is provided by this programme – see section A.4.3.

The Tunisian state acknowledges the importance of the support to the SWH sector to maintain its viability. As a result, it assists the ANME in the launch of a programme called Prosol in April 2005, which subsidizes the purchase of SWH and provides the households with facilitated credit options. It is financially supported by the Italian government through the Mediterranean Renewable Energy Centre (MEDREC) and UNEP. Prosol first generation also supports the stakeholders of the SWH sector, including banks, manufacturers, importers, suppliers and installers. However, due the structural organisation of the programme, the loans rest on the supplier balance sheets and not on the individual households[35]. This leads to significant indebtness for the suppliers and result in their discontentment and distrust in the programme. As this difficulty arises, Prosol first generation is rethought and a new mechanism is being structured with the support of the CDM as a crucial element (Prosol 2), as discussed in section A.4.3.



Source: adapted from Alcor 2007

Figure E.5.3. History of the Tunisian SWH market in the last 10 years

This short history, graphically represented in Figure E.5.3. above, illustrates that the SWH market in Tunisia cannot survive independently and requires support to exist. This means that without this support, households do not buy, or buy very few, SWH due to the low competitiveness of the technology and the unfavourable perception that persists among the households. Therefore, CPAs would not be implemented without being included in the PoA and are therefore considered additional. Conversely, the market for conventional natural gas, LPG or electricity powered water heaters is well established in Tunisia and does not depend on support programmes.

Barrier due to prevailing practice

One important reason for the high competitiveness of fossil fuel water heaters and their high market penetration is the incentives offered to the households for the use of LPG and natural gas. For example, a significant subsidy of 437 TND/toe of LPG is granted to consumers buying bottles of LPG. The state also provides favourable credit conditions for the installation of natural gas water heating systems as well as

[35] Renewable Energy World (May–June 2006) Usher, E. and Touhami, M - Engaging the banks Financing small-scale renewables in the developing world

decreased fees and favourable payment conditions for the connection of the households to the natural gas supply network[36]. This provides incentives for the installation of fossil fuel water heaters over cleaner alternatives. As a result, LPG fired water heaters are the prevailing practice (77% of the households with a water heater own a LPG water heater[37]). The households that adopted SWH did so mainly because of previous support schemes (the purchase of SWH is clearly linked to incentive schemes, as shown in Figure E.5.4. above). This shows that CPAs would not be implemented without being included in the PoA and are therefore considered additional.

The barrier analysis shows that the purchase of SWH without the PoA (Alternative 2) faces specific barriers that the continuation of the current situation (Alternative 1) and the purchase of conventional water heaters (Alternatives 3 – 5), which all lead to higher emissions, do not face. The continuation of the current situation (Alternative 1) does not involve costs: it is thus the alternative facing the fewest barriers and is identified as the baseline scenario.
As a result of these barriers, households in Tunisia would not buy a SWH without the PoA, i.e. SSC-CPAs would not be implemented without being included in the PoA. Therefore SSC-CPAs are not the baseline scenario and are deemed to be additional.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Based on section E.5.1. it is assumed that all SWH installed in households in Tunisia under the PoA, and hence SSC-CPAs which are going to be included in the registered PoA are additional, provided they meet the eligibility criteria for inclusion of a SSC-CPA in the PoA as set in section A.4.2.2.

This implies that all the SWH under the SSC-CPA:

- are installed after signature of a Prosol 2 contract between the household installing the SWH and the ANME.
- are eligible and certified systems under Prosol 2
- are provided by suppliers certified under Prosol 2
- are installed by installers affiliated to a supplier certified under Prosol 2
- are installed in households in Tunisia
- are new equipment.

The fulfilment of these criteria is shown by the up to date record kept for each of the SWH of a SSC-CPA in the Prosol 2 database developed by the ANME.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

>>
As discussed in section E.1., the approved baseline and monitoring methodology AMS.I.C is applied to a typical SSC-CPA included in the PoA.

---

[36] STEG Programme de développement du gaz naturel (*Plan for the development of natural gas*)- http://www.steg.com.tn/dwl/Gaz_Naturel.pdf

[37] STEG – Direction des Etudes et de la Planification – Département Demande d'Electricité (2005) Enquête auprès des clients résidentiels de la STEG 2004

As defined in sections E.4. and E.5. and in AMS.I.C, the baseline scenario is the following:
- *For SWH that displace technologies using fossil fuels:* the fuel consumption of the technologies that would have been used in the absence of the SSC-CPA times an emission factor for the fossil fuel displaced.
- *For SWH that displace electricity imported from the grid:* as per AMS-I.D, the amount of grid energy displaced by the SWH expressed in MWh of electricity multiplied by the emission factor for the grid. The emission factor for grid electricity is calculated as per the procedures detailed in AMS.I.D, which refers to "Tool to calculate the emission factor for an electricity system".

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

>>

Emission reductions calculation

$$ER_y = BE_y - PE_y - LE_y \qquad \textbf{(1)}$$

Where

ER_y	Emission reductions in year y (tCO_2e)
BE_y	Baseline emissions in year y (tCO_2e)
PE_y	Project emissions in year y (tCO_2)
LE_y	Leakage in year y (tCO_2)

Leakage

SWH are not transferred from another activity, so no leakage is to be considered.

Therefore $LE_y = 0\ tCO_2$
and

$$ER_y = BE_y - PE_y \qquad \textbf{(2)}$$

Project emissions

According to AMS.I.C, no project emissions need to be taken into account.
Therefore, $PE_y = 0\ tCO_2$.

As a result

$$ER_y = BE_y \qquad \textbf{(3)}$$

Baseline emissions

As mentioned above and as defined in AMS.I.C, the baseline scenario is the following:
- *For SWH that displace technologies using fossil fuels:* the fuel consumption of the technologies that would have been used in the absence of the SSC-CPA times an emission factor for the fossil fuel displaced.
- *For SWH that displace electricity imported from the grid:* as per AMS-I.D, the amount of grid energy displaced by the SWH expressed in MWh of electricity multiplied by the emission factor for the grid. The emission factor for grid electricity is calculated as per the procedures detailed in AMS.I.D, which refers to "Tool to calculate the emission factor for an electricity system".

Therefore, baseline emissions are calculated as follows:

$$BEy = (\sum_k N_{k,x} * O_k) * (\sum_i w_{i,x} * EF_i / eff_i) * U * F_{x,y} \quad \textbf{(4)}$$

Where

$\sum_k$	Sum over the SWH k installed in the SSC-CPA x
$N_{k,x}$	Number of SWH k installed in the SSC-CPA x
O_k	Estimated annual energy output of SWH k (MWh/y)
k	SWH type
$\sum_i$	Sum over the energy source i used in the baseline scenario
$w_{i,x}$	Weighting of water heater using energy source i[38] in the baseline scenario for the SSC-CPA x (%)
eff_i	Average efficiency of water heater using energy source i
EF_i	Emission factor EF_i for energy source i (tCO_2/MWh)
i	Energy source
U	Usage rate of the SWH (all types) in the SSC-CPA x (%)
$F_{x,y}$	Failure rate of the SWH (all types) in the SSC-CPA x in year y (%)

As mentioned above, the Prosol 2 database records the energy source that was used prior to the installation of the SWH for each SWH included in the SSC-CPA. The following energy sources are used in the baseline:

- LPG
- Natural gas
- Electricity
- Other

The emission factor EF_i for the energy source i (tCO_2/MWh) is obtained as follows:

<u>Emission factors *EF* for fossil fuels</u>

$$EF_i = EF_{CO2,i} \; x \; conversion \; factor \quad \textbf{(5)}$$

Where

EF_i	CO_2 emission factor of fossil fuel type i (tCO_2/MWh)
$EF_{CO2,i,}$	CO_2 emission factor of fossil fuel type (tCO_2/GJ)
conversion factor	Conversion factor GJ into MWh

Table E.6.1. CO_2 emission factor of fossil fuels

Fossil fuel type	$EF_{CO2,i,y}$ **(tCO_2/GJ)**	EF_i **(tCO_2/MWh)**	**Source**

[38] For reasons of simplicity, energy sources refer to fossil fuels as well as electricity.

LPG	0.0631	0.227	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Natural gas	0.0561	0.202	2006 IPCC Guidelines for National Greenhouse Gas Inventories

<u>Emission factor *EF* for grid electricity</u>

AMS.I.C refers to the procedures detailed in AMS.I.D in order to calculate the emission factor for grid electricity.

AMS I.D. (Version 16, EB 51) offers two choices for calculating the emission coefficient:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system".

OR

(b) The weighted average emissions (in tCO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) above will be applied for this project, which uses a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system".

The description below follows the steps of the latest version of the "Tool to calculate the emission factor for an electricity system" and focuses on the key process of the calculation of the emission factors. The data used is from the *Electricity Retrospective Statistics 1997-2007* published in October 2008 by the STEG, which was the most recent data available at the time of submission of the CDM-PDD to the DOE for validation[39]. Please see Annex 3 for the baseline data underlying the calculations.

Step 1. Identify the relevant electricity systems

Law number 62-8 (3 April 1962) defines the national utility (STEG) as the entity in charge of the production, transmission and distribution of electricity for the Tunisian grid. The Tunisian grid, comprising 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, as defined in the Electricity Retrospective Statistics 1997-2007 published by STEG, is identified as the relevant electric power system.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

The "Tool to calculate the emission factor for an electricity system" offers two options to calculate the operating margin and build margin emission factor:

[39] Data from the STEG Annual Reports 2005 (http://www.steg.com.tn/fr/institutionnel/publication/rapport_act/Rap_STEG_2005.pdf) and 2007 (http://www.steg.com.tn/fr/institutionnel/publication/rapport_act2007/index.html) was also used in this section, but not in the calculations of the grid EF directly.

- Option I: Only grid power plants are included in the calculation.
- Option II: Both grid power plants and off-grid power plants are included in the calculation.

The electrification rate in Tunisia is 99.5%[40]. As such off-grid power generation is not significant and is not likely to be displaced by CDM project activities. Therefore, Option I is applied and only grid power plants are included in the calculation.

Step 3. Select a method to determine the operating margin (OM)

The "Tool to calculate the emission factor for an electricity system" offers four methods to calculate the OM emission factor ($EF_{grid,OM,y}$):

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM.

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost / must run resources constitute less than 50% of total grid generation in average of the five most recent years (see Table E.6.1. below).

Table E.6.2. Share of low-cost / must run resources in the total grid generation[41]

Low-cost / must run resources	2003	2004	2005	2006	2007
Generation (MWh)	199,400	197,200	208,400	191,100	188,100
Share (%) of total generation	1.82%	1.71%	1.67%	1.49%	1.42%

No power plants registered as CDM project activities are included in the sample group that is used to calculate the OM since there are no such power plants in Tunisia.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages calculate the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

- *Ex-ante* option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.
- *Ex-post* option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

[40] *STEG Annual report 2007.*

[41] *STEG Electricity Retrospective Statistics 1997-2007;* see Annex 3 for detailed calculation.

$EF_{grid,OMsimple,y}$ is calculated *ex-ante* using the data from 2005 to 2007, available in the *Electricity Retrospective Statistics 1997-2007* which is the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation. This data vintage remains fixed during the crediting period.

Step 4. Calculate OM emission factor according to the selected method

The "Tool to calculate the emission factor for an electricity system" offers two options to calculate $EF_{grid,OMsimple,y}$:

- *Option A*: Based on the net electricity generation and a CO_2 emission factor, of each power unit
- *Option B*: Based 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.

Option A is used.

Option A – Calculation based on average efficiency and electricity generation of each plant
$EF_{grid,OMsimple,y}$, is calculated based on the net electricity generation of each power unit and an emissions factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad \textbf{(6)}$$

Where

$EF_{grid,OMsimple,y}$	Simple operating 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	All power units serving the grid in year y except low-cost / must-run power units
y	The relevant year as per the data vintage chosen in step 3, i.e. the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

Determination of $EF_{EL,m,y}$
For power units m for which data on fuel consumption and electricity generation is available, option A1 is applied and the emission factor of each power unit m ($EF_{EL,m,y}$) is calculated as follows:

$$EF_{EL,m,y} = \frac{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad \textbf{(7)}$$

Where

$EF_{EL,m,y}$	CO_2 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)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 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	The relevant year as per the data vintage chosen in Step 3

For power units *m* for which only data on electricity generation and the fuel types used is available, option A2 is applied and the emission factor of each power unit *m* ($EF_{EL,m,y}$) is calculated as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x 3.6}{\eta_{m,y}} \qquad \textbf{(8)}$$

Where

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2m,,i,y}$	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	All power units serving the grid in year y in except low-cost/must-run power units
y	The relevant year as per the data vintage chosen in Step 3

For power units *m* for which only data on electricity generation is available, option A3 is applied and an emission factor of 0 tCO_2/MWh is assumed as a simple and conservative approach.

Determination of $EG_{m,y}$

Since only grid power plants are included, $EG_{m,y}$ is determined once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PDD to the DOE for validation.

Using the above methodological choices, the OM emission factor is calculated as:

$EF_{grid,OMsimple,y}$ = 0. 570 tCO_2/MWh

For detailed information, please see Annex 3.

Step 5. Identify the group of power plants to be included in the build margin

According to the "Tool to calculate the emission factor for an electricity system", the sample group of power units *m* used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or
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.

Project participants should use the set of power units that comprises the larger annual generation.

In Tunisia, option a) and option b) comprise the same set of power plants, which account for 32% of the annual generation [42].

[42] *STEG Electricity Retrospective Statistics 1997-2007; STEG - Annual Report 2005*

Since there is no power plants registered as CDM project activities in Tunisia, they are not taken into account in the build margin.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages to calculate the BM:

- *Option 1.* For the first crediting period, the build margin emission factor is calculated *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.
- *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

The BM emission factor ($EF_{grid,BM,y}$) is calculated *ex-ante* using the data from 2007, available in the *Electricity Retrospective Statistics 1997-2007*. This data vintage remains fixed during the first crediting period and will be updated for the second crediting period.

Step 6. Calculate the build margin emission factor

According to the "Tool to calculate the emission factor for an electricity system", $EF_{grid,BM,y}$ is the generation-weighted average emission factor of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(10)}$$

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

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is be determined as per the guidance in step 4 (a) for the simple OM, using option A1, with data from year 2007, which is the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

Using the above methodological choices, the BM emission factor is calculated as:

$EF_{grid,BM,y}$ = 0.531 tCO_2/MWh

For detailed information, please see Annex 3.

Step 7. Calculate the combined margin emission factor

The combined margin (CM) emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad \textbf{(11)}$$

Where:

$EF_{grid,CM,y}$	Combined margin CO_2 emissions factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor, which is 0.5 by default
w_{BM}	Weighting of build margin emissions factor, which is 0.5 by default

The calculated CM emission factor is:

$$EF_{grid,CM,y}=0.570*0.5+0.531*0.5=0.550\ tCO_2/MWh$$

For detailed information, please see Annex 3.

Table E.6.3: Key information and data used to calculate the emission factor for grid electricity

Parameter	Value / Unit	Source
Operating Margin Emission Factor	0.570 tCO_2/MWh	STEG - Electricity Retrospective Statistics 1997-2007
Build Margin Emission Factor	0.531 tCO_2/MWh	STEG - Electricity Retrospective Statistics 1997-2007 and STEG – Annual Report 2005
Combined Margin Emission Factor	0.550 tCO_2/MWh	STEG - Electricity Retrospective Statistics 1997-2007 and STEG – Annual Report 2005

Emission factors *EF* for other

This includes households which did not have a water heater previously as well as households for which no data was entered into the Prosol 2 database. This is calculated as the weighted average of the *EF* of the other energy sources in the CPA (LPG, natural gas, electricity), adjusted to take into account potential existing SWH installed before the programme in the baseline[43].
The *EF* for the category "other" is specific to each CPA.

Discount factors *U* and *F*

U and *F* are discount factors discussed at the end of section E.6.2.

U is the usage rate of SWH introduced in order to reflect that households do not use their SWH 100% of the time. "Figures of the Tunisian tourism 2008" state that the average length of hotel stays for Tunisian residents was 2.2 nights in 2008. This represents 0.6% of the year. As such, a 99% usage rate was defined

[43] A 3% factor is used, which is the % of SWH in the water heater park in Tunisia as per the last "Survey of STEG clients from the residential sector".

for the SWH, which is higher than the statistics (in order to take into account any nights spent by the household abroad) and is hence considered conservative[44].

F is the failure rate of the SWH. The failure rate is determined by CPA through a yearly verification organized by ANME. See section E.7.2.

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	$w_{i,x}$
Data unit:	%
Description:	Weighting of water heater using energy source *i* in the baseline scenario for SSC-CPA *x*
Source of data used:	Prosol 2 database
Value applied:	LPG fired water heaters: to be determined in each SSC-CPA-DD Natural gas fired water heaters: to be determined in each SSC-CPA-DD Electric water heaters: to be determined in each SSC-CPA-DD Other: to be determined in each SSC-CPA-DD
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is recorded in the Prosol 2 database and comes from a form filled in by the SWH installer during the installation of the SWH.
Any comment:	

Data / Parameter:	eff_i
Data unit:	%
Description:	Average efficiency of a water heater using energy source *i*
Source of data used:	RETScreen
Value applied:	LPG fired water heaters: 86% Natural gas fired water heaters: 86% Electric water heaters: 94% Solar water heaters: 94%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values chosen are the highest efficiencies for typical residential water heaters given by the RETScreen® Software Online User Manual, Solar Water Heating Project (Typical Water Heating System Seasonal Efficiencies). This is published by the RETScreen International Clean Energy Decision Support Centre, which is managed by the Natural Resources Canada's (NRCan) CANMET Energy Technology Centre - Varennes (CETC-Varennes). "RETScreen is developed in collaboration with a number of other government and multilateral organisations, and with technical support from a large network

[44] Note that the number of nights spent by any other visitor living abroad staying in a household that has purchased a SWH under Prosol II is not considered, while this would compensate the nights households do not spend at home, which are factored in the ER calculations, This is conservative.

	of experts from industry, government and academia." (http://www.retscreen.net/ang/centre.php). This data complies with paragraph 22 c) of AMS.I.C version 17.
Any comment:	

Data / Parameter:	O_k
Data unit:	MWh/y
Description:	Annual energy output of SWH *k*
Source of data used:	SOLO software
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values are the output of SOLO, a recognized model calculating the energy output of SWH. This model was developed by the Centre Scientifique et Technique du Bâtiment (Scientific and Technical Centre for the Construction Industry). "CSTB collaborates with contracting authorities, architects, research offices, manufacturers and entrepreneurs, and helps the French public authorities to define technical regulations and ensure the quality of buildings. CSTB is a State-owned industrial and commercial corporative, placed under the administrative supervision of the French Ministry of Housing. It is one of Europe's leading research and test laboratory in the area of solar thermal in Europe" (http://international.cstb.fr/frame.asp?URL=overview/task.asp).
Any comment:	

Data / Parameter:	***Conversion factor***
Data unit:	No unit
Description:	Conversion factor from GJ to MWh
Source of data used:	
Value applied:	1/3.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$FC_{i,m,y}$
Data unit:	t, m^3
Description:	Amount of fossil fuel type *i* consumed by the group of power units *m* in year *y* (mass or volume unit)
Source of data used:	Electricity Retrospective Statistics 1997-2007
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics by the national power utility; publicly accessible and reliable data source; latest data available.

Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	STEG Electricity Retrospective Statistics 1997-2007
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics by the national power utility; publicly accessible and reliable data source; latest data available
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:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net electricity generated by power plant / unit *m* in year *y*
Source of data used:	Electricity Retrospective Statistics 1997-2007
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics by the national power utility; publicly accessible and reliable data source; latest data available.
Any comment:	

Data / Parameter:	$\eta_{m,y}$
Data unit:	%

Description:	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data used:	Annex I of the "Tool to calculate the emission factor for an electricity system"
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value given by the EB.
Any comment:	

Data / Parameter:	***U***
Data unit:	%
Description:	Usage rate of the SWH
Source of data used:	"Figures of the Tunisian tourism 2008" ("Le tourisme tunisien en chiffres 2008") published by the National Tourism Bureau of Tunisia
Value applied:	99%
Justification of the choice of data or description of measurement methods and procedures actually applied :	"Figures of the Tunisian tourism 2008" state that the average length of hotel stays for Tunisian residents was 2.2 nights in 2008. This represents 0.6% of the year. As such, a 99% usage rate was defined for the SWH, which is higher than the statistics and is hence considered conservative.
Any comment:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	$N_{k,x}$
Data unit:	number
Description:	Number of SWH *k* installed in the SSC-CPA *x*
Source of data to be used:	Database developed by the ANME
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined in each SSC-CPA-DD
Description of measurement methods and procedures to be applied:	Each solar water heating system is covered by a contract between the owner and ANME. The type and serial number, owner, location, supplier and installation date are entered into the Prosol 2 database.
QA/QC procedures to be applied:	ANME will carry out spot checks in order to ensure that the systems entered into the database are actually operating (see below $F_{x,y}$).

Any comment:	

Data / Parameter:	$F_{x,y}$
Data unit:	%
Description:	Failure rate of the SWH (all types) in the SSC-CPA *x* in year *y*
Source of data to be used:	Yearly verification done by ANME
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined in each SSC-CPA-DD
Description of measurement methods and procedures to be applied:	The failure rate is determined by CPA through a yearly verification organized by ANME. The sample size of the verification is determined following the criterions given by EB50 Annex 30 and the choice of the SWH to be verified is made through a randomized system. The failure percentage of the verification is applied to the whole population of the considered CPA.
QA/QC procedures to be applied:	

E.7.2. Description of the monitoring plan for a SSC-CPA:

>>

AMS.I.C offers four options for monitoring:

(a) Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient.

(b) Metering the thermal and/or electrical energy produced:

(i) In the case of heat energy (e.g. hot air, hot water), direct measurement of flow and temperature is required.

(ii) In the case of steam energy, direct measurement of flow, temperature, pressure is required to determine enthalpy of the steam.

(c) If the emissions reduction per system is less than 5 tonnes of CO_2 a year:

(i) Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute), if necessary using survey methods;

(ii) Estimating the annual hours of operation of an average system, if necessary using survey methods. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available

(d) For household or commercial applications/systems, whose maximum output capacity is less than 45 kW thermal and where it can be demonstrated that the metering of thermal energy output is not plausible, as in the case of biomass stoves, gasifiers, driers, water heaters etc, the project output energy shall be estimated based on consumption of the biomass (in terms of energy quantity) times the efficiency of the project equipment.

As the emissions reduction per SWH is less than 5 tonnes of CO_2 a year (between 0.2 and 1tCO_2/year), option (c) is applicable and chosen for the monitoring of the SSC-CPA. Therefore, the monitoring requirements are the following:

(i) Recording annually the number of systems operating.

(ii) Estimating the annual hours of operation of an average system.

(i) Recording annually the number of systems operating

Each SWH is covered by a contract between the owner and ANME. The type and serial number of the SWH, owner, location, supplier and installation date are entered into the Prosol 2 database. The database tracks the number of SWH *k* installed in the SSC-CPA *x* ($N_{k,x}$). The ANME manages the database and is responsible for collecting and archiving the data.

To determine the number of operating SWH, an annual verification is implemented by the ANME. The aim of the verification is to assess whether or not the SWH installed as listed in the database are operating. The verification is done by CPA and not for the whole PoA. The sample size is determined by CPA in order to respect the requirements of Annex 30 of EB50 (confidence level higher or equal to 90%, precision lower or equal to 10%, minimum sample size 50).
The SWH to be verified for each SSC-CPA are extracted from the Prosol 2 database by a randomized system. The result of the verification is the parameter $\boldsymbol{F_{x,y}}$, given as a percentage of non operating SWH in the SSC-CPA *x*. This percentage is applied to the whole population of the CPA.
The number of SWH operating is calculated as the number of SWH installed in the SSC-CPA ($N_{k,x}$) adjusted to take into account the failure rate of the SWH in the SSC-CPA x, i.e as $N_{k,x} * F_{x,y}$.

The SSC-CPA does not involve the replacement of existing equipment. Therefore there is no leakage and no monitoring of scrapped equipment is required.

(ii) Estimating the annual hours of operation

The annual hours of operation are directly linked to the annual insolation[45] incident on the collectors of the SWH. The annual insolation on the collectors is an input data to SOLO (see Annex 3 for details). The data used is historical data and as such is considered a representative estimate of the annual hours of operation. The input for annual insolation is from the Tunis region.
Tunis region has less annual insolation than other regions in Tunisia. In addition, using the climatic conditions of the different meteorological stations of Tunisia and the actual repartition of the SWH by station would lead to higher emission reductions. As such, using data fixed ex-ante to estimate the annual hours of operation is conservative.

.

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

>>

Date of completion of the application of the baseline study and monitoring methodology: 30/09/2010.

EcoSecurities is the company determining the baseline and the monitoring plan and participating in the project as Carbon Advisor. EcoSecurities is not participant in the PoA.
The persons responsible for the development of the baseline are:

[45] Insolation is derived from INcoming SOlar radiATION

Henk Harmsen
EcoSecurities Ltd.
40/41 Park End Street
Oxford OX1 1JD
UK
Phone: +44 1865 202 635
Email: henk.harmsen@ecosecurities.com

and

Noémie Klein
EcoSecurities Ltd.
40/41 Park End Street
Oxford OX1 1JD
UK
Phone: +44 1865 202 635
Email : noemie.klein@ecosecurities.com

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Coordinating/Managing Entity

Organization:	ANME
Street/P.O.Box:	3 rue Chott Mariem Montplaisir, BP 213
Building:	
City:	Tunis
State/Region:	
Postfix/ZIP:	1073
Country:	Tunisie
Telephone:	(+216) 71 906 900
FAX:	(+216) 71 904 624
E-Mail:	
URL:	
Represented by:	
Title:	Director
Salutation:	Mrs
Last Name:	Osman
Middle Name:	
First Name:	Néjib
Department:	Studies and Planning & Prosol
Mobile:	
Direct FAX:	(+216) 71 906 900
Direct tel:	(+216) 71 908 997
Personal E-Mail:	Osman.nejib@anme.nat.tn

Programme participant

Organization:	ORBEO
Street/P.O.Box:	17 cours Valmy
Building:	Tour Société Générale
City:	Paris La Defense
State/Region:	
Postfix/ZIP:	92987
Country:	France
Telephone:	+33 (0)1 53 56 61 01
FAX:	+33 (0)1 53 56 61 10
E-Mail:	philippe.rosier@orbeo.com
URL:	www.orbeo.com
Represented by:	Philippe Rosier
Title:	President
Salutation:	
Last Name:	ROSIER
Middle Name:	
First Name:	Philippe
Department:	
Mobile:	
Direct FAX:	+33 (0)1 53 56 61 10
Direct tel:	+33 (0)1 53 56 61 32
Personal E-Mail:	registry@orbeo.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

All information regarding public funding is indicated in the relevant sections of the PoA-DD.

- - - - -

Annex 3

BASELINE INFORMATION

Information regarding the values used for the parameter *O* (annual energy output of SWH *k*)

The values used for the annual energy output of a SWH *k* are the output of a recognised SWH model. The model currently used was developed by the Centre Scientifique et Technique du Bâtiment (Scientific and Technical Centre for the Construction Industry – CSTB)[46] and is called SOLO. It is used to predict the energy performances of SWH. The calculations of the energy performances of a SWH (yield in MWh produced per year) are based on correlations derived from a detailed physical model. The input data of the model are:

Parameter	Source
Type of system	Manufacturer specifications for the SWH *k*
Monthly hot water consumption in litres	Manufacturer specifications for the SWH *k*
Collector area (aperture area) in m^2	Manufacturer specifications for the SWH *k*
Collector orientation and tilt	Prosol specifications for the installation of the SWH
Collector characteristics (2 coefficients – zero loss efficiency and U value)	Manufacturer specifications for the SWH *k*
Location of the storage tank (inside vs. outside)	Prosol specifications for the installation of the SWH
Volume of the storage tank in litres	Manufacturer specifications for the SWH *k*
Number of tanks	Manufacturer specifications for the SWH *k*
Temperature of the hot water supplied	By default SOLO uses 60°C, which is the temperature needed for hygienic purposes. Nevertheless, a conservative value of 45°C is used.
Cooling constant (Wh/L.d.°C)	Manufacturer specifications for the SWH *k*
Climatic station and data (to be chosen in a list among different climatic stations in Tunisia) - temperature outside and of the water, collector insolation.	SOLO climatic data. The input is from the Tunis province. As shown in SOLO, Tunis is the province with the second lowest annual solar radiation behind Jendouba. Less than 3% of the SWH installed under Prosol 2 between January 2007 and end 2010 (number extracted from the Prosol 2 database) are installed in Jendouba. This means that more than 97% of these SWH are in a province where the solar radiation is higher than Jendouba. This shows that choosing Tunis is conservative, since the vast majority of SWH are situated in a province where there is as much or more solar radiation than in Tunis. This is confirmed by the calculation using the actual repartition of SWH in the CPA 1. This calculation leads to a more accurate but higher SWH output figure, and hence ER

[46] CSTB collaborates with contracting authorities, architects, research offices, manufacturers and entrepreneurs, and helps the French public authorities to define technical regulations and ensure the quality of buildings. CSTB is a State-owned industrial and commercial corporative, placed under the administrative supervision of the French Ministry of Housing. It is one of Europe's leading research and test laboratory in the area of solar thermal in Europe" (http://international.cstb.fr/frame.asp?URL=overview/task.asp)

	estimates, than assuming that all SWH are in the Tunis province.

Applications of SOLO include:

- certification procedure of SWH, in addition to EN 12976, in countries such as France
- GSR procedure explained below[47]

In the PoA, SOLO is used by the technical committee of Prosol 2 when it examines the applications of SWH suppliers and SWH models to be certified under the programme. The manufacturer specifications used as inputs are from technical reports published by either a national (ENIT, INRST, CETIME[48]) or an international laboratory (CSTB, TÜV, European Communities Solar Collector Testing Group, DEMOKRITOS, etc.) and they comply with relevant European standards for SWH tests and from technical specifications provided by the SWH suppliers.

The SOLO model was first developed for a certain scheme and contract (Guaranteed Solar Results – GRS) implemented between SWH professionals and costumers aiming at optimising the estimate of energy supply by a SWH in order to provide the best services. In this contract it is agreed that costumers would be compensated for the loss in case the actual energy supply by the solar water heater installed was below the estimated supply. As a result, it is argued that the assessed performances of the SWH might be conservative[49].

The values used for each SWH are recorded in a database after approval by the Technical Committee of Prosol and will be available during verification.

[47] Van Cruchten, G. and Vis, I. (2004) Collection and analysis of RES calculation methods in EP calculation for existing housing."Build-On- RES" Project. This project has been initiated by OTB Research Institute for Housing, Urban and Mobility Studies and is co-financed by the European Commission in the framework of the Altener Programme.

[48] ENIT: Ecole Nationale d'Ingénieurs de Tunis (National Engineering School of Tunis) ; INRST : Institut National de Recherche Scientifique et Technique (National Scientific and Technical Research Institute) ; CETIME: Centre Technique des Industries Mécaniques et Electriques (Technical Centre of Mechanical and Electrical Industries).

[49] Sanders, J. (2001) Solar Results Purchasing – ETSU S/P3/00273/REP – DTI/Pub URN 01/1141. Report prepared as part of the UK government's Department of Trade and Industry Sustainable Energy Programmes.

Calculation of the grid electricity emission factor

Data used

Plant and type of fuel	Year of commission	Licensed capacity (MW)	Low-cost / must-run plant	Net electricity generation (MWh) (for OM and BM)			Fuel consumption - $FC_{i,m,y}*NCV_{i,y}$ (GJ)		
				2005	2006	2007	2005	2006	2007
Grand Total		***3,195***		***12,445,900***	***12,783,600***	***13,242,180***	***95,912,931***	***95,891,704***	***101,201,152***
STEG generation		**2,697**		**9,481,700**	**9,868,500**	**10,132,180**	**95,912,931**	**95,891,704**	**101,201,152**
Steam turbines power plants		1,090		**5,343,900**	**5,173,600**	**5,926,200**	**58,583,506**	**57,516,960**	**64,865,757**
Residual fuel oil		0		2,600	0	0	0	0	0
Goulette II				2,600	0	0	0	0	0
Residual fuel oil (RFO) + natural gas (NG)		1,090		5,341,300	5,173,600	5,926,200	58,583,506	57,516,960	64,865,757
Ghannouch RFO		60		0	0	0	0	0	0
Ghannouch NG				212,900	317,700	332,400	3,035,849	4,605,145	4,737,992
Sousse RFO		320		0	62,800	27,400	0	733,862	305,134
Sousse NG				1.437.900	1.193.400	1.707.600	15.977.457	13.709.718	19.064.384
Radés A RFO		340		0	472,100	897,300	1,256,040	4,951,938	9,080,709
Radés A NG				1,721,100	1,106,000	1,262,200	17,386,231	12,112,999	13,547,815
Radés B RFO		370		0	411,600	466,800	795,492	4,159,586	4,792,169
Radés B NG				1,969,400	1,610,000	1,232,500	20,132,437	17,243,713	13,337,554
Gas turbine power plants		**1,161**		**1,507,100**	**1,680,600**	**1,806,680**	**17,045,133**	**15,072,689**	**17,970,164**
Small gas turbines		459		91,300	*265,400*	32,900	2,654,599	1,125,370	336,493
Tunis sud		66		6,700	6,700	800	10,467	116,770	14,026
Korba		56		42.900	42.900	8.400	2.389.825	699.614	140.383
Kasserine		68		10,900	10,900	3,800	191,923	182,419	62,551
Ghannouch		44		7.200	7.200	7.100	62.383	126.567	119.533
Bouchemma		181	**N**	13,700	13,700	10,300		235,926	174,590
Sfax		44		9.900	9.900	2.500		164.123	43.082
Large gas turbines		590		1,413,500	1,413,500	1,773,600	14,311,906	13,940,369	17,629,568
Bir M'cherga		242		309,700	309,700	367,700		4,079,157	4,803,013
Bouchemma				299.000	299.000	217.100	5.851.053	3.921.650	2.857.030
Thyna	2004	119		368,300	368,300	633,500	5,340,263	4,561,309	7,814,369
Goulette	2005	119		92,800	92,800	76,800	731,183	1,170,839	983,270
Feriana	2005	110		343,700	343,700	478,500	2,389,407	4,286,571	5,974,899
Gas oil turbine stations		112		2,300	*1,700*	180	78,628	6,950	4,103
Sfax				0	0	0	40,110	0	0
M.Bourguiba		44		1,300	400	100	20,934	6,611	2,177
Métlaoui		0		0	0	0	0	0	0
Korba				0	0	0	0	151	251
Kasserine				0	0	0	0	188	0
Robbana		34		1,000	0	40	16,747	0	795
Zarzis		34		0	0	40	837	0	379
Bir M'cherga				0	100	60	0	1.210	1.298
Feriana				0	0	0	0	867	586
Goulette				0	100	100	0	1.210	963
Thyna				0	0	0	0	791	16.873
Combined Cycle power plants		**364**		**2,422,300**	**2,823,200**	**2,211,200**	**20,284,292**	**23,302,054**	**18,365,231**
Sousse		364		2,422,300	2,823,200	2,211,200	20,284,292	23,302,054	18,365,231
Renewable power plants		**82**		***208,400***	***191,100***	***188,100***	**0**	**0**	**0**
Hydropower plants		63		*166,000*	*153,500*	*145,200*	0	0	0
Sidi Salem		33					0	0	0
Fernana		10					0	0	0
Nebeur		13					0	0	0
Aroussia		5	**Y**				0	0	0
Kasseb		1					0	0	0
Bouherthma	2003	2					0	0	0
Sejnene		1					0	0	0
Wind powerplants		19		42,400	37,600	42,900	0	0	0
Centrale éolienne Sidi Daoud		19		42,400	37,600	42,900	0	0	0
IPPs		**498**		**2,904,900**	**2,864,000**	**3,054,400**			
Gas turbine power plants		471		2,765,200	2,864,000	3,054,400	22,650,588	23,265,378	25,429,744
Carthage Power Company (CPC) -Radés	2001	471		2,765,200	2,864,000	3,054,400	22,650,588	23,265,378	25,429,744
Combined Cycle power plants		27	**N**	139,700	0	0			
Société d'Electricité d'El Bibane (SEEB)-ElBibane	2003	27		139,700	0	0			
Autoproduction supplied to the grid				**59,300**	**51,100**	**55,600**			
14 industries				59,300	51,100	55,600			

Source of information
STEG - Direction des Etudes et de la Planification - Statistiques Rétrospectives d'Électricité 1997-2007
STEG - Rapport Annuel 2005 (for the year built)

Given the lack of data on electricity generation, fossil fuel consumption, and commissioning dates for some power plants, some assumptions have to be made for the calculations of both operating and build margin emission factors.

Note on FC and NCV

Emission factors (tCO_2/t fuel) are IPCC default values. The fuel consumption is given in tonnes of oil equivalent (converted to GJ in the calculations) by the national utility. This is equivalent to $FC_{i,m,y}$ x $NCV_{i,y}$ from the Tool[50]. FC and NCV are thus not individualised in the emission factors calculations. This is in line with the Tool since the fuel consumption in toe incorporates the NCV provided by the national utility. The table below summarises the electricity generation and fuel consumption information available.

[50] "Tool" in Annex 3 refers to the latest version of the "Tool to calculate the emission factor for an electricity system"

Calculation of the OM emission factor

Plant and type of fuel	Year of commission	Licensed capacity (MW)	Low-cost / must-run plant	$EG_{m,y}$ - Net electricity generated and delivered to the grid (MWh) 2005	2006	2007	Fuel consumption - $FC_{i,m,y}$*$NCV_{i,y}$ (GJ) 2005	2006	2007	EF_{OM} Option	$EF_{EL,m,y}$ (tCO_2/MWh) 2005	2006	2007	Emissions OM - tCO_2 ($EG_{m,y}$·$EF_{EL,m,y}$) 2005	2006	2007
Grand Total		***3,113***		***12,237,500***	***12,592,500***	***13,054,080***								***6,793,973***	***7,130,485***	***7,670,282***
Total for OM calculation				**12,237,500**	**12,592,500**	**13,054,080**										
STEG generation		**2,615**		**9,273,300**	**9,677,400**	**9,944,080**								**5,478,601**	**5,827,624**	**6,246,216**
Steam turbines power plants		1,090		**5,343,900**	**5,173,600**	**5,926,200**	**58,583,506**	**57,516,960**	**64,865,757**					3,165,791	3,427,703	3,930,221
Residual fuel oil		0		2,600	0	0	0	0						0	0	0
Goulette II				2,600	0	0	0	0	0	A1	0.000	0.000	0.000	0	0	0
Residual fuel oil (RFO) + natural gas (NG)		1,090		5,341,300	5,173,600	5,926,200	58,583,506	57,516,960	64,865,757					3,165,791	3,427,703	3,930,221
Ghannouch RFO		60		0	0	0	0	0	0	A1	0.000	0.000	0.000	0	0	0
Ghannouch NG				212,900	317,700	332,400	3,035,849	4,605,145	4,737,992	A1	0.799	0.812	0.798	170,008	257,888	265,328
Sousse RFO		320		0	62,800	27,400	0	733,862	305,134	A1	0.000	0.900	0.857	0	56,507	23,495
Sousse NG				1,437,900	1,193,400	1,707,600	15,977,457	13,709,718	19,064,384	A1	0.622	0.643	0.625	894,738	767,744	1,067,606
Radés 1A RFO		340		0	472,100	897,300	1,256,040	4,951,938	9,080,709	A1	0.000	0.808	0.779	0	381,299	699,215
Radés 1A NG				1,721,100	1,106,000	1,262,200	17,386,231	12,112,999	13,547,815	A1	0.566	0.613	0.601	973,629	678,328	758,678
Radés 1B RFO		370		0	411,600	466,800	795,492	4,159,586	4,792,169	A1	0.000	0.778	0.790	0	320,288	368,997
Radés 1B NG				1,969,400	1,610,000	1,232,500	20,132,437	17,243,713	13,337,554	A1	0.572	0.600	0.606	1,127,416	965,648	746,903
Gas turbine power plants		**1,161**		**1,507,100**	**1,680,600**	**1,806,680**	**17,045,133**	**15,072,689**	**17,970,164**					1,176,890	1,095,006	1,287,543
Small gas turbines		459		91,300	*265,400*	32,900	*2,654,599*	*1,125,370*	336,493		1.628	0.237	0.573	164,517	85,423	31,033
Tunis sud		66		6,700	6,700	800	10,467	116,770	14,026	A1	0.087	0.976	0.982	586	6,539	785
Korba		56		42,900	42,900	8,400	2,389,825	699,614	140,383	A1	3.120	0.913	0.936	133,830	39,178	7,861
Kasserine		68		10,900	10,900	3,800	191,923	182,419	62,551	A1	0.986	0.937	0.922	10,748	10,215	3,503
Ghannouch		44		7,200	7,200	7,100	62,383	126,567	119,533	A1	0.485	0.984	0.943	3,493	7,088	6,694
Bouchemma		181	N	13,700	13,700	10,300		235,926	174,590	A1/A2	0.672	0.964	0.949	9,206	13,212	9,777
Sfax		44		9,900	9,900	2,500		164,123	43,082	A1/A2	0.672	0.928	0.965	6,653	9,191	2,413
Large gas turbines		590		1,413,500	1,413,500	1,773,600	*14,311,906*	*13,940,369*	17,629,568		0.567	0.552	0.557	1,009,585	1,009,093	1,256,225
Bir M'cherga		242		309,700	309,700	367,700		4,079,157	4,803,013	A1/A2	0.672	0.738	0.731	208,118	228,433	268,969
Bouchemma				299,000	299,000	217,100	5,851,053	3,921,650	2,857,030	A1	1.096	0.734	0.737	327,659	219,612	159,994
Thyna	2004	119		368,300	368,300	633,500	5,340,263	4,561,309	7,814,369	A1	0.812	0.694	0.691	299,055	255,433	437,605
Goulette	2005	119		92,800	92,800	76,800	731,183	1,170,839	983,270	A1	0.441	0.707	0.717	40,946	65,567	55,063
Feriana	2005	110		343,700	343,700	478,500	2,389,407	4,286,571	5,974,899	A1	0.389	0.698	0.699	133,807	240,048	334,594
Gas oil turbine stations		112		2,300	*1,700*	180	*78,628*	*6,950*	4,103		2.530	0.303	1.687	2,788	489	285
Sfax				0	0	0	40,110	0	0	A1	0.000	0.000	0.000	0	0	0
M.Bourguiba		44		1,300	400	100	20,934	6,611	2,177	A1	1.192	1.223	1.611	1,549	489	161
Métlaoui				0	0	0	0	0	0	A1	0.000	0.000	0.000	0	0	0
Korba				0	0	0	0	151	251	A1	0.000	0.000	0.000	0	0	0
Kasserine				0	0	0	0	188	0	A1	0.000	0.000	0.000	0	0	0
Robbana		34		1,000	0	40	16,747	0	795	A1	1.239	0.000	1.472	1,239	0	59
Zarzis		34		0	0	40	837	0	879	A1	0.000	0.000	1.627	0	0	65
Combined Cycle power plants		**364**		**2,422,300**	**2,823,200**	**2,211,200**	**20,284,292**	**23,302,054**	**18,365,231**					**1,135,920**	**1,304,915**	**1,028,453**
Sousse		364		2,422,300	2,823,200	2,211,200	20,284,292	23,302,054	18,365,231	A1	0.469	0.462	0.465	1,135,920	1,304,915	1,028,453
IPPs		**498**		**2,904,900**	**2,864,000**	**3,054,400**								**1,315,372**	**1,302,861**	**1,424,066**
Gas turbine power plants		471		2,765,200	2,864,000	3,054,400	22,650,588	23,265,378	25,429,744					**1,268,433**	**1,302,861**	**1,424,066**
Carthage Power Company (CPC) - Radés	2001	471		2,765,200	2,864,000	3,054,400	22,650,588	23,265,378	25,429,744	A1	0.459	0.455	0.466	1,268,433	1,302,861	1,424,066
Combined Cycle power plants		27	N	139,700	0	0								**46,939**	**0**	**0**
Société d'Electricité d'El Bibane (SEEB)-ElBibane	2003	27		139,700	0	0				A2	0.336	0.336	0.336	46,939	0	0
Autoproduction supplied to the grid				**59,300**	**51,100**	**55,600**								**0**	**0**	**0**
14 industries				59,300	51,100	55,600				A3	0	0	0	0	0	0

Low-cost must run resources	2003	2004	2005	2006	2007
Generation (MWh)	199,400	197,200	208,400	191,100	188,100
% of total generation	1.82%	1.71%	1.67%	1.49%	1.42%

Results	
OM	**tCO_2/MWh**
2005	0.555
2006	0.566
2007	0.588
Average	**0.570**

Calculation of the BM emission factor

Plant and type of fuel	Year of commission	Licensed capacity (MW)	$EG_{m,y}$ - Net electricity generated and delivered to the grid (MWh)	Fuel consumption - $FC_{i,m,y}$*$NCV_{i,y}$	EF_{OM} Option	$EF_{EL,m,y}$ (tCO_2/MWh)	Emissions BM - tCO_2 ($EG_{m,y}$*$EF_{EL,m,y}$)
Total BM (option a = b)		***847.6***	***4,243,200***				*2,251,328*
Grand Total Grid		***3195.1***	***13,242,180***				
Total BM in % of Grand Total Grid			***32.0%***				
STEG generation		**349.6**	**1,188,800**	**14,772,538**			**827,262**
Gas turbine power plants		348	**1,188,800**	**14,772,538**			827,262
Large gas turbines			1,188,800	14,772,538			827,262
Thyna	2004	119	633,500	7,814,369		0.691	437,605
Goulette	2005	119	76,800	983,270	A1	0.717	55,063
Feriana	2005	110	478,500	5,974,899		0.699	334,594
Renewable power plants		2		**0**			
Hydropower plants				0			
Bouherthma	2003	2		0		0	
Sejnene	2005	1		0		0	
IPPs		**498**	**3,054,400**	**25,429,744**			**1,424,066**
Gas turbine power plants		471	3,054,400	25,429,744			**1,424,066**
Carthage Power Company (CPC) -Radés	2001	471	3,054,400	25,429,744	A1	0.466	1,424,066
Combined Cycle power plants		27	0				**0**
Société d'Electricité d'El Bibane (SEEB)-ElBibane	2003	27	0	0	A2	0.336	0

Results	tCO_2/MWh
BM	**0.531**

Calculation of the CM emission factor

Results	
	tCO_2/MWh
OM	0.570
BM	0.531
CM	**0.550**

Annex 4

MONITORING INFORMATION

All the monitoring information is indicated in the relevant sections of the PoA-DD.

- - - - -

Annex 5

STAKEHOLDER CONSULTATION

Announcement made on the ANME website in order to consult stakeholders on the PoA

Translation of the announcement:

"The ANME plans to register the Prosol programme with the Executive Board of the Clean Development Mechanism of the United Nations Convention of Climate Change in order to benefit from the sale of the emission reductions units generated under this mechanism. Revenues from the sale of these units will be used in order to strengthen the Prosol programme.

As part of the formal process of registration, the ANME publishes this notice in order to gather potential comments from the public on this project.

Comments can be sent to the ANME through the webmaster in the "Contact us" section or through the Infocom space in the section "Express yourself" or through email at the following address: boc@anme.nat.tn."