



A national Institute at the Polytechnic of Namibia

TERMS OF REFERENCE
CONSULTANCY

TO CONDUCT A PRE-FEASIBILITY STUDY FOR THE ESTABLISHMENT OF A PRE-COMMERCIAL
CONCENTRATED SOLAR POWER PLANT IN NAMIBIA

The Renewable Energy and Energy Efficiency Institute (REEEI) at the Polytechnic of Namibia of Namibia, on behalf of the Namibian Ministry of Mines and Energy (MME), seeks technical services on a pre-feasibility study for the establishment of a pre-commercial concentrated solar power plant in Namibia.

**PRE-FEASIBILITY STUDY FOR THE ESTABLISHMENT OF A PRE-COMMERCIAL CONCENTRATED
SOLAR POWER PLANT**

1. Background

In 2011, Namibia had 393 MW of installed generation capacity shared among three conventional power plants albeit the electrical peak demand was 590MW. Moreover the national power utility (NamPower) copes with a demand growth estimated at 3 percent per year. Consequently Namibia relies on imports from other Southern African Power Pool (SAPP) members to bridge the gap between electricity generation and demand. Concerns to secure electricity supply entail a revision of the current energy system as well as new power plants procurements in the years and decades to come. In this context, fossil-fuels power stations are generally considered due to lower investment requirement. For instance, the national power utility is currently studying a new coal-fired power plant in Erongo Region as well as the rehabilitation of the Van Eck coal-fired plant. However, decision-makers have identified renewable energy as having a strong potential and a role to play in the Namibia's power supply. The White Paper on Energy Policy of 1998 recognizes the benefits of renewable technologies with regard to sustainability and security of supply. Multiple technical considerations and country specific aspects indicate that concentrated solar power (CSP) could effectively challenge conventional energy. It is a commercially available technology that uses direct sunlight and mirrors to create high temperature steam to run conventional turbines. The utilization of thermal storage provides CSP plants with base-load characteristics and night-time generation possibility, thus increasing its capacity value. The countrywide solar regime is one of the best in the world with an average of 2,200kWh/m²/year and vast areas of wasteland with low ground slope cover the territory.

The purpose of the study, which is funded by the **MINISTRY FOR FOREIGN AFFAIRS OF FINLAND** through the **ENERGY AND ENVIRONMENT PARTNERSHIP WITH SOUTHERN AND EASTERN AFRICA (EEP S&EA)**, and the **MINISTRY OF MINES AND ENERGY OF NAMIBIA**, is, therefore, to provide a basis for triggering the development of concentrated solar power in Namibia. The pre-commercial plant will serve as a research and development (R&D) facility while generating power at the same time. The study will provide valuable input to the Concentrated Solar Power Technology Transfer for Electricity Generation in Namibia

(CSP TT NAM) project. CSP TT NAM is funded by the Global Environment Facility through the United Nations Development Programme (UNDP). The programme is implemented by REEEI on behalf of the Ministry of Mines and Energy (MME).

Scope of Services

The scope of consulting services includes the following key components:

(i) Nation-wide solar resource assessment

The first objective of the assignment is to provide a high resolution assessment of the solar resources in Namibia. The entire surface area of Namibia (approximately 824,000 km²) is analyzed in search of areas that hold the most promising solar potential for the application of CSP plants.

The assessment utilizes a minimum of ten (10) years of direct normal irradiance (DNI) data derived from second generation satellite data with 1 km x 1 km nadir resolution and auxiliary atmospheric data sets. Namibia being the most arid country of southern Africa, a particular attention is drawn to the impacts of aerosols concentration on direct normal irradiance. The influence of topography on solar irradiation at the surface is to be analyzed using a digital elevation model to derive slope and azimuth maps. Moreover, the methodology applied (e.g. satellites use to retrieve data, models) as well as the related accuracy and distribution statistics have to be clearly described.

Much of the information gathered are compared to other solar power sites around the world so as to provide perspective on Namibia's potential for establishing a CSP power plant.

(ii) Site selection and environmental analysis

An evaluation covering the entire country enables to select potential sites for the establishment of a 5 to 50 MWe CSP plant and possible solar parks. The evaluation process should lead to the selection of two (2) to five (5) sites. Upon receipt of the solar resource assessment, an attempt would be made to match high DNI potential sites with relatively short distances to the infrastructures, suitable geographic and geomorphic features and land availability. The evaluation also considers, thoroughly, social and environmental aspects since the selected sites must comply with the country's environmental regulations and provide economic benefits to the society.

Spatial remote and on-site analysis technologies, taking into consideration such variables as current land use, vegetation, soil types, risks, topography, hydrology are included. Existing electric transmission and substations, where grid connections could take place, are limited and the creation of new transmission substations and/or long transmission lines has a substantial impact on the capital investment. Therefore potential sites have to cope with distance to the grid. Similarly, selected site should be located relatively close to existing road infrastructures. Aquifers in Namibia are vulnerable and water availability is to be examined although dry cooling system designed for CSP plant prevents water abstraction. The list of selective parameters is not exhaustive.

Part of the outcome of the site selection and technology review would be the identification of regulatory issues associated with key areas of interest, especially the potential for adverse social and environmental impacts.

For shortlisted sites selected for further assessment, site reconnaissance visits by a qualified environmental and social analyst would be conducted, followed by a desk study of biophysical and socio-economic impacts and proposed mitigation measures. Alternative sites with potentially less impact would be considered.

Assumptions and limitations affecting analysis would be described. Gaps needing further study would be identified. Terms of reference for a full EIA would be suggested.

Public participation would not be included in the study at this stage of the project, though consultation with governmental authorities would be deemed best practice. Minutes of authority meetings would be prepared, with a list of issues identified.

All national and international laws, regulations, treaties, and guidelines which govern the environmental management of the project would be reviewed such that all legal processes required for the project are identified and included in the report.

(iii) High level technology review, including hybrid generation and business model

An important component of the study is to model several possible CSP technologies (for both electricity generation and large scale thermal applications) and plant configurations for a 5MWe or larger plant with the possibility of scaling it up to as large as 50MWe. The two first components of the study (i.e. solar resource assessment and site selection) would enable the study to elaborate a technology review according to site specific characteristics (e.g. solar irradiation, infrastructure access, water availability). Considerations includes wet/dry condenser cooling, with/without thermal storage and with/without hybrid (e.g. biomass, photovoltaic, gas) production or industrial co-generation (e.g. mining operations). The potential for hybrid power production is examined as a means of reducing the cost of electricity generated and of producing power when the sun is down or obscured by cloud cover. Such a plant would offer the substantial benefit of making dispatchable power available when most needed. The pre-feasibility study would compare two or more CSP technologies, selecting one that appears to have the best promise of cost-effective operation for different identified sites under Namibian conditions and evaluating the economic feasibility of that technology.

A business model for the development of the CSP plant is proposed after thorough investigation. Namibia welcomes the involvement of private sector in power development through the Independent Power Producer (IPP) framework.

(iv) Best practice on solar ground measurements

Satellite remote measurements do not provide data accurate enough to be fully “bankable”. Based on the results of the site selection, REEEI will undertake metrology procedures of solar ground measurement that would complement the solar resource assessment. The data retrieved from radiation sensors would give accurate and reliable data for a full feasibility study. Therefore, the pre-feasibility study integrates a description of the best practices to be applied for measurements on selected sites. The data accuracy or uncertainty levels required are evaluated and lead to a selection of relevant DNI measurement instruments (pyranometers and pyrhemometers). The selection takes into account instruments operation and maintenance efforts as well as cost-performances criteria. Instruments are recommended according to existing facilities and skills in Namibia. Moreover, the necessary and suitable redundancy of radiation sensors on sites is evaluated. Ideally, a potential CSP site will have several years of high-quality on-site measurements. Nevertheless, the study describes the techniques (e.g. ratio method) to determine on-site solar resources with a shorter period of measurement that would still permit to design systems and model energy performances in a feasibility study.

(v) Technology Transfer Program

The study evaluates a means of providing a technology transfer program to run in parallel with and after the development, construction and operation of the proposed CSP plant. The main purpose would be to provide a vehicle for technology transfer and development of skills necessary for the development of a CSP industry in Namibia. Providing a means for developing the necessary skills sets in CSP technology would not only benefit this particular project, but would be an important key component for the establishment and development of a

CSP sector in Namibia. As a point of departure, recommended foreign and national entities are identified to be part of the technology transfer program. For instance, national stakeholders which represent opportunities for CSP development (finance, construction, research & development) are enumerated as well as the possible partners that would transfer skills accordingly. Furthermore, the technology transfer process that would create the necessary capacities in Namibia with regard to CSP is designed. Trainings, capacity building and collaborations resulting in a constructive and successful technology transfer are described. Finally, pertinent financing tools and schemes that could be employed in Namibia for CSP development are designated. Considerations toward Namibian specific characteristics (e.g. middle income countries, low GHG emissions) are thoroughly integrated.

2. Duties and Responsibilities

In not more than 6 months the Consultant/s will be entrusted with the following responsibilities:

- 1) Work closely with key national implementing partners (e.g. MME, REEEI);
- 2) Undertake regular meetings with the implementing partners;
- 3) Meet with relevant stakeholders, which will include key national implementing partners, government counterparts, the private sector, financial institutions, civil society and academia, amongst other;
- 4) Organize and conduct workshops with all relevant stakeholders, to build partnerships and collaboration and raise awareness for the CSP project;
- 5) Prepare and deliver a document outlining the results of the pre-feasibility study for the establishment of a pre-commercial concentrated solar power plant in Namibia.

3. Competencies and Qualifications

Interested individual consulting teams should possess relevant experiences in the solar thermal sector. The minimum key expertise of the consultant(s) shall cover the following:

- Concentrated Solar Power expertise, with at least 10 years of proven experience in this field and familiarity with solar resource assessment, site selection, technology review and technology transfer.
- Multiple references on similar studies previously accomplished.
- Strong research background in solar thermal energy.
- The team of experts required for this assignment is expected to have appropriate qualifications and professional experience in geographical analysis, atmospheric science, meteorological data processing, and renewable energy technology and business development or equivalents.

4. Reporting Timelines

The **PRE-FEASIBILITY STUDY FOR THE ESTABLISHMENT OF A PRE-COMMERCIAL CONCENTRATED SOLAR POWER PLANT IN NAMIBIA** is requested with the expectation that the work will not take longer **6 months (February - July 2012)**. The consultant will report to the REEEI at the Polytechnic of Namibia and, as applicable, to a multi-disciplinary team comprised of the MME, UNDP and key stakeholders. Payments schedules will be in accordance with the delivery of specific outputs to be agreed with the selected consultant, with the following tentative schedule for each deliverable:

- a) Acceptance and commencement of duties, by no later than **01 February 2012**;
- b) Inception meeting with the principal parties (e.g. REEEI, MME, UNDP), with a schedule and definite timetable for the overall consultancy, by no later than **10 February 2012**;
- c) Draft version of deliverables, by no later than **23 February 2012**;

- d) Presentation of the First Draft for final version of the pre-feasibility study, by no later than **24 May 2012**;
- e) Presentation of the Final Draft by no later than **21 June 2012**;
- f) Workshop on the draft version, by no later **5 July 2012**;
- g) Submission of final deliverables, incorporating all stakeholder comments, by no later than **31 July 2012**.

5. Submission and Evaluation Process

The consultants are required to submit **TWO (2)** separate and clearly marked proposals; Technical and Financial. The proposals are evaluated based on their technical and financial strengths.

a) **Technical Proposal Evaluation Criteria** (with Total Possible **Score of 100%**):

Phase 1: Expertise of Firm/Organization Submitting Proposal (with Total Possible **Score of 30%**).

Areas to take note of in the Submission include: Reputation of organisation and staff in terms of competence /reliability; Expertise in data collection, verification and analysis; General organisational capability which is likely to affect implementation (i.e. loose consortium, holding company or one firm, size of the firm/organisation, strength of project management support e.g. project financing capacity and project management controls); Extent to which any work would be subcontracted (subcontracting carries additional risks which may affect project implementation, but if properly done it offers a chance to access specialised skills; Experience in building services sector, with at least TEN (10) years of expertise in the field; Relevance of specialized knowledge, experience on similar projects, experience in the Southern African Development Community region and work with major multi-lateral and bi-lateral programmes.

Phase 2: Proposed Work Plan and Approach (with Total Possible **Score of 50%**). **Areas to take note of in the Submission include:** Understanding of the task; sufficient addressing of the important aspects of the task; relating different components of the project; understanding of the project environment; appropriateness to the task of the conceptual framework adopted; defining and relating the scope of task to the Terms of Reference; clarity and organization of activities and whether the planning is logical and realistic.

Phase 3: Personnel; educational background and experience in similar assignment and knowledge of region (with Total Possible **Score of 20%**). **Areas to take note of in the Submission include:** Proposed team's qualifications and relevance to the assignment; professional experience; knowledge of the region and its renewable energy sector.

b) **Financial Proposal Evaluation Criteria:**

The Consultant/Organization(s) with a score of **80%** and above in the Technical Proposal Evaluation proceed(s) to the Financial Proposal Evaluation, and the lowest bid is recommended.

6. Anti corruption and illegal practices

The tender can be rejected or can be cancelled in case any illegal or corrupt practices are found to be connected with the award or the execution of the contract. No offer, gift, payment or benefit, which would or could be construed as an illegal or corrupt practice, shall be accepted, either directly or indirectly as an inducement or reward for the award or execution of procurement contracts.

7. Submission of Brief Letter including CVs and Technical –and Financial Proposals

Interested consultants must provide clear and specific evidence of their background, qualifications and experience relevant to the writing of pre-feasibility study proposals and project documents; a proposal outlining

how the consultant proposes to undertake the work, the process and timeframes; and, a quote to complete the work, all of which must be submitted in hardcopies to:

The Coordinator
Renewable Energy & Energy Efficiency Institute
Office of the Rector
Polytechnic of Namibia
13 Storch Street
Private Bag 13388
Windhoek-Namibia
Tel: +264-(0)61 207 2154
Fax: +264 (0)61 207 2059;

OR,

by e-mail to the REEEI at: reeei@polytechnic.edu.na

Note: All submissions must clearly indicate **“TENDER NO. 20/2011: PRE-FEASIBILITY STUDY FOR THE ESTABLISHMENT OF A PRE-COMMERCIAL CONCENTRATED SOLAR POWER PLANT IN NAMIBIA Proposal”** on the subject line

The deadline for applications is **16h30-Namibian Time, Wednesday, 16 January 2012**