TERMS OF REFERENCE

Expert Mission for Assistance in a Study on 2050 Power-To-X Roadmap for Morocco

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General Introduction

Morocco has a very high renewable energy capacity potential. The country's potential is estimated at 20GW for solar, 25GW for onshore wind and 250GW for offshore wind.
Moreover, since 2009, the Kingdom of Morocco has been driven by a proactive policy of large-scale renewable energy deployment. In fact, the country has been able to put in place a legal, regulatory and institutional framework beneficial to the development of this sector. In the same way, an industrial, research development (R&D), and training ecosystems have been developed to support the Moroccan renewable plan.

Morocco's commitment on this path is reflected by its vision to achieve 42% of the electricity capacity from renewable energies by 2020, and at least 52% by 2030, out of a total installed capacity of around 14 and 22 GW respectively.

Morocco is therefore joining a global trend observed over the past ten years, which has resulted in an increasing penetration of renewable energies into the energy mix of many countries worldwide. This dynamic has resulted in a substantial drop in the kilowatt-hour price of renewable electricity to record low levels. Indeed, a photovoltaic (PV) solar project in Mexico recently broke the world record for PV by being auctioned at about 1.6 c€/kWh (16€/MWh). In August 2019, this record was crushed by 150MW PV bid in Portugal, with a kilowatt-hour price of 1.47c€/kWh (14.76€/MWh).The world record for wind energy was set for many years in Morocco for the integrated wind project, with a rate of less than 3 c€/kWh (30€/MWh). Recently, this record was broken by a bid in Mexico 1.7 c€/kWh.

This important reduction in renewable energy tariffs further encourages governments to install even more renewable energy capacity. However, the massive installation of these variable renewable sources (solar, wind) can be a challenge for electricity networks and systems.

While electricity storage costs are falling, mainly for batteries, some manufacturers and R&D institutes are considering alternative uses for storing renewable electricity. This is a new paradigm commonly referred to as "Power-to-X". The X can be replaced by: heat, hydrogen, gas, liquid, or chemical elements more generally.

Power-to-X has gained increasing interest around the world in recent years, particularly in Germany, France, the Netherlands, Japan, South Africa, Chile and Morocco.

Hydrogen and, increasingly, ammonia, are among the most interesting molecules for the "Power-to-X" process. These raw materials are used in several industrial processes. Thus, producing them in a green way, using dedicated renewable plants and via electrolysis in addition to the renewable energy first dedicated to the grid system, is a real step towards reducing emissions of the heavy industry and the transport sectors. In this perspective, hydrogen is of real interest because, in addition to its direct use (hydrogen vehicles, industrial gases, etc.), it could also be used in the recycling of CO2 (Syngas) into various molecules and hydrocarbons, starting with methane and methanol for example.

Ammonia has the advantage of being easier to transport than hydrogen. Ammonia is obtained from hydrogen and nitrogen (via the "Haber-Bosch" process) and, on the other hand, it is possible to "crack" the ammonia molecule to return to hydrogen, but both processes can have energy losses. Ammonia is therefore identified as a good hydrogen carrier.

Morocco's strategic geographical proximity to Europe, along with its exceptional potential in wind and solar energy, particularly in the south of the country, as well as its current and future port and gas infrastructure, make it a potential supplier of green molecules with very high added value[1].

Finally, Morocco's interest in ammonia is also based on the fertilizer industry since the leading Moroccan group, the public OCP Group, has significant market shares worldwide. Ammonia happens to be an essential raw material for the production of fertilizers (about 80% of the world's ammonia production is directed towards the fertilizer industry). This year, OCP will import about 2 million tons (MT) of ammonia, or more than 1% of the world production of this molecule (170MT), for the sole purpose of its Jorf Lasfar site. A domestic production of ammonia (green and competitive) would represent for Morocco not only an opportunity for independence but also an opportunity to diversify its traditional markets.

Context and project description

Created in 2011, the Research Institute for Solar Energy and New Energies (IRESEN) is at the heart of the national energy strategy in The Kingdom of Morocco, by its position in the fields of applied research and innovation.

Activities on "Power to X" in Morocco, initiated and driven mainly by IRESEN, have received Ministerial commitment within the framework of the German-Moroccan Energy Partnership (PAREMA).

The Moroccan-German Energy Partnership (PAREMA) was created in July 2012 with the signature of the joint declaration of intent on ministerial level of both countries. The objectives that have been defined are increased cooperation on renewable energy, energy efficiency and electricity grids.

The GIZ has been assigned by the Federal Ministry of Economy and Energy (BMWi) to support its global energy partnerships with various partner countries (Algeria, Brazil, China, India, Mexico, Morocco, Tunisia and South Africa.

In February 2019, a joint PAREMA-IRESEN workshop on "Power to X" (PtX) and its opportunities in Morocco was held in presence of H.E. the Minister of Energy Aziz Rabbah. It presented and discussed of a preliminary study carried out by Fraunhofer ISI Institute on the opportunities, potential and recommendations for Morocco (funded by GIZ PAREMA).

The result of this study revealed that Morocco could capture a significant share of the world demand for PtX, estimated at 2-4% in 2030, thanks to the important potential in wind and solar energy. The geographic proximity to Europe may facilitate exports of liquids and reduce emissions related to transport in the long-term. The results also showed that Morocco's local market gives enough reasons for the development of "green ammonia" as it offers opportunities to meet the needs of its huge fertilizer industry and the international market in the longer term.

[1] Meaningful only under the condition that environmental and economic efficiencies are valuable and considered, since the priority is to use renewables to meet Morocco's own energy needs.

Based on the discussion and results of the workshop, the Minister of Energy has decided on the creation of a national task force in charge of preparing a PtX roadmap, as well as the elaboration of a new in-depth study to prepare the roadmap for the PtX in Morocco.

Supported by a consortium of public and private actors, the national task force has been named and is composed of:

The Ministry of Energy, Mines and Sustainable Development (MEMDD), the Ministry of Economy and Finance (MEF), the Ministry of Industry, Trade and Investment and the Digital Economy (MICIEN), the National Office for Hydrocarbons and Mines (ONHYM), the National Office for Electricity and Drinking Water (ONEE), the Research Institute for Solar Energy and New Energies (IRESEN), the Cherifian Phosphate Office (OCP), the Moroccan Federation of Energy (FME), Ministry of Education and Training, Higher Education and Scientific Research (ENSSUP), the National Center for Scientific and Technical Research (CNRST) and the Moroccan Agency for Sustainable Energy (MASEN).

Objective of this call for tender

The previous study identified the opportunities of "Power to X" and its sub-sectors in Morocco. The objective of the second in-depth study is to present a dedicated roadmap for establishing a global PtX industry in Morocco over the next decades (2050) including assessing its feasibility, as well as concrete steps to materialize the roadmap on the ground. This in-depth study funded by GIZ will be carried out by an international consultancy team.

Via this call for tender, IRESEN is hereby intending, to recruit a Moroccan consultant/expert who will be supporting the international team as well as IRESEN and GIZ in conducting the in-depth study. This support will consist in the tasks specified in the next section (Scope of Work).

The estimated effort of the Moroccan consultant/expert is estimated to be around 25 Person.Days, to be distributed on 4 months (end of October 2019 – end of February 2020). The final results of the in-depth study will be delivered in a workshop to the Moroccan Commission on Power-To-X.

Scope of Work

The Moroccan consultant will act as a facilitator to the international consultancy team to guide them in their mission. This includes (but not limited to):

- Providing necessary input data on Moroccan sectorial strategies to complete their missions
- Putting them in contact with specific public and private stakeholders
- Preparing the ground for the successful completion of their meetings and interviews,

The Moroccan consultant/expert's contribution is described as follows under 4 distinct tasks:

Task 1- Collection of the information necessary for the work of the international team: All relevant Documents, Studies, Questionnaires, Articles, Interviews, Roadmaps…from different Moroccan sectors related to the Power-To-X economy (Energy, Industry, International Trade, Transport, Infrastructure, Environment, etc.)

Task 2- Organisation of appointments, meetings and interviews of the international team with Moroccan stakeholders relevant to the subject:
Assist and manage meetings with stakeholders in Morocco such as: The Ministry of Energy, Mines and Sustainable Development (MEMDD), the Ministry of Economy and Finance (MEF), the Ministry of Industry, Trade and Investment and the Digital Economy (MICIEN), the National Office for Hydrocarbons and Mines (ONHYM), the National Office for Electricity and Drinking Water (ONEE), OCP Group, Moroccan Agency for Sustainable Energy, the Ministry of Education and Training, Higher Education and Scientific Research (MENSSUP), Ministry of Equipment, Transport, Logistics and Water (METLE), Moroccan Highways Company (Autoroute du Maroc – ADM), etc.

Task 3- Support the IRESEN-GIZ / PAREMA project team:
Assist the project team by monitoring the progress of the work of the international team throughout its mission via meetings, conference calls, mailing, periodic reports…

Task4- Organisation of the workshop to present the final results of the study and adaptation in French the deliverables of the study:
The workshop will take place at the end of the study, to present the action plans that shall cover: RD&I, training, local content, industry, investment, regulation and policies, infrastructure and other relevant aspects identified.

Application form and documents

In order to apply, please address the following documents:

- Curriculum vitae of the expert/consultant
- List of relevant references in relation to the proposed mission
- **A technical offer:** summary document (maximum 10 pages) presenting the consultant's vision of the execution of the mission: work methodology and volume, detailed activities, planning organization, deliverables
- **A financial offer:** explaining in detail the relationship between the cost and the activities performed, as well as payment conditions depending on the planning, deliverables and milestones to be achieved

Confidentiality

This study is considered to be strictly confidential. Therefore, the successful Moroccan expert/consultant will work under a Non-Disclosure Agreement to be signed at the kick-off meeting of the mission.

Deliverables and expected deadlines

The successful Moroccan consultant/expert will be responsible for providing the following deliverables:

Deliverables	Format (*)	Deadlines
Methodological note	Approx.5* pages in English (Word)	First week after kick-off
Weekly reporting on: • exchanges with the international experts, and main points discussed, • all data and information provided for support, • Potential remarks, comments, and recommendations. ***N.B***: Documents, Studies, Questionnaires, Articles, Interviews, and Roadmaps shared with international expert could be delivered in separate files.	In English Word and/or PPT format (Approx. 5* pages/slides)	Monday of each week after the First week after kick-off
Final synthetic and global report on the conducted mission	In French Word and PPT format (Approx. 30pages/30slides respectively) *	1 week before the workshop (around February 2020)

(*) Excluding appendices

The detailed planning above must be confirmed and adapted, if necessary, in consultation with the international expert, IRESEN and the GIZ PAREMA project team. The tasks may also be slightly altered within the scope of the assignment.

Consultant/Expert Minimal Qualifications/Requirements

To succeed in this mission, the Moroccan consultant/expert should fulfil the following minimal qualifications and requirements (A team of experts may be acceptable, provided that the work volume remains within the estimation given above):

- Relevant university degree (Masters of Science, PhD) and training/certifications in: Energy, Chemical Engineering, Renewables, with qualifications in Economics, Econometrics or any other relevant field
- Language: Very good skills in written and spoken English, French and Arabic
- A confirmed experience in the energy sector (+10 years)
- Acute awareness of the deployment of new sectorial strategies in Morocco
- Strong knowledge about the Moroccan industry, in particular the energy ecosystem, with a clear vision on the potential of the local industrial content
- Proven track record of collaborations and/or strong networking with the Moroccan energy stakeholders
- Desirable specific professional experience:
    - Awareness about the "Power-To-X" paradigm
    - Experience of collaboration with international cooperation projects
    - Experience or collaboration with ministries/public actors
    - Experience in elaboration of industrial or policy roadmaps and actions plans

Offer Submission and Assessment

The submitted offer must be fully in accordance with the provisions of this document. In addition, the offer must have a clear structure and cover all the elements of the Terms of References embodied in this document.

The offer with all the supporting documents shall be submitted under seal on a paper format, to IRESEN before **Monday October 21st, 2019 at 4pm**:

IRESEN – Institut de Recherche en Energie Solaire et Energies Nouvelles
16, rue Amir Sidi Mohamed
Souissi – Rabat, MAROC

The offers received will be opened in a public session on **Tuesday October 22nd , 2019, at 10h30** at IRESEN's office in Rabat.

The assessment will take into consideration both technical and financial elements on an equal basis (50/50).