Expression of interest to participate in SREP[1]

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[1]The expression of interest should not exceed 10 pages, including tables, charts, and annexes.

I. Country and Government Agency Submitting Expression ofInterest

State of Eritrea

Ministry of Energy and Mines

Department of Energy

II. Description of the Country and Energy Sector Context

Please provide a summary of the country and energy sector context, including resource potential for developing renewable energy, status of energy access (population with access to electricity), renewable energy policies, targets, and implementation measures.

Eritrea is located along the west coast of the Red Sea in east Africa. It is bordered with Djibouti to the south; Ethiopia to the south andSouthWest; and with Sudan to the Westand North West. The country has a total land mass of 125,000 square km and 2,234 km of coastline along the Red Sea.

No population census has been done since independence; however, based on some population counts and estimated growth rate the population is estimated to beabout 4 million.

Eritrea is one of the poorest countries in the world it ranked 177 out of 187 countries as indicated in the human development index (HDI) report of 2011, GNI per capita (constant 2005 PPP $) was 536. According to human development index (HDI) report of 2011, life expectancy at birth (year) was 61.6% or health adjusted life expectancy is 55; whereas Adult literacy rate (% age 15 and above was 66.6%) or gross primary school enrolment ratio is 48.3%.

The situation of Eritrea's energy supply system is characterized by massive dependence on traditional/biomass fuels to cover domestic energy requirements, lack of easy access by more than three quarters of the population to modern energy, and total reliance on imported oil as a source of modern energy services in particular electricity. Particularly, rural communities in Eritrea have poor access to modern energy, both for subsistence and productive purposes. In 2009, the total final energy consumption was 81.9% biomass-based (dung, agricultural residue, wood and charcoal), 14.9% from oil products and 3.3% from electricity. Biomass based energy accounted for 94.5% in the household energy mix, implying only 5.4% contribution from commercial energy (electricity, kerosene and LPG), which is indicative of the extremely poor access of the population to modern energy services even in comparison with Sub-Saharan Africa. At the national level, and as per the 2002 Eritrean Demographic and Health Survey, only 32% of the population has access to electricity (78% in urban areas compared to 3% in rural areas).

Despite a huge potential of renewable energy resources as well as their expected key role in the energy policy in Eritrea, including wind, solar, and geothermal, their development has been rather slow. Therefore, contribution of renewable energy to the total supply mix is negligible. For 2009 total energy supply was 716 thousand tons of oil equivalent; of which modern energy (oil product) accounted for only 21.1%, whereas, contribution of renewable energy was only 0.04% of the total supply. The 2009 total final energy consumption was 627 thousand tons of oil equivalent of which 83.7% is accounted for by the household sector, 8% by the public and commercial 6.3% by

transport and 2.1% by the manufacturing industry. These figures also reveal that energy is dominantly consumed by household sector, which is an indication of low level of economic development of the country.

High Poverty level and poor access to modern energy in rural areas: The poor constitute about 66 percent of the Eritrean population, of which about two-thirds live in rural areas.About 70%of the population lives in rural and semi urban areas where the present level of access to electricity is still around 5%. At the national level, The Department of Energy recent figures indicate that about 38% of Eritreans have already the access or soon will have the access as over 120 villages are in the pipeline. The lifestyle of the rural poor cannot be transformed to modern and acceptable lifestyle unless the Government and its development partners coordinate their efforts to cover or at least share the costs of modern infrastructures like energy and water, transport and communications and to facilitate various farm and non-farm income generating activities. The rural electrification initiative in the country is a reflection of this national drive.

The above description is indicative of the poor level of modern energy penetration in the country. Hence to reverse this situation and develop the energy sector, the government has put the development of the energy sector at the forefront in the national development program, the sector receiving top priority.

Renewable Energy Resources

Wind Energy: Eritrea has a high potential for wind energy applications ranging from Class1 to 7. The potential for class 6-7 wind speed ideal for electricity generation is extending for more than 300 km in the southern coastal area and in some wind passes in the central highlands. Wind water pumping for human and livestock consumption and irrigation agricultural production could be installed anywhere in the country as per the wind resource assessment done by the Ministry of Energy and Mines. Ice making for fishermen and sea water pumping to salt fields along the coasts are among the productive functions of wind energy that we would like to promote. Larger wind farms in the vicinity of the electric load centres of the central highlands, specifically Dekemhare and Gizgiza areas are feasible for development to feed the national grid. A pilot wind farm of 3X250Kw has been installed to strengthen the Assab grid.

Solar Radiation: The average annual global radiation in Eritrea is around 2200 kWh/m^2 per year for most of the highland regions. There is no doubt that Eritrea has a very high potential for utilization of solar energy. Possible uses are solar photovoltaic systems, solar water heaters and sterilizers, solar crop dryers and tobacco curing, solar desalination plants, solar cooling and refrigeration, solar thermal electricity generation and are among the investment opportunities. Solar systems installed in the country are mostly for welfare focused applications like village water pumping, powering health centers/ stations, educational facilities, communications, light homes, even water pumping for drip irrigation purposes etc. With more effort it is possible to equip households in remote areas with similar solar home systems. With more finance it is possible to feed the national grid with solar systems.

Geothermal Energy: Eritrea is located within the East African Rift Valley System where the geothermal energy potential is real. Preliminary measurements at the volcanic mountain Alid indicate an underlying hydrothermal reservoir with a temperature in the range of 250 - 350^oC with water to rock ratio high enough for a developable hydro-thermal electricity generation system.

Notwithstanding the need for detailed feasibility study, appears that Eritrea has great prospect to develop and benefit from this potential resource.

The Ministry proposes concrete steps to be taken to undertake detailed assessment of the geothermal resource potential at MountAlid. Such an assessment will lead to the development of the potential in Alid, and open an opportunity to further assessment and development of similar resources potential in Southern Red Sea Region.

Studies sponsored by USAID have concluded that the water to rock ratio in the reservoir is high enough for a developable hydro-thermal system. It appears as possible to install one or several power stations in this area. The distance to the existing transmission line is not more than about 100 km, which makes the site even more interesting for development. More detailed studies are however necessary for an assessment of the financial and environmental feasibility of exploiting this geothermal resource.

Therefore, the Government is committed to expedite the uptake of renewable energy resources, and has introduced a number of policy measures to promote them. The efficient, reliable and sustainable production and supply of affordable energy throughout Eritrea is the primary objective of the Government's policy in the energy sector on both grounds of economics and social development. This policy incorporates the management of energy utilization, and promotional and regulatory activities of renewable energy and energy conservation.

This will definitely require huge investment on improving the efficiency of the existing energy infrastructures and installing additional capacity as well as upgrading institutional competence compatible with the need for proper sector management.

In regard to the Renewable Energy Development the main policies are:

◊ Identify and exploit the commercial potential of renewable energy sources for community benefits, the worth of environmental benefits being included in the assessment. In particular, support the application in isolated rural areas where alternative refined energy is not readily available. Such sources will include:

- solar - PV, until the cost is competitive, give priority to high value community based projects, including mini-grids and grid connected;
- develop and promote solar thermal applications, in particular domestic ovens and water heating medical sterilization equipment;

- wind energy applications, in particular, wind turbines for electricity generation, both grid connected and smaller isolated systems, for water pumping for domestic and agricultural use;
- assess the potentials and conduct feasibility studies to develop geothermal for electricity generation;

◊ Implement action programs aimed at reducing Eritrea's dependence on biomass and other delectable conventional fuels. In particular, undertake the following:

- Improve the efficiency of biomass use, in particular the traditional three stone stoves, to introduce organic waste digesters for electricity generation and local direct use, and briquette manufacture from agricultural residue. Such developments will be vigorously promoted, particularly in isolated rural areas;
- Develop and promote energy efficient processes and products, using refined fuels to replace biomass;

To enhance the progress toward its renewable energy and energy accessibility objectives, the Eritrean Government is wishing financing from the Scaling Up Renewable Energy in Low Income Countries Program (SREP) for investments in wind, geothermal, and solar development.

III. Rationale for Selected Sectors for SREP Financing

Please identify barriers for the deployment of renewable energy, potential sector, sub-subsectors, and technologies for possible SREP financing as well as the rationale for prioritizing them for SREP interventions.

The major barriers and constraints facing the development and penetration of renewableenergy in Eritrea include, among other things

◊ **Economic and Financial Barriers:** High Initial Capital Cost of Renewable Energies Technologies and lack of available finance; Lack of credit facilities necessary for promoting their widespread application as well as financing mechanisms and other incentives to facilitate investment, promotion and dissemination of RETs; High risk associated with geothermal drilling;

◊ **Technical and Human capacity:** Low public awareness about the efficacy and potency of RE technologies (RETs). Lack of training and capacity building especially at local level; almost all renewable energy technologies are imported; there, is lack of locally developed and adapted technologies that fit with local conditions; moreover, the technology is new to the country, so that there is lack of technology transfer, and training experience hence the country have human resource constraint;

◊ **Technology transfer:** the commercial laws and regulations of the country of relevance to the promotion of foreign direct investment, technology and knowhow transfer in the energy sector will require to be updated.

These barriers not only reduce the size of the market but also reduce the economic potential by swelling the cost of the technology. The actual size of the market for renewable energy technologies to a greater extent depends on how well these barriers are addressed.

Awareness of the benefits and impacts of renewable energy technologies by final consumers and promoters, building technical capacity of local technicians and the market infrastructure, putting appropriate financing mechanism in place and providing an integrated barrier removal approach through policy supports will have a vital impact in the realization of the full size of the market for these technologies.

Therefore, the Government of Eritrea will expect the provision of initial capital cost needed for barrier removal measures from its development partners like (SREP) that will ultimately make the transition from the presently expensive renewable energy sources to more affordable RETs deployment scenario to the public. SREP financing will support the development of Eritrea's geothermal resources and the design of a long-term sectoral strategy for diversifying the Eritrean energy mix and providing valuable base load capacity at low cost and with limited environmental impact. Moreover, SREP financing will expect to support the development of mini grid or grid connected wind or solar electricity generation in order to enhance renewable energy-based products and services. Also SREP financing will expect to support even to prepare an SREP investment plan.

IV. Enabling Policy and Regulatory Environment,

Please provide an overview of the existing policies legal framework, market and regulatory structure for renewable energy development and the potential impacts of public and private sector interventions in addressing the barriers. Discuss the existing regulatory environment for attracting private investments in renewable energy technologies and governance within the energy sector, including commercial performance of relevant institutions, pricing and tariff practices, competitive procurement of goods and services, the transparency and accountability of these practices and the degree to which they are subject to public oversight.

The Ministry of Energy and Mines (MoEM) is mandated by both the Policy and the Law for overall coordination of the Energy Sector. It is also responsible for formulation and articulation of policies through which it provides an enabling environment to all operators and other stakeholders in the energy sector.

The energy sector policy has drafted in 2009 to enable increased private sector participation in the development of the sector whilst simultaneously focusing on improved management and delivery of energy services. This was intended to enable the sector address its mission of providing clean, sustainable, affordable, reliable and secure energy services at least cost while protecting the environment.

The primary objective in the energy sector is ***"to avail ample, dependable and sustainable energy for the growing needs of all sectors in Eritrea at an affordable price".*** This objective comprises of economic, financial and equity goals. The financial and economic goals take into account that energy is one of the basic needs of life but not a free public good. Its price has to reflect its true costs including, wherever possible, all externality costs of securing and delivering it.These goals guarantee sustainability and expansion of energy supply by establishing a reliable system that ensures all agents who use energy pay for it. This in a way stands in stark contradiction with the goal of social equity, which recognizes energy as a basic need of life and aims at making it

accessible to all at an affordable price. The realization of this goal takes a much wider policy consideration and intervention that goes beyond energy policy.

Energy Sector Policy and Objectives

The overall objective of the **Energy Sector Policy** is to contribute to the country's sustainable development through the provision of affordable energy services in order to increase access to electricity and promote socio-economic activities.

The general objectives of the energy policy are:

- To ensure a reliable supply of energy at the right time and at affordable prices, particularly to support the country's agricultural and industrial development strategies adopted by the GoE.
- To ensure and encourage a gradual shift from the use of traditional energy sources to modern energy sources.
- To streamline and remove bottlenecks encountered in the development and utilization of energy resources and to give priority to the development of indigenous energy resources with a goal toward attaining self-sufficiency.
- To set general guidelines and strategies for the development and supply of energy resources;
- To increase energy utilization efficiency and reduce energy wastage; and,
- To ensure that the development and utilization of energy is benign to the environment.

The specific objectives of the Energy Policy, among other things are:

(i) meeting the energy needs in quality, quantity and cost;
(ii) ensuring the protection of persons, property and environment against therisks of inappropriate energy services;
(iii) strengthening the capacities of policy, management, monitoring and control of the energy sector; and
(iv) strengthening the benefits of international cooperation in the field of energy. In terms of guiding principles, these are based on decentralization, liberalization, a programmatic and participatory approach, competitiveness and on the implementation of public-private partnerships.

The energy sector policy constitutes a tool for: (i) establishing a better match between energy availability and national socio-economic development; (ii) fostering synergies between the activities of major stakeholders in the energy sector; (iii) effectively directing the interventions of public, para-public and private actors of the energy sector for a rapid, balanced, and sustainable development of the country; and (iv) ensuring a better balance between energy supply and demand with a view to improve access to electrification and reduce geographic unbalances between the grid and off-grid areas covered.

V. Institutional and Technical Capacity

Please provide an analysis of the institutional and technical capacity for implementation, including the government's ability to effectively absorb additional funds. Please also provide a preliminary assessment of potential implementation risks.

Eritrea, has sufficient institutional and technical capacity to implement the projects to be supported under SREP, including the resources to be leveraged.

Institutional Aspects: Major reforms in the energy sector have established an efficient and transparent institutional framework. To this effect the electricity subsector has been restructured in 2004 by the proclamation number 142/2004 to corporatize the sector and open a door for private investors in the sector.

Technical and Managerial Aspects: The implementing agencies of the SREP-funded activitiesis Ministry of Energy and Mines; it is sufficiently equipped in terms of technical and managerial capacity. Ministry of Energy and Mines has substantial working experience with EU, World Bank, BADEA and other MDBs. and other development partners. On-going activities supported by development partners have been providing training to enhance its capacity further.

The following are the key actors in the sector:-.

Ministry of Energy & Mines (MoEM)

It is responsible for formulation and articulation of energy policies through which it provides an enabling environment for all stakeholders. Its tasks include national energy planning, training of manpower and mobilization of financial resources.

Department of Energy (DoE)

It is regulator of the energy sector, responsible for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors. Its functions also include tariff setting, draft and enforce laws, regulations and standards for the energy sector. The oil and electricity tariffs of the country are set by the Ministry of Energy and Mines.

Eritrea Electricity Corporation (EEC)

EEC is a state corporation responsible for electric power generation, transmission and distribution of electricity consumed in the country. It was restructured as a corporation in the year 2004 by the proclamation number 142/2004 in order to provide efficient, dependable, cost-effective and environmentally safe generation, transmission and distribution of electricity for sale to the Eritrean public. Despite Eritrea endowed renewable energy resources, it depends on thermal generation; its renewable source of electricity accounted for about 2%. So far, the electrification program of the country has not been progressing in a pre-planned way but it has rather been dependent on availability of funds, which in turn has made the electrification rate unpredictable.

Eritrea Petroleum Corporation (EPC)

At present, Eritrea is totally dependent on imported oil products to meet its modern energy requirements. This makes the country's energy supply and economy extremely vulnerable to international oil price increases. The continuous rise in demand for oil and cost of its importation is exerting heavy impact on the economy. This will continue to be so until the economy is developed and is able to generate sufficient foreign exchange and thus hedge the effects of rising oil prices.

For strategic and economic reasons the importation and retail price setting of petroleum products has been regulated by the government. The Eritrean Petroleum Corporation (EPC) is mandated to assume the responsibility of importing petroleum products to the country. The storage and retail distribution segment of the business is left to the private sector.

Renewable Energy Center (REC)

The main mission of REC is to build and increase the applications of renewable energy and energy efficiency technologies in Eritrea through: promoting local resources, technology transfer, market development and local capacity building. Eritrea's high dependence on imported oil can be reduced by increasing the share of indigenous renewable energy resources in the total energy mix and hence the REC of the Department of Energy has been working to assess and develop these resources. Biomass is the most used renewable energy resource in Eritrea. Wind, solar and geothermal resources have been found to be abundant and are expected to be the energy source of the future.

Appreciable investment has been made by the Government in the last years since independence on energy infrastructure and institutional capacity development. Some of the major actions taken to address the energy problems include the following. These achievements also demonstrate the project implementation capability and experience of the country;

- Power generation capacity has increased from less than 30 MW in 1991 to around 134 MW by 2003;
- The length of transmission lines has increased from less than 150 km to over 350 kmthat of the distribution lines has increased from 800 km to over 2880 km. This has enabled the inception of an integrated national power grid and commencement of phased rural electrification programme;
- Rehabilitation of the Massawa power distribution system has been successfully finalized; this shall be soon followed by the rehabilitation of the distribution system in Greater Asmara;
- The Rural Electrification of villages and remote towns has so far benefited around 160 of them, which is merely under 6% of the total number of villages in the country;
- To assess the wind and solar resources potential of the country, 25 meteorological stations have been installed and data collected from these stations have been processedsince 1999. An 800 kW Pilot Wind Energy Applications Project has being implemented. So far aggregate capacity of about 1MW solar systems have been installed throughout the country;
- Preliminary study on the geothermal energy potential has been conducted at Mount Alid and its environs;
- A 2000m^3 LPG storage facility has been built in Massawa this is being increased by 4000 m^3 and a 12,000m^3 strategic fuel depot rehabilitated;
- Three concession exploration licenses were issued to two different consortia, which drilled four deep offshore wells. Although this operation did not result in oil discovery, it was important in acquiring valuable information and experience. In September 2008 the Ministry of Energy and Mines has concluded a new PPSC with DEFBA, a joint venture company formed by the Government and Energy Alliance;
- An improved version of the widely used traditional stove of '*mogogo'* has been developed in order to optimise firewood consumption and minimize smoke emissions. Through promotional campaigns, it has been possible to install the improved *mogogo* in over 40,000 rural households as of 2006;

VI. Programs of MDBs and Development Partners

Please describe briefly the on-going and planned programs of the relevant multilateral development bank (MDBs) and other development partners relevant to energy access and renewable energy and how the proposed interventions for SREP would like to and build upon these programs.

The implementing agent (Ministry of Energy and Mines) currently working with EU for a project LPG facility financed jointly by the Government and EU. The Ministry is also preparing to commence a new Mini grid solar PV project. Moreover, the implementing agency has worked with other development partners like World Bank and BADEA in the rural electrification program.