Expression of Interest to Participate in SREP – Islamic Republic of Afghanistan

I. COUNTRY AND GOVERNMENT AGENCY SUBMITTING EXPRESSION OF INTEREST

This Expression of Interest (EoI) is submitted on behalf of the Government of the Islamic Republic of Afghanistan (Afghanistan), with the endorsement of the Ministry of Energy and Water (MEW), Da Afghanistan Breshna Sherkat (DABS – Afghanistan electricity utility company), the Ministry of Rural Rehabilitation and Development (MRRD), the National Environmental Protection Agency (NEPA) and the Ministry of Finance (MoF). As such, this EoI has the endorsement of all the government agencies responsible for the development of renewable energy, protection of the environment (including national climate change efforts) and disbursement of international assistance. This application has been prepared by the Renewable Energy Department of MEW in coordination with the other government agencies described above.

II. DESCRIPTION OF THE COUNTRY AND ENERGY SECTOR CONTEXT

Country / Energy Sector Context and Status of Energy Access

Afghanistan is a mountainous land-locked country located in South-Central Asia. The population is 29.82 million (2012 estimates) with more than 70% living in rural areas. Decades of instability and conflict has constrained the country's development, especially energy infrastructure. In recent years development progress has been substantial but large challenges still remain. One-third of the population lives below the poverty line and more than 50% are vulnerable to becoming poor. The country is among the poorest in the world; IMF ranks Afghanistan 175 out of 184 countries and Human Development Index (HDI 2012) rank is 175 out of 187. In 2012, per capita gross national income is US$680 and per capita gross domestic product is US$687[1].

Afghanistan is rebuilding its energy sector and the country has made providing sustainable energy to its population a focus of its development efforts with the support of the international community. Currently, only 28% of the population is estimated to have access to electricity, with average per-capita use of 195 kilowatt-hours (kWh) per person per year ranking it among the lowest worldwide[2]. Even this low per-capita level of electricity access masks significant urban/rural disparities, as it is estimated that only 23% of supplied electricity reaches rural areas[3].

Currently, up to 85% of primary energy use is from traditional biomass (such as wood and dung), which contributes to deforestation. Traditional biomass is supplemented by the use of diesel generators in off-grid areas as well as to compensate for power outages. Lack of access to affordable energy is limiting economic, social and educational opportunities, particularly for the poor and those in rural areas. Over 97% of the rural population is estimated to use solid fuels for cooking, with the result that Afghanistan is among the top 10 countries worst affected

[1] World Bank Data http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
[2] World Bank Fact Sheet – Accessed at http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,contentMDK:21935594~pagePK:146736~piPK:146830~theSitePK:258644,00.html
[3] World Bank, "Afghanistan Partnership: Country Program Snapshot," 8/29/2013.

by indoor air pollution[4]. UNEP estimates that at the current rate of wood consumption and deforestation, Afghanistan's forests will disappear within 30 years[5]. Given the low levels of energy production and access, Afghanistan's contribution to global CO_2 emissions is small; however, the Global Environment Facility (GEF) has determined that Afghanistan is highly vulnerable to the effects of climate change[6].

Energy access is a high development priority for Afghanistan. Since 2001, the major focus of efforts has been on reconstruction and expansion of the national electricity grid that would also afford the possibility of power trade with Central and South Asia. However, given that the national grid is being created almost from scratch, it is accepted that there are swathes of the country that the national grid will not serve by 2020 (Figure 1).

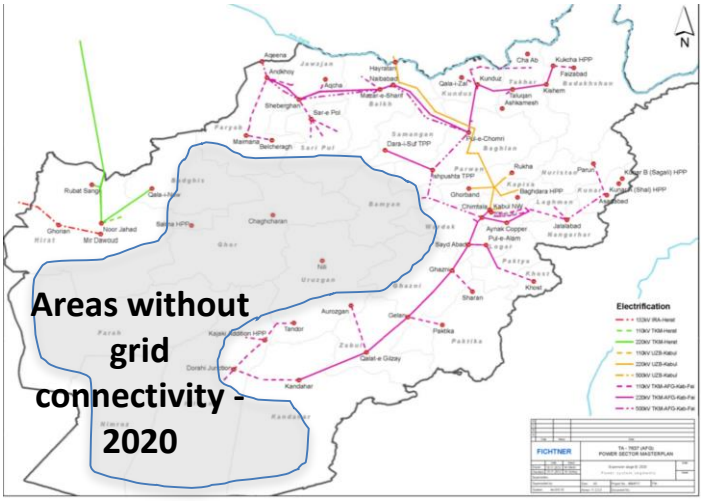

Figure 1 – Grid Expansion and Unserved Areas – 2020 Projection[7]

<u>RE Resource Potential, Implementation Status and Potential for Increasing Overall Energy Access</u>

Fortunately, much of the country - especially those areas which are unlikely to be served by a centralized grid – is endowed with significant renewable energy potential. Figure 2 overlays solar PV resource potential with the projected grid expansion in year 2020.

[4] Global Alliance for Clean Cookstoves - http://www.cleancookstoves.org/countries/asia/afghanistan.html
[5] UNEP - http://www.unep.org/NEWSCENTRE/default.aspx?DocumentId=2667&ArticleId=9054
[6] http://www.thegef.org/gef/content/building-adaptive-capacity-and-resilience-climate-change-afghanistan
[7] Power Sector Master Plan

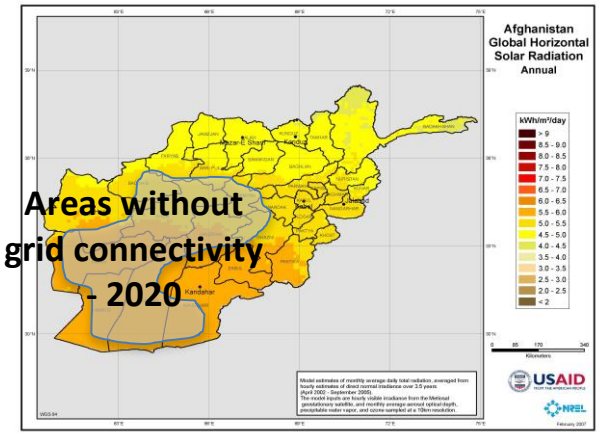

Figure 2 - NREL Solar PV Resource Assessment with 2020 Grid Expansion Projection

Based upon preliminary estimates by the National Resource Energy Laboratory (NREL) of the United States, technical solar potential in the country is over 220 GW and technical wind potential is over 66 GW. Given a projected 2020 electricity peak demand in the country of only 1800 MW, harnessing only 1% of the RE potential would provide significant benefit. In addition to wind and solar, Afghanistan is also endowed with significant hydroelectric, biomass and geothermal potential: hydropower potential alone is estimated at 23 GW, and indigenous generation capacity is currently dominated by large hydropower projects. Furthermore, there are about 2600 micro and mini-hydropower plants (MHP) with potential for further development. Preliminary conditions also suggest good potential for geothermal development with three large prospective regions; region- and site-specific surveys are required to identify overall sector potential and prioritize opportunities. Based on the experience of mobilized private sector investment in centralized natural gas-fired power, geothermal development can be structured to attract private sector participation. Furthermore, geothermal plants offer the potential to attract medium-scale investment and expand private sector participation beyond the extremes of sub-MW plants or mega-projects.

Afghanistan has made significant progress with over 5000 RE projects (with a total capacity of 50 MW) either completed or under construction, mostly from micro hydropower and solar (Table 1). It should be noted that these projects have been successfully implemented across the country, including in areas such as the South and East which have heightened security concerns. The proposed SREP interventions will build upon this experience and address the barriers required to catalyze the widespread adoption of RE systems.

Table 1 - Summary of Renewable Energy Project Implementation

Renewable Energy Projects	Total	MHP	Solar	Wind
Total No of Renewable Energy Projects Completed	4,549	2,186	2,358	5
Total No of Renewable Energy Projects Under Construction	496	451	45	0
Total No of Renewable Energy Projects Planned	98	39	43	0
Total Number of Projects (Planned and Completed)	5,143	2,676	2,446	5
Total Capacity of Renewable Energy Projects Completed (kW)	49,755	36,656	12,898	200
Total Capacity Under Construction (kW)	7,655	6,094	1,571	0

Source: Afghanistan Renewable Energy Database as of 6 March 2014.

III. RATIONALE FOR SELECTED SECTORS FOR SREP FINANCING

A two-step methodology was used for preliminary identification of appropriate SREP interventions. The first step is a "quick look" assessment to identify renewable energy prospects with maximum benefit according to the following criteria:

- Resource potential: given readily available information, to what extent does Afghanistan possess the natural resource for generation?
- Energy Access and CO_{2e} mitigation potential: correlation of resource potential with areas likely to be underserved by grid power. For this preliminary screening, it is assumed that this can also be a proxy for CO_2 mitigation potential, as the areas unserved by the grid are more likely to resort to wood burning and diesel use at present.
- Unit generation cost: cost per megawatt-hour generated.
- Financial/Economic benefits: potential for resultant energy to be used for commercial activity. Qualitative assessment.

The second step is an assessment of the conditions required for widespread adoption, as follows:

- Sector resource assessment: what feasibility studies or resource assessments have been done and what is the quality of the data?
- Deployment experience: what RE technologies/systems been deployed in the country and has the experience been positive?
- Cost recovery: is there demonstrable experience of financial viability?
- Operations and Maintenance: does a skilled local labor force for the RE system installation and operations exist who can both assure asset quality and gain economic benefit?

Using the criteria above, RE resources, systems, and applications were screened and the following t**he proposed interventions appear most appropriate for SREP support**[8]:

- Solar PV home systems operations and maintenance training: Stand-alone solar PV systems have wide applicability to areas unlikely to be served by the grid. These systems have already been widely deployed through development partner and government programs and uptake/community acceptance is reported to be good. However, while curricula have been developed, O&M training deployment is being held back by lack of resources. The lack of local engineers is raising concerns about the continued operation of these systems. Incorporating training about small scale-pay-for power systems into the curriculum also has the potential to create clean energy entrepreneurs (e.g. mobile phone and lantern charging).
- Micro-hydro system pay-for-power pilots. As in the case of solar home systems, microhydro plants have also seen significant deployment. Furthermore, a local base for the industry (e.g. turbine manufacturing) exists. While the technical capability is available and deployable, lack of experience with pay-for-power mechanisms and cost recovery is holding back development in line with potential, particularly in areas likely to be underserved by national grid expansion.

[8] Details on selection criteria and evaluation can be made available upon request; details would be provided in the SREP Investment Plan.

- Efficient Cookstoves: The majority of Afghanistan's population, particularly in rural areas, relies on traditional biomass for heating and cooking. Efficient cookstoves offer the potential both for the reduction of indoor air pollution and to reduce the deforestation associated with inefficient wood use. Programs for efficient cookstoves (with support from UNEP and the Global Alliance for Clean Cookstoves) have had good reception, but support is required to scale up efforts.
- Diesel-solar hybrid minigrids and diesel-hydro minigrids: The use of diesel generators (often operated by entrepreneurs under pay-for-power models) is widespread to compensate for inadequate and irregular power supply. Based upon local conditions, integrating renewable technology (particularly solar and hydro, which already have significant deployment) offers the potential to reduce diesel use, with concomitant climate change benefits. The intervention proposed is pilot-scale implementation that would lead to commercially operated minigrids.

In addition, a geothermal energy survey and a pilot program for a municipal solid waste (MSW) to energy program might also be suitable for SREP interventions. Deployment of both of these technologies is still in its infancy in Afghanistan. However, geothermal energy offers the potential for clean baseload power and early indications suggest that the resource potential exists, and it may be an attractive opportunity for private sector investment. However a resource characterization survey would be required as the first step before gauging private sector interest. With regards to MSW, very few urban centers have functioning programs and most MSW is discharged without treatment. MSW management with associated electricity generation offers the potential for environmental conservation with baseload power being generated close to urban demand centers. UN-Habitat is in the land-acquisition process for a MSW-to energy program in Kabul. However, SREP interventions would make it possible for this program to be expanded to other cities.

Taken collectively, the interventions aim to collectively break barriers for private sector involvement in the renewable energy sector. Barriers to renewable energy adoption and potential mitigation measures (SREP interventions) are described in the table below. Table 2 summarizes key issues and how SREP-supported investments might address many of the barriers.

Table 2 - Barriers and Mitigation Measures

Barrier	Mitigation	RE Sub-Sector
Technical and Human Capacity		
Insufficient data	· High-level resource survey	Geothermal Waste-to-energy
	· Site specific surveys	Mini-grids
Lack of equipment availability	· Expand market for private sector participation in appropriate areas	Solar standalone And Mini-grids
Lack of local capability for deployment and O&M	· Preparation of technical standards/guidelines	
	· Training - Curriculum review and deployment	
RE deployment in areas underserved by grid	· Prioritize interventions in underserved areas	
Economic / Financial		
High Capital costs	· Development partner funding / capital cost subsidy schemes	All

Barrier	Mitigation	RE Sub-Sector
Lack of credit availability	· Development of community financing mechanisms and microfinance schemes	Solar standalone
	· Development of cost-recovery evidence to increase attractiveness to commercial banking	Mini-grids
	· Development of resource estimates and feasibility studies to increase potential for commercial financing	Geothermal Waste-to-energy
High cost of resource estimates	· Development of resource estimates and release to potential investors	Geothermal Waste-to-energy
Social		
Low awareness of technology and potential economic benefits	· Advertising of Training	All
	· Publication of case studies	All

IV. ENABLING POLICY AND REGULATORY ENVIRONMENT

Existing Policies, Legal Framework and Regulatory Environment

The development of an enabling environment for private sector participation in the energy sector is a major focus for the Government. The country's national development strategy enshrines private sector participation - both domestic and foreign - and, accordingly, the parliament has passed a Private Investment Law. The rural electrification policy similarly encourages private sector involvement, particularly in areas that are likely to be unserved by the grid, with a view towards providing energy for commercial activity. The Electricity Law (to be submitted to Parliament shortly) explicitly allows for private sector involvement in generation and the provision of electricity services. The formation of an independent electricity regulator is underway, as are guidelines for private sector electricity operators. To receive a generation license, private sector operators can apply through a form freely available on the Ministry of Energy and Water's website. Furthermore, electro-technical standards for RE (particularly for MHP) are freely available to provide further guidance to private sector operators.

The journey towards creating a robust environment for private sector is not complete and the planned interventions under the SREP program are targeted to further these efforts. Planned interventions (particularly in mini-grids) are specifically targeted towards supplementing the regulatory framework with implementation and cost-recovery lessons.

Market Structure and Governance

The market for grid connected power infrastructure is still largely that of a monopoly, with the state-owned utility (DABS) currently responsible for vast majority of power assets. The market is far less monopolistic in RE services. While RE projects are still predominantly grant-funded, development partners both directly contract with private sector operators as well as commission projects through the government. Private sector activities include site assessment, equipment manufacture (particularly in the area of microhydro power), construction, and O&M. Pay-for-power schemes exist for RE but are currently mostly community rather than private sector owned. There are also private sector players operating pay-for-power systems from diesel generation. The proposed SREP interventions will assist in extending private sector involvement in renewable energy from service provision to commercial generation and cost recovery. The interventions are also designed to build upon recently completed projects.

For example, recently commissioned mini-grid hydro projects in Takhar province (approximately 250 kW capacity) incorporate local O&M and community ownership with cost-recovery. A 1 MW solar-diesel mini-grid in Bamyan province operated by DABS utilizes pay-for power mechanisms. Privately operated diesel mini-grids are widespread, with reports of over 30 operators in the city of Jalalabad alone. The proposed SREP intervention in MHP-diesel minigrids would draw from the successes of both approaches while displacing fossil fuel use.

USAID's Afghanistan Clean Energy Program (ACEP) deployed over 1,500 PV systems and included components for home systems, small scale entrepreneurship and training curricula. SREP funding would build upon the success of this program by supporting the training of additional technicians who would find a ready market through the maintenance of systems already installed, as well as provide the required skill base for new private sector entrants.

Financial sustainability and cost recovery are a recognized concern in Afghanistan's energy sector in general and the RE sub-sector in particular. While energy sector development is largely development partner funded, DABS is increasing the number of connections and reducing the subsidy it receives from the government, and has made significant progress on its glide path towards financial independence.

V. INSTITUTIONAL AND TECHNICAL CAPACITY

With regard to institutional capacity, the government ministries and DABS operate under a clear mandate as endorsed by the parliament. Organizational structures for each ministry have been developed. DABS has gained considerable experience in developing and operating assets. In additional to traditional infrastructure such as transmission lines (both high and low voltage), DABS also has experience in running and maintaining microhydro plants and has recently also taken over a 100 kW solar-hydro hybrid mini-grid. DABS also runs a 1 MW off-grid solar-diesel mini-grid installation.

More capacity needs to be developed for mobilization and integration of private-sector participants. This is precisely the area where the interventions in mini-grids are targeted. The MRRD and USAID have extensively deployed solar home systems. While this program has enjoyed some success, the lack of private sector involvement in operations and maintenance has meant that an undesirable number of these systems are no longer operational. The planned intervention of expanding training programs in the solar home system category is designed to revive these units and demonstrate that solar energy can be an effective solution for off-grid initial energy access.

<u>Ability to absorb funds</u>

The international community is a major contributor to energy sector development in Afghanistan. Increasingly, those contributions are being channeled through the national budget, under the stewardship of the MoF. The MoF therefore has well-established policies and procedures for energy sector financing absorption. Moreover, the MoF has a specific (and well-used) provision for 'non-discretionary' financing, ensuring that any potential financial support from the SREP can be targeted specifically for identified projects and programs.

As mentioned, the regulatory and governance structures for private sector participation (consisting of elements such as application forms, guidelines, an independent regulator and legal basis for IPPs) are in an advanced stage of development. However, private sector deployment of RE projects with cost-recovery is still in its infancy. The proposed interventions are designed to contribute to capacity building both with private sector implementation and public sector management.

Potential implementation risks

Table 3 contains a preliminary assessment of risks, mitigation measures, and residual risks.

VI. PROGRAMS OF MDBS AND DEVELOPMENT PARTNERS

Table 4 below outlines completed and ongoing efforts by MDBs and development partners in the areas of the proposed SREP interventions. SREP interventions are designed to assist the transition from grant-funded RE installations to private sector operation by creating the requisite conditions in all steps of the RE activity chain. For example, solar home systems have been widely deployed with good acceptance and an O&M training curriculum exists. However, the lack of trained local technicians prevents private sector involvement in further deployment and in O&M services – which would be addressed by the proposed training with SREP support.

Similarly, grant-funded RE minigrids (both solar-diesel and MHP-solar) have been deployed, and a local technician base is coming into being. These mini-grids utilize pay-for-power mechanisms, though they are currently government or community rather than private-sector owned. Privately operated diesel minigrids are in operation, and are financially sustainable. The proposed intervention of expanding RE/diesel minigrids with associated training and pay-for-power would build upon this experience to increase the penetration of private-sector RE minigrids.

Table 3 - Implementation Risks and Mitigation Measures

RISK	DESCRIPTION AND MITIGATION MEASURES	RESIDUAL RISK
Technology Risks (risks related to technological complexity)	With the exception of geothermal energy, the envisaged technologies (solar stand-alone, MSW to energy, mini-grids) are all established and all indications are that resource potential exists. Geothermal intervention is only a survey, rather than more complex intervention. The risk for the other technologies is with the human capacity required for effective O&M and cost recovery. This is precisely the area, which the SREP intervention is targeting.	Low
Financial Risks (risks related to financial viability of the sector/entities)	Given that much of the renewable energy sector has been developed with grant funding and that pay-for-power and cost recovery efforts are nascent, financial sustainability is a concern. However, the government recognizes that private sector involvement (with commensurate financial sustainability) is vital to develop the energy sector. Furthermore, the SREP interventions are targeted specifically to catalyze private sector involvement in renewable energy sectors (e.g. MSW to energy operation, mini-grids, geothermal survey).	Moderate
Environmental Risks (risks related to environmental concerns)	With the support of the international community and conforming to their norms, renewable energy activities (e.g. MHP construction) have included environmental assessments and this practice is institutionalized. Solar stand-alone systems are predicted to have low environmental footprint after the proposed SREP training incorporates environmental management of non-solar panel components (e.g. battery management). MSW interventions are designed to include an environmental assessment component as part of the proposed feasibility study/pilot.	Low
Institutional Risks (risks related to policy and regulatory environment and/or institutional capacity)	The envisaged institutional structure is robust, with a) An independent regulator b) Transparent procedures for involvement of the private sector with oversight safeguards c) technical capacity in some areas that can be built upon through SREP interventions. However, as mentioned, some of these institutional procedures (e.g. an electricity law, tariff agreements) are in the process of development and not yet in force. Furthermore, technical and human capacity on the part of the government in areas such as tariff setting and cost recovery from private sector operators are yet to be tested.	Moderate
Social Risks (risks related to social issues)	With the support of the international community and conforming to their norms, renewable energy activities (e.g. MHP construction) have included social impact assessments and this practice is institutionalized. In many cases, systems such as MHP plants are community owned and operated. Tenders for services are advertised and include opportunities for public comment. These safeguards will be incorporated into the proposed SREP interventions.	Low

Table 4 - Existing International Development Efforts and SREP Interaction

	Resource Assessment	Construction	Financing & cost recovery	O&M
Solar Stand-alone	USAID/NREL have completed country-wide (10 km and 40 km resolution, annual and seasonal) solar radiation study Feasibility study in 5 provinces (proposal stage)	Over 2000 solar PV systems (stand-alone) deployed with assistance from USAID, GiZ	Little evidence of commercial models or cost recovery	Curriculum developed but deployment scale-up needed
			SREP intervention to develop training which includes cost recovery	**SREP intervention to expand O&M training**
Solar/diesel hybrid mini-grids	Countrywide solar assessment conducted. Site specific assessments need to conducted	• 1 MW solar diesel mini-grid deployed with Govt of NZ support •Solar/hydro minigrid pilot deployed with support of GiZ	•Pay-for-power system being piloted for 1 MW solar-diesel mini-grid •Evidence of pay-for-power private systems for diesel minigrids	Little local training for O&M of solar/diesel minigrids
	SREP Interventions: Site specific assessments followed by pilots		**SREP intervention to expand pilot solar/diesel minigrids and integrate pay-for-power training**	
MHP/diesel hybrid mini-grids	Province-level studies done in several areas (with support from GiZ and USAID). Site specific assessments need to be conducted	• Over 2000 microhydro projects deployed - World Bank supported, GiZ supported, ADB supported • Hydro mini-grids constructed - World Bank GiZ, ADB supported	•Pay-for-power systems for MHP minigrids (community owned) recently deployed with support from GiZ. WB supported projects with community ownership •Evidence of pay-for-power private systems for diesel minigrids	•Training program for hydropower technicians •40+ local firms manufacturing equipment and delivering services
	SREP Interventions: Site specific assessments followed by pilots		**SREP intervention to develop pilot hydro/diesel minigrids and integrate pay-for-power training**	
MSW to energy	NREL completed high-level country overview for biomass resources (including MSW)	Pilot plant for Kabul in land acquisition phase (supported by UN-Habitat)	No evidence	Wastewater engineers in major cities such as Kabul.
	SREP intervention to expand pilot program (including resource assessment) to other major cities		**SREP intervention to develop expand MSW to energy pilot programs and integrate energy sales**	
Cookstoves	Some Resource Assessment Conducted by UNEP and USAID	Systems being deployed by UNEP/ Global Alliance for Clean Cookstoves	Grant basis – no evidence of private sector cost recovery	Program includes training
	SREP intervention to scale up program			