

Commercialization of Solar Energy- Business Model for Small and Medium Enterprises (SMEs) in Yemen

A Concept Note

Section I: Introduction

1.1 Purpose

- 1- The Concept Note proposes relevant policy instruments to catalyze expansion of solar energy investments in Yemen especially in relation to improving the performance of SMEs, and SSIs which promotes poverty reduction through generation of employment opportunities, creation of new green jobs in the economy. In addition, this Note explores the potential of solar energy alternative in boosting the performance of SMEs and small industries and on the other hand, improving the livelihoods of the poor in rural areas.
- 2- The Concept Note builds on, and links with the project concept paper entitled as "Expansion of Solar Power use in Yemen" which was developed by the Ministry of Industry and Trade's (MOIT) under the leadership of HE Dr. Saadaldeen Talib. MOIT concept note aims at "developing policy and implementation strategy for the Government of Yemen to undertake the expansion of the use of solar power all over the country especially in government offices, agencies, schools, hospitals and in the agricultural sector".

1.2 Background

- 1- A major concern in the world today is achieving the Millennium Development Goals (MDGs) to contribute to the wellbeing of societies around the globe. Many countries in the world including Yemen remain an off-track related MDGs achievement due to a number of difficulties and challenges including access to energy. Yemen is a Least Developed Country (LDC) in which poverty is high particularly in rural areas where about 75 percent of the total population lives. The multidimensional poverty in Yemen is characterized by the indicated lack of access to basic social services such as education, health, and energy. As such, energy poverty for instance is a facet of a multidimensional poverty.
- 2- In this regards, Yemen has the lowest access rate to electricity (i.e. 40 percent of the population) compared to the regional rate of around 85 percent. Inequalities in terms access to electricity exists among rural and urban households. Although rural accounts for about 75 percent of population, only around 23 percent have access to electricity compared with about 85 percent of urban population. Despite the low access rate of electricity, only about one-half of those populations are connected to public grid, and the other one-half gain access through other private sources including diesel generator

which usually operate for few hours for lightening, and less-intensive electric appliances. Alternative lighting devices are being used by non-grid electrified rural households includes kerosene Lamps (about 67 percent) and Lequified Petroleum Gas (LPG) Lamps (about 5 percent) which has serious environmental impacts. On the other hand, renewable energy share is estimated about 0.009 percent of the total energy mix.

- 3- In genral, energy supply in Yemen is limited, and weak generation capacity, high electricity losses from the grid (about 30 percent of production capacity), and increasing demand are among the top sector challanges. The total generation capacity of the Yemeni electricity system is about 1.223 GW after accounting for the recently installed capacity of about 341 MW powered by Natural Gas Turbines (NGT), Phase I. The supply gap against demand is estimated about 500 MW in 2013. The latest Power Development Plan (2009-2020) forecasts a total capacity demand of 3,102 MW at an annual growth rate of 10 percent over the next decade. New capacity of 3,538 MW by 2020 will need to be added to the grid to replace the retiring units and to accommodate the growing demand with sufficient capacity. It worth mentioning that power demand of industrial development will require additional power supply beyond the aformentioned projections.
- 4- Energy-related constrains has seriously been affecting the performance, and sustaibility of SMEs, and SSIs in Yemen. For instance, with the lack of access to eletricty, and fuel during the 2011 political instability, a quite number of SMEs both shut down business, and large numbers of their employees, and workers were laid off. In addition, many other SMEs downscaled or suspended their operations in 2011. On the other hand, lack of access to eletricty in rural areas has further been limiting the livelihood potentials of the poor. Without access to adequate energy service, the poor particularly in rural areas have limited choices for income generation, improved education, and health services, etcetra.

Section II: Alternative sources of energy

- 5- Yemen has vast untapped potential of renewable energy sources. A recent study by the Ministry of Electricity has outlined the various aspect of potentiality for five types of renewable energy in Yemen. Table (1) illustrates the five sources of renewable energy, and the various aspects of their potentials including theoretical, and physical.
- 6- It worth noting that among the five sources of renewable energy in Yemen, solar has the largest gross technical potential but ranks second after wind in terms of gross practicable potentiality. The average solar radiation is about 18 - 26 MJ/m²/day over 3,000 hours per year clean blue sky and the theoretical potential for solar electric using concentrated solar power (CSP) reaches about 2.5 million MW. Wind energy on the other hand reaches a potential of 308,000 MW and Geothermal potential of about 304,000 MW. As such, the National Strategy for Renewable Energy and Energy Efficiency

has set targets including a 15 percent increase of renewable energy contribution to the power sector by 2025.

Table (1): Renewable Energy Potentials in Yemen in MW

Resource	Theoretical Potential (MW)	Technical Potential	
		Gross (MW) Practicable (MW)	Gross (MW) Practicable (MW)
Wind	308,722	123,429	34,286
Geothermal	304,000	29,000	2,900
Solar electric	2,446,000	1,426,000	18,600
Biomass-landfills	10	8	6
Hydropower- Major Wadies	12 – 31	11 – 30	-
Solar thermal-Solar Water Heater	3,014	278	278

Source: Joint Socio-economic assessment

3.1 Solar Energy Prospects in Yemen: Challenges and Opportunities

- 7- Geographically, Yemen is located in the Sunbelt area of the world, and endowed with solar energy radiation ranges between 6.8–5.2 kWh/m² per day, and annual average of daily sunshine ranges between 7.3 and 9.1 hours/day. Even in winter, the daily average of sunshine hours is estimated of about more than 8 hours per day. On such ground, Yemen has immense naturally endowed potential to generate solar energy to significantly contribute in filling the energy gap in Yemen especially in remote rural areas using a range of available solar technologies on a sustainable manner. In general, solar energy has numerous economic, social, and environmental advantages. For instance, solar energy is sustainable in the sense that its technology entirely relies on renewable sun’s light, and heat radiation rather than using fossil fuels which is limited, non-renewable, and declining over time while at the same time polluting to the environment.
- 8- In addition, solar energy has virtually zero-GHG emissions, and negligible environmental and social externalities. Furthermore, it has lower running Operation and maintenance (O&M) costs over longer lifetime (i.e. approximately 15-20 years), and hence ensures greater energy security. Solar energy is a flexible technology and can be installed anywhere where sunlight is available and therefore provides a real energy security advantage. For instance, instead of using diesel generators especially during electricity intermittent, solar energy technology provides feasible and decentralized energy backup either for SEMs, and SSIs, and/or commercial buildings, and business shops as well as homes applications in Yemen.

- 9- Solar energy can also provide opportunities for local labor, and creates green job opportunities while at the same time promotes greater efficiency and productivity of business and small industries (SMEs and SSIs). As stated in the MOIT concept note, "using solar power will help to alleviate Yemen's power woes. Furthermore, several studies come to the same conclusion: solar, and renewable energy jobs in general, are much more significant job creators than the fossil fuel industry, creating ten times the jobs. A widely quoted University of California (UC) report states that solar photovoltaics (PV) creates more jobs per megawatt of capacity than any other energy technology - 20 manufacturing and 13 installation/maintenance jobs per installed megawatt. Another study, "The Job Creation Potential of Solar and Conservation: A Critical Evaluation," concludes that solar PV creates 55-80 times as many direct jobs as natural gas, and solar heating creates 2-8 times more direct jobs than conventional power plants.
- 10- Nevertheless, the present high upfront capital cost of solar technologies, and low conversion efficiency are the major limitations on way forward. Solar installments particularly for securing business's electric power applications require considerable space area and this might turn technically infeasible especially when space is a constraint. However, the conversion efficiency of light and heat into electricity by PV technologies is on increase. In addition, the subsidized diesel for electric power generation which is estimated at US\$ 4.7 billion in 2008 (i.e. equivalent to 50 percent of the average annual national budget, and 17 percent of GDP) will make solar energy less cost-competitive compared to diesel-based power generation.

3.2 Potential Applications of Solar Energy in Yemen: Business Model for SMEs

- 11- In Yemen, the industrial sector accounts for about 43 percent of the GDP which includes about 19 percent as oil sector contribution in 2011. Although SMEs and SSIs sector accounts for considerable percentage of employment opportunities in Yemen, the sector faces substantial challenges which directly reduce its performance, and increases its vulnerability to shocks as occurred for instance in 2011 crises. The sector has very low levels of productivity, and weak annual turnover due to high operation costs including high energy costs, and its involved cost of energy insecurity risks as well as. Lack of sufficient and reliable energy system is among the top obstacles of running businesses which has consequently been hindering development of businesses, and small industries in Yemen.
- 12- Alternatively, solar energy has tremendous potential in provision of a viable and sustainable business model for SEMs and SSIs which promotes improved energy security, enhanced productivity, and profitability. In addition, improving the performance of SMEs, and SSIs through solar energy solutions will consecutly has additional spill-over effect on the performance of the economy at large which ultimately reduces poverty by generating employment opportunities in addition to creation of new green jobs in the economy. As such, deployment of solar energy by SMEs and SSIs will largely contribute in improving their performance, and realizing their potential in terms

of growth, and job creation. Among the various feasible solar applications (e.g. Solar Home Systems, Water Pumping, Water Desalinization, Water Heating, Lanterns, Street Lightening, Lightening of Governemnt buildings ..etc). There is also high potential for application by small businesses and industries including agicultural industries (e.g. coffee been drying and roasting, and packaging; drying and packing of apricot, fig, dates, and grapes for raisins, etcetra ..etc).

13- It worth mentioning that coffee been in Yemen has a particular unique comperative advantage to capitalize on. Owing to its quality (i.e. taste, and flavor), global, and historic reputation (Mocha coffee), implementing of pilot Solar Coffee Drying and Roasting Systems will significantly upgrade its quality to higher standards for either local market and/or export. Introduction of Solar Coffee Drying and Roasting Systems will create new jobs, and reduce post-harvest losses, increases profitability of agricultural post-harvest business and industries while at the same time promotes expansion of coffee been production, and its competitiveness in local and global marketplace.

14- Yet, solar energy market is still limited despite that a number of small entrepreneurs are entering this business as suppliers. The majority of solar initiatives across the country are either donor driven or small-scaled with limited potentiality for expansion. For instance, that the UNDP Yemen Country Office (CO) has made prilimnary feasibility assessment of convesrion into renwable enrgy supply system using PV panels, and steps to implement the new proposed solar energy system have already been intiated.

15- It worth noting that, initial solar technologies avaiable in market were imported from Europe. But with the availability of low-cost solar technologies imported from China, the upfront capital investment of solar instllaments has dropped in the country, and hence positively influneced demand.

3.3 Proposed Interventions

16- Longr term actions require policy, legal and financial mechanism to to access solar finance and facilitate addressing the high upfront investment, a major barrier confrinting engagement and marketing of solar energy. However, in the shoter term and based on the aforementioned analysis, the following include key programme interventions to catalyze expansion, and use of solar energy particularly for small business and industries in Yemen:

1) Promote private sector investments in solar energy

- i) **Assess solar energy market potential and outline strategic marketing Mix:** Assessment of solar energy market will open new horizons for private sector, and a marketing mix will support partners to pursue

additional awareness activities to encourage private engagement, and influence demands of solar energy. As such, partnership with solar energy Non-Governmental organization (NGOs) will contribute in raising awareness as well as market research and promote expansion of solar energy in Yemen.

- ii) **Organize a national conference on prospects and investment opportunities in solar energy:** The conference will bring together the various stakeholders, and partners including private sector, and financial institutions as well as rural development partners. It will raise awareness about market prospects of solar energy, and new investment, and opportunities with private sector.
- iii) **Implement pilot solar energy interventions:** Demonstrate the feasibility of solar energy alternatives by implementing pilot interventions (i.e. power supply for drying of fruits and vegetables, community electric supply, street lighting, refrigeration systems of rural health centers ...etc) in collaboration with private sector.

2) **Encourage south-south cooperation**

Encourage south-south cooperation for joint business venturing and investment. There is high potential for business engagement in solar energy production and supply either in the rural areas or to fed into the electric grid. The cooperation will enable gaining of current international best practices addressing energy poverty. As such it will enable drawing upon relevant experiences from emerging and partner countries, and will also illustrate processes that achieved involvement and investment of the private sector.