



Solution to sustainable rural electrification in Myanmar



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ARTICLE INFO

Article history:

Received 28 March 2015

Received in revised form

21 December 2015

Accepted 27 December 2015

Available online 19 January 2016

Keywords:

Myanmar

Rural electrification

Rice husk biomass power plant

Sustainable and affordable energy

Financially viable business model

ABSTRACT

About 70% population of Myanmar lives in rural areas where average electrification rate is mere 16%. Out of total 64,917 villages, about 57,557 villages are in remote areas, far away from the national grid. Myanmar is blessed with an abundance of energy potential and extensive renewable resources, including large amount of agricultural biomass waste. The rice husk is one of the major sources of biomass. The paddy rice production had been estimated at 28.9 million tons for 2014, producing 5.78 million tons of rice husks. Over 1000 rice mills across Myanmar are being powered by rice husk small scale biomass gasifiers. After 2001, few rice husk biomass power plant were installed by rural cooperatives/committees for rural electrification.

The present investigation focuses to explore the self-sustaining energy service model to provide grid quality power to rural populations without the need of subsidies. The power system model focusing on both power requirements for the productive use and the neighboring villages/rural households at affordable tariff could become the most appropriate solution for the sustainable rural electrification. It is argued that the rice husk biomass power system installed and operated by rice millers is not only the sustainable and affordable option to rural electrification but also the financially viable business model to provide the grid quality power to rural population without grant or subsidy. Furthermore, the modern energy policy objectives-energy security, affordability, and sustainability are also met with the biomass rice husk power plant.

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1. Introduction

Myanmar is a Southeast Asian tropical country with a land area of 653,520 Km² and population of about 61.65 million people in 2013 [1]. Administratively, Myanmar is divided into 14 states and regions, with 69 districts, 330 townships, 82 sub-townships, 396 towns, 3045 wards, 13,276 village tracks and 67,285 villages [2]. The country has broadly three ecological regions: (i) the fertile delta and coastal regions – including the coasts of Rakhine, Mon and Tanintharyi, (ii) the plains of the central dry zone, and (iii) the mountainous northern forested regions, including the Chin Hills and the Shan Plateau. About 70% of the total populations are living in rural areas. Population below poverty line (earning less than US \$1.25 per day) was estimated to be 25.6 million in 2012.

Myanmar has one of the lowest rates of electrification in Southeast Asia, with only 29% of households having access to electricity in 2013 [3]. The annual electricity consumption was about 160 kW h per capita in 2012. The access to grid power is limited to only big cities such as Yangon City (67%), Naypyitaw (54%), Kayar (37%), and Mandalay (31%) [4], leaving behind poorly electrified vast rural areas. In 2011, the average electrification rate in Myanmar was 26% [5]. The rural electrification rate is as low as of only 16%. The off-grid population was about 26 million in 2012 [6]. The urban–rural divide in having access to modern electricity services is significant. Recent World Bank report shows that only 33% of the population has an electricity connection in 2014 [7]. Obviously, the low electrification rates are contributing to the low levels of economic and social welfare in the country.

In Myanmar, out of total 64,917 villages (inhabited), 26,357 villages are electrified till 2014–2015 Fiscal Year [8]. The national power grid covers only 6918 villages (merely 9.5% of the total villages) while the remaining villages rely on other available energy sources to meet their daily requirements. The rural electrification data is displayed in Table 1 [8,9]. Candlelight and kerosene are the main sources for the household illumination in rural

areas. About 70% of households depend on diesel/kerosene lamps, batteries or candles for home lighting.

Myanmar is endowed with an abundance resource base of oil, natural gas, hydropower, and renewables such as solar, wind, biomass. Government of Myanmar is keen to expand the energy access nationally. The rural electrification options vary from addressing the most basic energy needs for home lighting to a full-fledged electricity connection to the national grid. Table 2 describes the various options with the delivery model for the rural electrification of Myanmar. The national grid lines can reach only few village areas and most villages have no opportunity to receive electric power from the grid [10]. Further, the growth of grid expansion is slow due to vast mountainous terrain and challenging landscape, keeping millions of families in the dark. Additionally, the distribution pattern of villages scatters to far apart at remote areas. While the long term rural electrification target may be the grid electrification, the case is strong for the off-grid renewable energy (RE) as two-thirds of the population lives in rural areas and the central grid is unlikely to expand into remote areas for at least a decade(s). As a consequence, investing in clean, off-grid energy solutions can alleviate the severe energy poverty faced by poor and rural families, and help to improve energy access.

Photo voltaic (PV) solar energy systems (Pico PV and SHS) and battery charging stations for places with no significant potential for productive energy use and for decentralized remote households are most suitable options. Agricultural waste is abundantly available in rice producing regions of Myanmar. Therefore for the centralized households and with some potential for productive energy use (such as for rice milling operations), rice husk (RH) biomass gasification mini-grids are desirable solutions for the rural electrification. Earlier, Swe had studied the distributed power generation from rice husk gasification for the rural electrification use [11]. The electricity tariff from RH power plant was estimated to be in the range between US\$0.12–0.23/kW h (150–300 kyat/kW h) compared to US\$0.60/kW h (800 kyat/kW h) from the diesel power system in 2009.

Over 10,000 rice mills (small, medium and large) are operating in Myanmar. More than 1000 RH biomass power plants are providing power to rice mills machine operations, while some are exclusively installed for the rural electrification. Since RH biomass is locally abundant at almost no cost in rural areas and many rice mills are already operating RH power plant, such rice mills are most appropriate to implement the self-sustaining power systems for rural home lighting. Therefore, rice mills focusing on both power requirements for the industry such rice mills and power requirements for the people living in the neighboring villages/rural areas could become a potential candidate for the rural electrification in Myanmar.

Here, we present a self-sustainable financially viable business model to provide the grid quality power to rural population at an affordable tariff without grant or subsidy. In the proposed business

Table 1
Rural electrification data, 2014–15 (Refs. [8,9]).

Rural electrification access	Number of villages	Percentage (%)	
No. of inhabited villages	64,917	100	
Total electrified villages	26,357	40	
Electrified villages (national grid)	6198	26	Electrification share. Total 100%
Generator	13,088	50	
Mini-hydropower	2426	9	
Solar system	2693	10	
Bio-mass/gas	1232	5	
Un-electrified villages	38,560	60	
Future plan for village electrification	2015–16	2308	

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