Adapting Smart Grid Fundamentals for Mini Grids Without Extensive use of IoT with Minuscule Cost

Vikas Pujara

A Student of M Tech , Patel College

Abstract –This research is n the pursuit of a solution that is low cost yet very effective in stopping the theft of power from some small energy service companies that use renewable energy that electrify small villages with either no grid or non powered grid or powered but non reliable grid.

Keywords: Green Energy, Solar Power Load limiter, Theft of Power, Energy Service Companies

I.   INTRODUCTION

In India there are still more than 10000 villages that are not electrified and there are many more that or do not have dependable electricity source. These villages are located in the remote areas and are not on the electrification map and forecast for the coming years. The only way to provide electricity to these villages today is via developing a source of power near the village. This way the match between the consumption and generation can be close and this will also minimize the transmission losses. Hosting a PowerStation in a village is not a very viable project as the paying capacity of the village is far less and so is the energy usage and need. Setting up a thermal power plant for a village of the size of 200 house holds is neither viable not profitable for the power companies, due to the minimal usage and even minimal paying capacity. If thermal plant is not the way for the small village what is? The solution lies in the power of the Sun. Solar power based power generation plants that cater to small loads. The power is green as well as renewable. These loads fullfill the basic needs of the consumers in the remote areas. Need such as basic lighting and mobile phone charging. The Typical load that is distributed to the household is in the range of 20 to 30 watts for 6 to 8 hours in a day. This much power is enough to light up a room as well as charge a mobile phone for communication. This model is widely used in the more than 100 villages in Uttar Pradesh, Bihar and Jharkhand.

II.   SYSTEM MODEL

A mini grid is also at times referred as a micro grid or isolated/independent grid. It can be classified as combination of a electricity generator system which is interconnected to a distribution network that supplies power to a localized area or group of customers, the System may or may not have energy storage systems. The power generation capacity of a mini grid is usually between 10 kW to 10MW. Due to the limited size it serves a limited consumers base usually via a power distribution grid that is cut off from the country main national grid.How is distribution of powerdone?
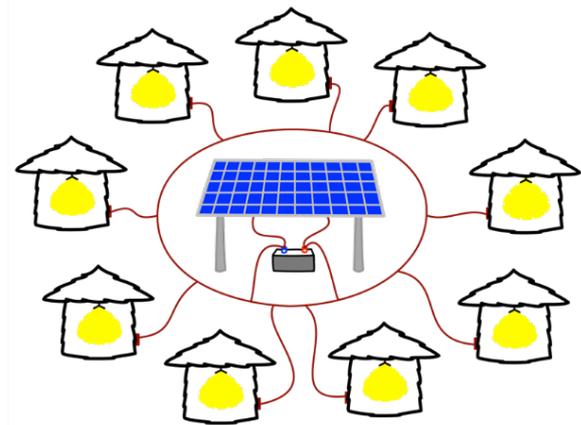

Fig. 2.1 Mini Grid.

The distribution of power is done via load limiters;these are inexpensive devices as compared to smart meters. The load limiters are controlled via a mobile phone, the smart phone connects with these load limiters Bluetooth. The smart phone interface is used to control and configure the load limiter. The load limiters are installed on every pole from where a cable is run to a household. The load limiter is designed to distribute up to 5 simultaneous connections. As the name suggests it load limiter controlled the amount of load the end user can use.Theft of power is the number one reason why running of such power plants is not economically viable for the entrepreneurs. These thefts happen by allowing higher loads to be used by the end users and not charging(monetization) the same to the user. This is done via setting a higher limit on the load limiter but not documenting in the register for billing.

III.   PREVIOUS WORK

With the focus on electrification in the rural sector by private companies fairly new and naïve, The evolution of the equipment like load limiters and smart energy meters for small loads is very limited. Though we have large corporation both Indian and foreign companies that have smart energy meters that are connected to the network but the cost of the energy meters is fairly high. This high cost of the meter make it extremely non useable for the small revenue customers with such small loads. Some noticeable work is done by companies such as Spark Meters(an American company based on Boston America) and Secure

Meters an Indian organization. The only drawback in Spark Meters is the high cost of each meter and the revenue sharing SAAS model of the manufacturer. While the Secure meters log the smartness part of the metering in terms of connectivity.

IV.   PROPOSED METHODOLOGY

The objective is to ensure that theft of electricity is stopped. The method used in this is to automate and create a log of all the transactions done by the operator. The log of the transactions is created in the device. The transactions are stored in secure place. A different app with authorization is made to read the transaction and transmit the data over to the cloud. On the cloud the information can be stored and displayed. This information can be used to reconcile the customer data in order to stop theft.

V.   SIMULATION/EXPERIMENTAL RESULTS

We were able to capture date from a shared folder on the android app and post the data on the remote server on the cloud. Once the data is captured and posted on the remote server it may be used in whatever form needed

VI.   CONCLUSION

Though the data capture is possible but it is not possible to read the data without the permission of the OEM. The OEM of the load limiter in this case has to ensure that the settings on the load limiter is replicate don the mobile device in form od readable flat file and in a shared location. So that the same can be read, analyzed and transmitted to the cloud.

VII.   FUTURE SCOPES

To make this model commercially available the cloud service has to be either owned by the OEM. In which case a SAAS fee may be charged to the customer. However if the responsibility of the cloud is owned by the energy service company the OEM may refuse crate log and store them on a convenient and shared location for the Energy Service company to read. Hence a either technical and commercial partnership is needed between the energy service company and OEM or The OEM has to provide with additional service at a nominal charge .

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