Solar Water Supply Scheme – A boon to the people of Makhala

Shweta S. Banerjee, Executive Engineer, Maharashtra Jeevan Pradhikaran, Amravati, Maharashtra, India

Introduction

Energy is the most important inputs for economic growth and human development. In impoverished and undeveloped areas, small amounts of electricity can free large amounts of human time and labour. In absence of electricity, people are forced to carry water and fuel by hand and their activities are limited to daylight hours. People are also subjected to many water borne diseases, like dysentery, due to direct contact between people (hands) and water supply. Adding electric power wells for clean water can save people, especially women folk, from the daily drudgery of carrying water and water borne diseases. The time saved can be utilized for improvement of economy. However, among the main issues that have to be considered in rural electrification are the potential conflicts with land use and the impact on the rural environments. With regard to land use, administrators need to ensure adequate planning in regards to infrastructure development and land use allocation. Moreover the economic cost attached to providing electricity in rural areas is also of major concern. The extension of wires is expensive and usually do not last long in these environments, such as in the middle of the jungle. This paper illustrates how renewable energy provides a sustainable solution to all such problems by citing an example of Makhala village in Maharashtra State of India.

Repertoire

India occupies 2.4% of the world's land area but supports over 17.85% of the world's population. As per census 72.2% of the population lives in about 638,000 villages while the remaining 27.8% lives in more than 5,100 towns and over 380 urban agglomerations. Maharashtra (Area 119000 square miles, population 112 million) is situated in western part of India and covers the entire Deccan region. The hourly global solar radiation estimated for the state is in the order of magnitude of 2000 KWh / m^2 year. There are 35 districts in Maharashtra. A district is an administrative division of an Indian State or territory. The village Makhala is located in the hilly and tribal taluka Chikaldhara of Amravati district in the state of Maharashtra (India). It is situated at 959m above mean sea level and can be sited at latitude 21^0-31'N and longitude 77^0-22'E. The climate is tropical and most people wear cotton clothes. In summer temperatures can go up to higher than 47 °C (117 °F). Although accessible by roads in all seasons, the village is isolated, surrounded by forests and has no power supply. The nearest village is Semadoh at a distance of 12 kms. The village has 2 hamlets or *dhanas* at a distance of 1km which shall be referred as Hamlet – 1 and Hamlet – 2 for easy understanding. Overall Makhala provides nestle to population of 1045souls. Other than this it

also houses a gram panchayat office, a primary health center, a anganwadi and a primary school.

Figure-1: Satellite Image of Village Makhala

About the water supply system

The village has 2 open dug wells situated in each hamlet. The well-1 of Hamlet – 1 is situated at a distance of 450m from the habitation at an elevation nearly 55m lower than that of the hamlet. However the good part is that it has water even during summer. Whereas the well-2 in Hamlet – 2 though closer to the habitation would get dry during summer. As a result the inhabitants of Hamlet – 2, especially the women folk, had to traverse a distance of 1.5kms carrying pots of water on their heads. This had adverse effects on the health of the women. Their growths were stunted and they were also getting bald. Deployment of tanker for the village during summer was a regular routine for last twenty years. Example of Makhala was cited wherever water scarcity in Amravati had to be mentioned.

Absence of power supply posed difficulty to the rural water supply department in designing a suitable water supply scheme for village. Multiple options were checked and finally it was decided to tap solar power.

In the year 2000, a solar power based mini water supply scheme was executed with source as well– 1. The components of the scheme included solar pump, rising main and few standposts located nearby the source. The main intention was to save both time and labour of climbing down the elevation of 55m. Unfortunately the purpose got defeated. Since the solar plates were fixed closer to the well away from the vicinity of the habitation, they got stolen shortly bringing the situation back to square A.

Figure-2: Key plan of Makhala Water Supply Scheme

Challenges

The challenges in front of the rural water supply division were:

- To design a solar based water supply scheme
- To take adequate measures such that the solar plates do not get stolen
- To make provision of water storage such that water is pumped to the elevated service reservoir from where it flows by gravity.
- To provide water at the door steps of each household in both the hamlets.

Accordingly a scheme was proposed for a projected population of 2535 souls for the year 2026. Components of the scheme constituted of

- Rising Main: PVC 90mm 6kg/cm^2 490m
- Solar Submersible Pump: 2.4 KW, 2nos, (PS 1800), 80m head
- Solar Control Inverter: PS 1200, 2 nos
- Circuit Power Supply Cable : 3 Core-10mm^2 Armoured Cable, Length 2 x 450m
- Solar Plates : For 1 pump – 32 nos x 75 Watts = 2.4 KW
- RCC ESR : 50000 litres capacity , 9 m staging height
- Distribution System : PVC 90mm & 75mm 4kg/cm^2
- Miscellaneous : MS structure for plates

The scheme was technically sanctioned by the Executive Engineer, Rural Water Supply Division, for an amount of Rs 49.33 lakhs on 4th February 2011.

The work got commenced on 15th March 2011.

Difficulties encountered

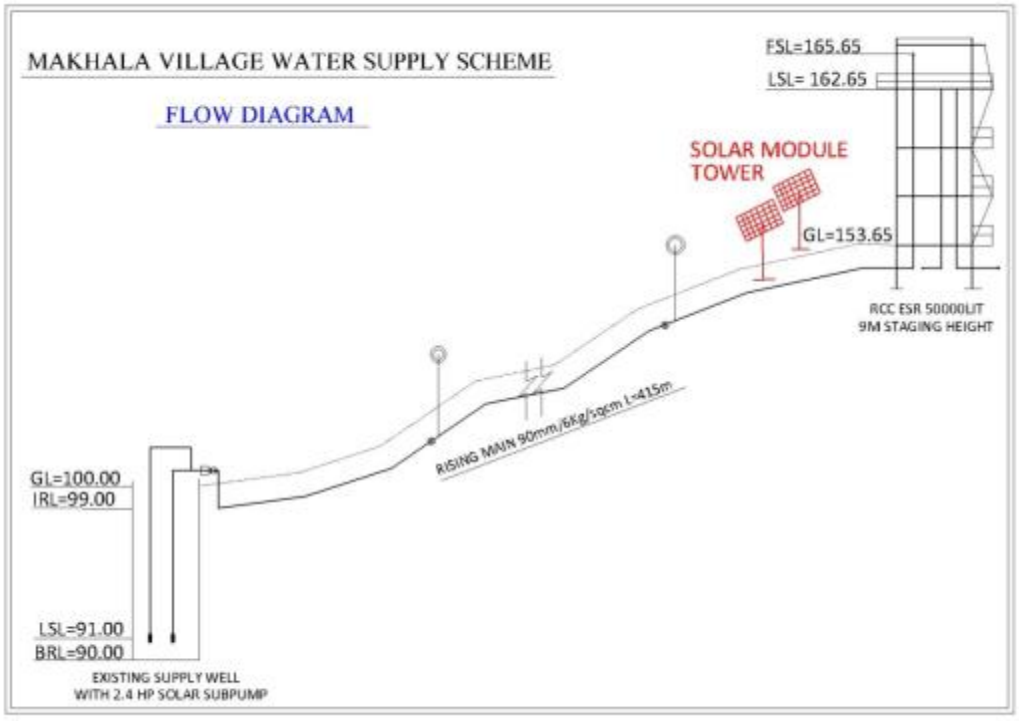
The major difficulty encountered was in the procurement of solar pumps of 2.4KW and 80m head. Local manufactures of solar power pumps had pumps not more than 40m head. After a lot of net surfing, a German based company Lorentz was found who manufactured solar pumps of higher heads.

The next difficulty was their procurement in India. A hunt was carried for the retailer who could procure the same and also get it installed. No big companies were found. Finally a local dealer from Ahmednagar district (Maharashtra) came to the rescue.

The solar plates were fixed on mild steel structures in the vicinity of the habitation. Due to high wind velocity the plates shuddered. This required the structure to be strengthened and location of fixation such where the threat from the wind would be minimum.

Maximum effort was put in fixation of power supply cable. It was only after two to three iterations that the mechanism started working successfully. Solar pumps used generally were not more than 3HP where plates and pumps were quite close by. Here both the distance between the plates and pump as well as head was much more. Either the pumps would not lift the water or the circuit would trip.

The solar plates were riveted so that both pilferage as well as theft could be prevented.



Operation and Maintenance

The scheme finally got commissioned on 1st January 2012. The expenditure to be incurred towards O&M worked out as:

Table: 1 Annual Expenditure towards O & M

Sr No	Particulars	Amount (Rs)
1	One pump attendant cum water supply employee	18000/-
2	Cost of bleaching powder	4000/-
3	Repairs to pipeline & other miscellaneous expenditure	23000/-
	Total:	**45000/-**

The expenditure towards electricity bills which contributes to the major chunk of O & M is absolutely nil in this case. The total number of households in the villages is 352. As on date 85 households have opted for individual water connections while the resort to the 5 public standposts [1] in the village.

Benefits accrued

- No tankers were required to be deployed in the village since summer 2011.
- The number of SAM (Severely Malnutritioned) children reduced from 4 to 1 in the first 10 months of commissioning of the scheme.
- Similarly the number of MAM (Moderately Malnutritioned) children also reduced from 15 to 9.
- Experiences of maintaining electricity based water supply schemes reveal that most of the schemes become non-functional due to non-payment of electricity bills, from which Makhala is saved.
- Villagers have seen a new ray of hope. They have taken up the onus of maintaining the scheme in a proper way.
- Villagers have started also started maintaining kitchen gardens.
- Today all houses use solar energy for lighting.

Replication

After closely observing the benefits of the scheme, solar based water supply schemes have been replicated in other hilly, inaccessible and tribal villages in Chikaldara block of Amravati district viz Raksha, Bhawai, Bichukheda, Lawada, Salita, Sumita, Ektai, Hirda, Piplya, Bodu, Lakhewada, Chobita, Domi, Kuhi, Chilati, Bhutrum, Raipur and Rehtya which do not have power supply. Benefits of the scheme have also been mentioned in a conclave of water engineers CoWAT – 12 hosted by Water Supply and Sanitation Department,

[1] Although discouraged by Government, public standposts are not completely eradicated. They constitute of a vertical pipe fitted with a tap. They are maintained by Gram Panchayats especially for slum areas, consumers below poverty line who cannot afford household connections and public places like markets, bus stands etc.

Government of Maharashtra, after which many other districts have also started showing interest in Solar based water supply schemes.

References

1. Kulkarni S., Banerjee R., Renewable energy mapping in Maharashtra, India using GIS, Sustainable Cities and Region (SCR), World Renewable Energy Congress 2011- Sweden 8-13 May ,Linkopin, Sweden.
2. Demographics of India, Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Demographics_of_India
3. Rural Electrification, Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Rural_electrification
4. http://www.indiaonlinepages.com/population/india-current-population.html

---------xxxx---------