COMMUNITY-BASED SERVICE DELIVERY MODEL

Through Solar Irrigation Pump

GIZ in India is exploring different service delivery models mainly in the eastern parts of India. **Nilanjan Ghose** highlights one of the models being tested which is a community-based 'pay-as-you go model' in Bihar. The objective of this article is to share some insights on the community-based pay-as-you-go-water-as-a-service delivery model based on the operational data collected over last four years and also provide some learnings from the model.

Over the last two years, there has been a steady increase in the deployment of solar irrigation pumps in India. The Ministry of New and Renewable Energy (MNRE), Government of India, has already installed around 142,000 solar pumps by November 2017 and has a target of installing 1 million solar pumps by 2020/21. Apart from the MNRE's subsidy-based technology deployment model, there are also experiments to promote other means of deployment and testing of service delivery models. GIZ is exploring different service delivery models mainly in the eastern parts of India. One of the models being tested is a community-based 'pay-as-you go model' in Bihar. The article is broadly divided into three sections apart from the introduction. The second section explains the community based 'pay-as-you go–water-as-a-service model' as has been tested by GIZ in Bihar. The third section provides an insight into the usage pattern of the solar pump while the concluding section basically summarizes the key insights and also outlines the enabling condition for deployment of community-based service delivery model.

UNDERSTANDING THE COMMUNITY-BASED 'PAY-AS-YOU GO–WATER-AS-A-SERVICE DELIVERY MODEL

A community-based model involves sharing of the asset, that is, solar pump within an irrigation water-sharing group of farmers based on the individual member's irrigation requirements. One of the preconditions for formation of the group is that the farmers sharing the solar pump either need to have their land adjacent to the water pump or within the catchment area which the pump can cater to. Generally, an operator nominated within the group keeps track of the usage of solar pump by different members and a service charge is levied based on the quantum of water delivered to various members. In case of the GIZ pilot in the Vaishali district of Bihar with Vaishali Area Small Farmer's Association (VASFA), a solar pump was installed in two of the sites used by diesel pump, which were being used for irrigation. The objective was to set up a site for the community-based pay-as-you-go–water-as-a-service-delivery model, to reduce the usage of the diesel pump for irrigation and to use the same site for technology demonstration of farmers of the neighbouring districts. Apart from the operator, there is a group leader elected by the group members for collection of service charges. The service charge to be collected is also decided by the irrigation group and the collected money is partly used for salary of the operator and the rest is saved within VASFA for operation and maintenance of the asset. The group leader decides the sequence in which the members will receive water in a particular day. In this model, irrigation water is also shared with non-members after meeting the needs of the primary members. The service charges for non-members are slightly higher than that of the members. GIZ has provided financial support to set up the site for the pay-as-you-go model. In case of the GIZ project, the ownership of the asset lies with VASFA.

ANALYSIS OF THE SOLAR PUMP UTILIZATION DATA

This section provides an analysis of one of the community-based solar pump sites (referred as Tube Well No. 11) installed in Vaishali. The solar pump caters to a group of around 34 farmers with a catchment area of approximately 34 acres. The irrigation group had access to an 8.5 HP diesel pump. With the GIZ intervention, a 5 HP (4.8 kW) AC solar submersible pump was installed. The operational data on the usage of pump has been analysed for four years starting from April 2014 till November 2.017. Some details of the project are mentioned in Table 1.

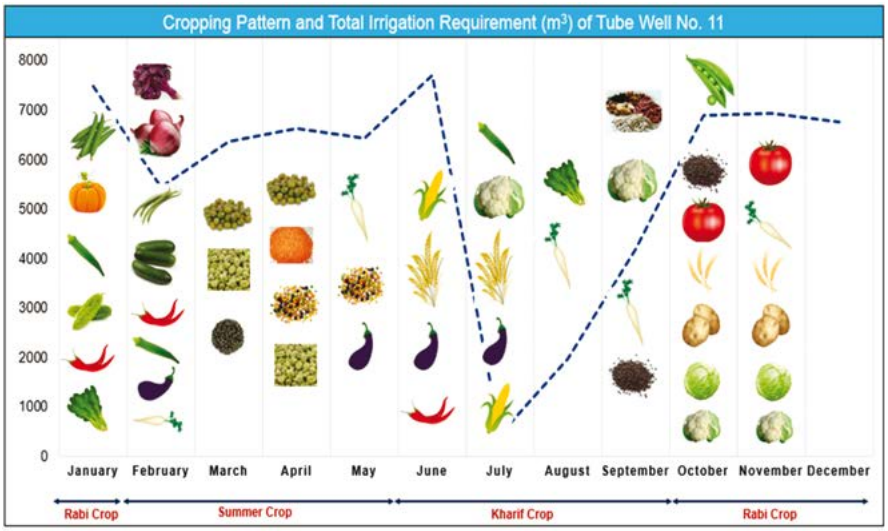
It is worthwhile to mention that the farmers in the site have less than 1 acre of land and cultivate for three seasons in a year. For most of them, agriculture is the primary occupation. Cultivation of vegetables is a common practice and is mostly undertaken during the Kharif and Rabi season. As seen in Figure 1, Tube Well No. 11 grows a variety of vegetables, wheat, paddy and pulses, and therefore, experiences a high water requirement throughout the year.

Table 1: Details about the project site

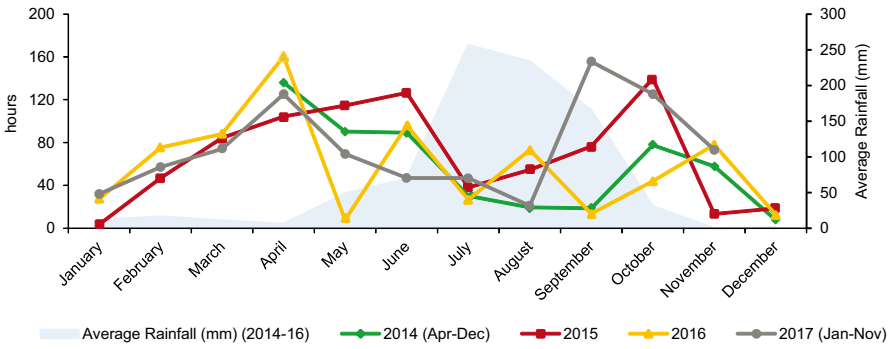
Parameter	Details
Geographic details	Village: Lalpura District: Vaishali
Year of installation	2014
Pump capacity	5 HP
Solar panel capacity	4.8 kW
Type	AC Submersible
Supplier	Claro Energy Private Limited
Catchment area	34 acres
No. of farmers served	34
Mode of finance	Financed by GIZ
Alternate pumping options available	Diesel pump
Capacity of the diesel pump	8.5 HP
Operating model	Water as a Service

Figures 2 and 3 highlight the usage of the solar pump set by the farmer group for the years 2014, 2015, 2016, and 2017. Figure 2 has been plotted against the average rainfall data over the mentioned year while Figure 3 provides the distribution of the usage hours of the solar pump between the members and non-members over the projected duration.

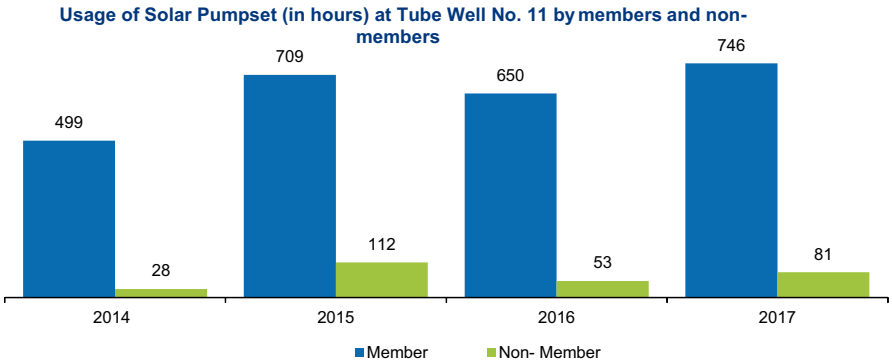
The total number of hours of usage of the solar pump set in Tube Well No. 11 was 527 hours, 821 hours, 703 hours, and 827 hours in 2014 (April–December), 2015, 2016 and 2017 (January–November), respectively. The monthly usage of diesel pump set available in Tube Well No. 11 and the total number of hours of usage is 262 hours, 578 hours, and 259 hours in 2014 (May –December), 2015, and 2016, respectively. It can be seen that the usage of both the pump has significantly reduced in 2016. This may be



» **Figure 1:** Cropping pattern and irrigation requirement of Tube Well No. 11



» **Figure 2:** Total usage at Tube Well No. 11



» **Figure 3:** Usage of solar pump set at Tube Well No. 11 by members and non-members

attributed to adequate rainfall during the monsoon season.

The water requirement is highest during October to May. During high demand seasons, the farmers have to wait for water delivery and therefore sometimes opt for other irrigation means, preferably diesel pump sets. During peak season, the solar pump set cannot fulfill the entire water requirements. The problem might have been addressed through a higher capacity of solar irrigation pump. However, the higher capacity solar irrigation pump might also have two other implications: a) it would have increased the project cost; b) the pump would have remained underutilized for a major duration of the year.

USAGE PATTERN OF THE SOLAR AND DIESEL PUMPS ACROSS THE DAY OVER MULTIPLE YEARS

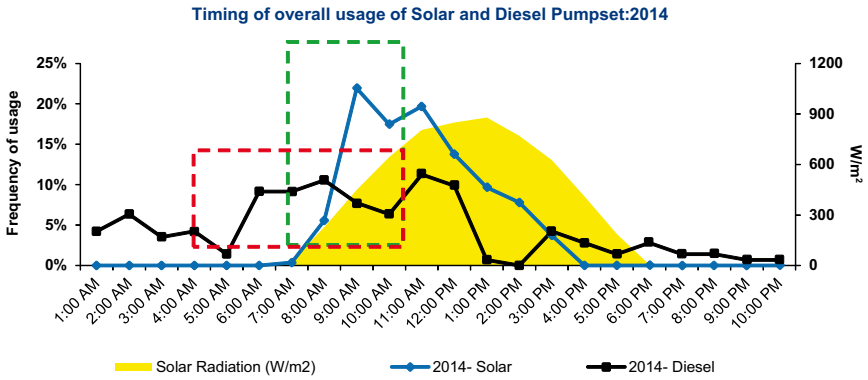
Solar pumps run on solar energy and their performance fluctuates based on the intensity of solar radiation. Therefore, the time of solar pump operation is of importance to get a consistent output. Figures 4 to 7 provide a year-wise break-up of the usage pattern in terms of the preference of the day for irrigation. The graphs show that the majority of the farmers prefer having irrigation water in the early morning. It seems that the farmers prefer to irrigate the most before 12:00 noon.

The time usage pattern for Tube Well No. 11 is shown below.

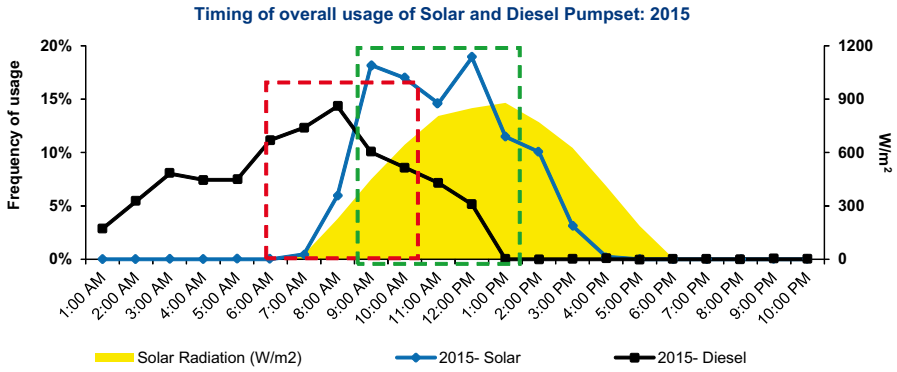
- Discussions with farmers have revealed that most farmers do not want to work in the field post noon due to the heat and hence tend to prefer completing their irrigation activities before noon. It was also revealed that most farmers tend to go to market in the late afternoon and hence they prefer to complete their irrigational activities before noon.
- The farmers highlighted that the group grows a lot of vegetables especially during February to June and the irrigation requirement for the vegetables is mostly during early morning and evening. Therefore, the specific water requirements, especially early morning and late evening, are better fulfilled by diesel pump set.
- Assurance of irrigation water at the appropriate time to prevent crop mortality is more important than economic incentive of lower price of irrigation water. Hence, if needed, the farmers prefer paying higher price to get assured supply of water especially during November to January when the solar irradiance in Vaishali is often much lower to run the solar pump for the desired duration.

CONCLUSION

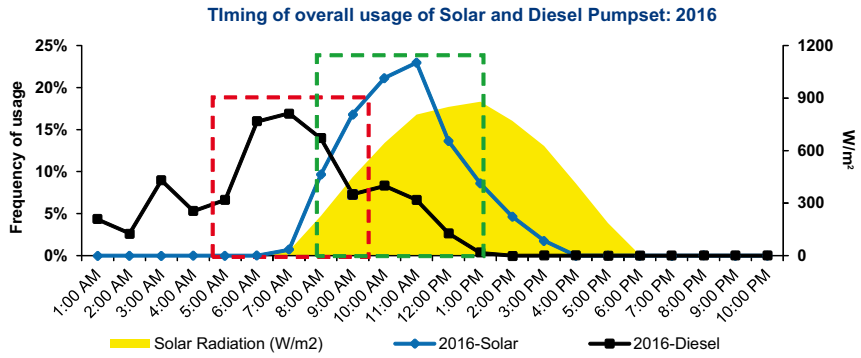
Having a dedicated community-based organization can create an enabling



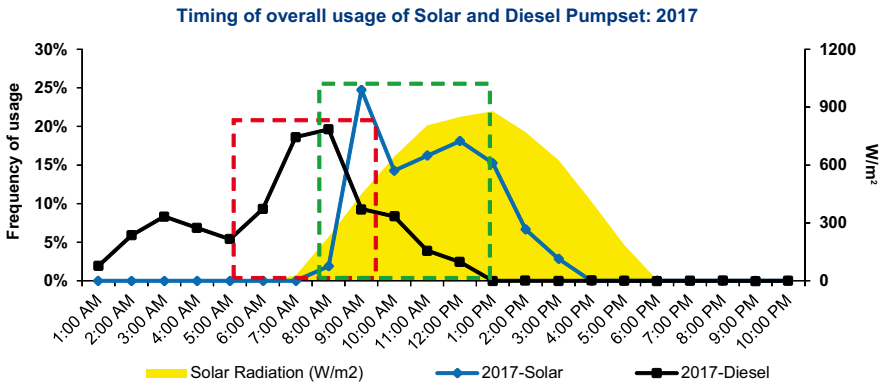
» **Figure 4:** Timing of overall usage of solar and diesel pump set: 2014



» **Figure 5:** Timing of overall usage of solar and diesel pump set: 2015



» **Figure 6:** Timing of overall usage of solar and diesel pump set: 2016



» **Figure 7:** Timing of overall usage of solar and diesel pump set: 2017

environment for developing a community-based asset sharing model. Presence of such an organization can facilitate in technology transfer and also technology adoption. Collaboration between private sector and farmer's collective or a community-based organization is essential for upscaling such a model. The project developer needs to carefully look at the sizing of the solar pump. While oversizing of the asset can lead to increased project cost and also under-utilization of the asset, undersizing may not be able to meet the irrigation demand of the catchment area.

In a community-based water sharing model, solar irrigation pump can supplement the use of diesel/electric pump. Analysis of the operational data (over the past four years) of the community-based solar irrigation pump in Vaishali, Bihar, reflects the fact that a considerable portion (about 50%) of the irrigation load is borne by solar pump. The need of water for irrigation for the winter crops often remains unmet through the solar pump, due to low or inadequate solar irradiance, during the months of November to January in Vaishali district of Bihar.

The usage pattern of the solar pumps in Bihar also shows that farmers have a preference of using the water pump only during a limited period of the day (especially between 8:00 a.m. till 12:00 noon). A change in the behavioural pattern of the farmers can also lead to increased and improved utilization of solar pumps. Having a water tank for storage can also reduce the dependency on diesel/electric pumps and can also ensure access to water for irrigation in periods with low or inadequate solar radiance. The experience also highlights the fact that assurance of supply of adequate water during a particular period is more important than economic incentive in the form of a lower service charge for irrigation water for farmers. Therefore, a community-based service delivery model most importantly needs to ensure assurance of irrigation water for farmers.AU

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