

## 3<sup>rd</sup> SDC-SoLAR India Project Management Committee Meeting

**Venue:** Virtual mode through Zoom meeting

**Date:** 14 September 2021

**Time:** 2:00- 3:30 PM (IST)

**Attendees:**

| <b>Name</b>          | <b>Role in C-PMC</b>  | <b>Attended</b> |
|----------------------|---|-----------------|
| Dr Alok Sikka        | Chair, India C-PMC  | Yes             |
| Dr Yashodha Yashodha | Member Secretary, Country Project Manager SoLAR                       | Yes             |
| Dr Aditi Mukherji    | Member, Regional Project Leader, SoLAR                                | Yes             |
| Dr Tushaar Shah      | Member, Emeritus Scientist, IWMI                                      | Yes             |
| Rajendra Vala        | Member, Gujarat Urja Vikas Nigam Limited                              | No              |
| Divya Kashyap        | Member, Swiss Agency for Development and Cooperation (SDC)            | Yes             |
| Akhilesh Magal       | Member, Gujarat Energy Research and Management Institute (GERMI)      | Yes             |
| Nilanjan Ghose       | Member, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) | Yes             |
| Veena Srinivasan     | Member, Ashoka Trust for Research in Ecology and Environment (ATREE)  | Yes             |
| Dr Ratan Jain        | Member, Gujarat Water Resources Development Corporation (GWRDC)       | Yes             |
| Ashwin Gambhir       | Member, Prayas Energy Group   | No              |

### Agenda

The third Country Project Management Committee Meeting (C-PMC) in India for the 'Solar Irrigation for Agricultural Resilience' (SoLAR) project was chaired by Dr Alok Sikka, Country Representative – India, IWMI. It was held virtually on 14 September 2021 and discussed the progress and plans for various activities under the SoLAR project.

## Discussions

1. Opening remarks by Dr Alok Sikka.
2. **Updates on activities carried out since the last CPMC meeting:**

**Activity 2.2.2: Scale Pilot - Impact of grid connected SIPs:** This section was presented by Dr. Yashodha.

### Key Points:

- Overview of the SKY scheme - feeder participation, technical and financial design.
- Key findings from the 2<sup>nd</sup> CPMC – Analysis of real time energy data of 93 feeders from GUVNL's SKY web portal revealed that 40% energy generated is exported to the grid which can be attributed to the augmentation in the system capacity and energy pie which was offered under the scheme – to explore whether the scheme incentivizes farmers to reduce pumping and sell surplus energy to DISCOMs.
- Field visits have been undertaken across all DISCOMs in Gujarat to better understand the heterogeneity.
- Rapid enumeration of 2000+ farmers in 40 SKY and neighboring control/Business as Usual feeders has been completed using a proportional sampling strategy – consumer status, participation, agricultural practices and perceptions on SKY.
- Early results from rapid enumeration:
  - Prior to SKY, average pump size was 14 HP, 5% sold groundwater. The irrigation practices are tube-well dominated. Drip irrigation and group owned connections are more prevalent in Northern and Western Gujarat.
  - Northern and Western Gujarat have similarities in cropping patterns. The Central and Southern regions are dominated by more water intensive crops like paddy and sugarcane owing to high levels of river recharge and alluvial soil.
  - Richer farmers, multiple connection owners and micro irrigation users are more likely to participate in the scheme – equity concerns; main reasons for non-participation are capital constraints, risk aversion, late decisions and land documentation issues when obtaining the loan.
  - Changes since SKY (indicative of pumping behavior) - No difference in number of crops grown, area cultivated for business-as-usual feeders is similar to that of SKY feeders, except in summer where it has increased marginally for SKY feeders. Drip irrigation adoption has increased for SKY enrolled farmers mainly due to the high uptake in Northern and Western Gujarat.
  - ~95% of SKY consumers have exported to the grid but farmers mainly in the Southern and Central Gujarat have not realized solar income as they have not exported sufficient units to cover their annual loan instalment.
  - Short repayment period, generation, and voltage fluctuation issues in South and Central Gujarat limit actualization of income.
  - Larger pump sizes and lower per HP cost for rich farmers in the North and West and crops grown therein realized the benefit.
  - Farmers do not have capital to service the loan, 90% have not yet paid to the DISCOMs.
- Conclusions:

- Water use could remain the same or increase given rise in drip irrigation adoption and slight increase in area cultivated. This will lead to employing econometric matching methods and data on area allocated to each crop and pumping hours which would be collected through the detailed household survey.
- Current financial design does not incentivize energy/water saving behavior.
- Data analysis is currently in progress to understand the large variation in pumping behaviour of farmers, their cropping patterns, irrigation practices, water selling behaviour and the extent of benefits accrued as a result of SKY.

#### Discussion Points and Q&A:

- **Divya Kashyap (SDC):** Interesting to observe the reasons for increase in drip irrigation adoption among Business-as-Usual farmers in addition to SKY farmers. Water extraction under SKY seems to be still high because of groundwater selling. Could this be due to low frequency of payments received by DISCOMs and quicker realization of revenues from neighboring farmers?
- **Nilanjan Ghose (GIZ):** How are water prices changing? How is this impacting farmer (making farmers better or worse off)? These questions would be interesting to explore.

**Yashodha (IWMI):** Field visits and interactions revealed that there has been a wide scale promotion of drip irrigation (extension program) by the state government. There is a need to explore the reasons. As farmers receive solar income only once a year, revenue streams are quicker for groundwater selling and existing strong ties (groundwater infrastructure to transfer water). These factors may contribute to continued preference for groundwater selling. To know the impact of SKY on groundwater markets in terms of equity distribution, we would be collecting detailed data on this especially from Northern and Western Gujarat.

- **Veena Srinivasan (ATREE):** Characteristics and weightage of enrolled and non-enrolled farmers need to be matched to claim any statistical significance for results. Cropping patterns transitions for enrolled farmers need to be looked at, have they changed? Would be interesting to get detailed reasons for enrolment and their baseline expectations. One reason for pumping more is the high loan instalment to be paid. In other electricity grid expansions, farmers are not asked to bear the capital cost, why was it necessary for farmers to finance this transition?

**Yashodha (IWMI):** We have not yet used standardized matching methods to make statistical comparison across similar groups which is the next step. In terms of post-SKY cropping patterns, it is similar to what we have presented for the pre-SKY period but there is a small proportion of farmers that have shown a change. We did not ask farmers why they enrolled, from field interactions, most farmers cited independence to generate power and earn and daytime electricity as the primary reasons. We need data to confirm this, which would be collected sometime soon. The reason for farmers having to finance the solar pump system and the short repayment period would need to be explored from GUVNL. They may not have considered the heterogeneity in farmer's ability to repay the loan and their energy usage. This period would have been determined based on their average consumption and augmented pump capacity.

**Dr. Alok Sikka (IWMI):** Area under different crops may have changed which would change energy and water use, which needs to be considered as we go forward.

**1.2.2 Activity: Groundwater Sustainability Studies-** This section was presented by Md Faiz Alam.

**Key Points:**

- Objective: Evidence based assessment of SIP adoption on groundwater sustainability of SKY and Non-SKY (Business as Usual) feeders.
- Methodological approach: Census of 4 SKY feeders, farmer selection, monitoring and installation of flow meter have been completed. Estimation and data analysis of the groundwater energy relationship (proxy for groundwater extraction) is in progress and the regional estimation is the next planned activity.
- Census of 370 farmers collected on technical and agricultural parameters in the hard rock aquifer district of Botad and alluvial aquifer district of Anand.
- Characteristics of study regions:
  - Anand is dominated by tube-wells and larger pump sizes and higher cropping intensity, while dug-wells, smaller pumps and lower cropping intensity are more prevalent in Botad.
  - Age of wells in Anand range from 30-50 years and pumps are relatively new (15-20 years). Pumps have been serviced in the recent past (2-6 years) which impacts energy usage. In Botad, pump sizes are smaller than in Anand, have also been recently serviced and wells are older.
  - Depth and irrigated area relatively higher for larger pump sizes under SKY but there is a wide variability and oversizing is prevalent. Depth of wells is comparatively lower for non-SKY farmers in both the districts.
  - 16 farmers were selected for permanent installation of flow meters to monitor water usage, pumping hours and measure the groundwater-energy relationship.
  - Regular energy flow testing being conducted regularly for 160 farmers of different HP sizes to measure flow rate and energy use. Agri seasonal data on crops grown, seeds sown, area cultivated etc. is also being conducted to compare SKY and Non-SKY farmers' water use.
  - Till date, 27 energy flow tests have been conducted with a target to cover 200-300 tests to have sufficient sample size. In Anand, flow rate is similar across pump size (oversizing, limited aquifers, pump location which needs to be explored).
  - Higher energy consumption for higher HP. Early results from applying the conversion factor reveals that 10 HP pumps are the most efficient in terms of water abstraction (8 cubic meter per unit of energy use). Relating conversion factors with other variables needs to be done (deeper the well would result in energy use > water use) and up scaled to feeders with similar water abstraction levels.

**Discussion points:**

- **Veena Srinivasan (ATREE):** There is a slight increase in average pumping. Higher HP does not mean higher water abstraction because it could mean that depth is higher. Benefits of having a larger pump size for larger area are marginal as total flow rate is similar.

- **Alok Sikka (IWMI):** Higher HP are more prevalent when depth is higher or larger area. Mismatch of pump and aquifer characteristics results in oversizing and wrong selection of pump sizes. Lower aquifer yield with higher pump size will also not result in higher water abstraction.
- **Tushaar Shah (IWMI):** Most pumps installed at a time when power supply was unreliable, which is a factor contributing to oversizing. Pushing water to distant farms was also required which resulted in this.
- **Yashodha (IWMI):** After 2011, high power thefts and resulting raids by DISCOMs led to converting unit rate from flat rate. This resulted in upgrading of pump sizes.

**Activity 3.1.1: Training of SKY farmers, Revised/Updated Activities, Innovation Fund and National Forum** - This section was presented by Dr Aditi Mukherji.

- Large variation in generation and net energy exported across utilities which leads to lack of understanding of billing and an overall lack of awareness surrounding panel cleaning.
- Quick enumeration results revealed that farmers clean panels on a weekly or bi-weekly basis with Southern Gujarat cleaning the least often; only 40% of smart phone users use the SKY app for monitoring their energy use which necessitates capacity building.
- Training will use the Randomized Control Trial (RCT) method so that impact of training on outcomes on generation and evacuation can be clearly understood.
- 2200+ farmers in 48 SKY feeders will be trained on financial design/billing and Operation and Maintenance. The remaining 45 feeders (~2000) will serve as the control feeders.
- To be undertaken in partnership with GERMI as soon as the agreement with GUVNL is finalized.
- IWMI will enter into a contract with IRMA Water Centre to assess the Saur Krishi Vahini Programme in Maharashtra. Dr Tushaar Shah will be involved in this project. In Maharashtra, the entire feeder is solarized and there is no incentive design in place to reduce pumping. This would allow for comparison between the components A and C of the KUSUM scheme to determine whether farmers would be willing make a choice between pumping for sugarcane and selling electricity to the grid.
- IWMI has entered into an agreement with ATREE, wherein the price elasticity of demand for groundwater for six major crops at the district level would be estimated. This will be followed by developing a district-level map showing groundwater abstraction levels and preparing a decision framework determining the conditions for solar irrigation to be successful in India.
- Dr Aditi gave an update on the newly announced innovation fund grantees. Two out of 19 proposals from India were selected. One was from **Urmul Seemant Samiti**, who will use solar power to grow fodder crops in a controlled greenhouse in Rajasthan. **Collectives for Integrated Livelihood Initiatives (CINI)** have proposed a project titled '*Excess Energy Accumulation and Redistribution Network*' (EARN), which will be carried out in Jharkhand and involve the creation of a solar mini grid for the use of excess solar energy.
- Plans are underway to conduct a National Forum around October-November 2021, which could be either a virtual or physical meet depending upon the Covid-19 situation.

**Discussion Points:**

- **Akilesh Magal (GERMI):**
  - Results from SKY scheme have not been in alignment with its initial design. Concerns regarding loan repayment hold merit.

- In Dhundi pilot, there was a very high penalty on energy consumed from the grid which dis-incentivised farmers from becoming net consumers. Under SKY, farmers would have had to pay Rs 3.5 per unit for consumption, but the regulator reverted this to 0.6 per unit. This has incentivised farmers to become net importers which is a reason for results being contradicting.
  - Under SKY, bimonthly bills were initially intended to ensure frequent cash flows to farmers. However, many ended up being net importers and hence the annual billing cycle was introduced anticipating that they would be net exporters by the end of the year. However, data reveals that this did not happen in two DISCOMs. Awareness among farmers therefore becomes the solution.
  - These initial findings must go back to the government – GERMI would be happy to facilitate and engage with energy department so that necessary mid-programme corrective actions can be taken.
- **Tushaar Shah (IWMI):** Second pay out across all four utilities was higher than the first pay out – farmers could have been uncertain about receiving anything in the first year. Selling electricity since then became more attractive than water selling. Getting farmers to pay for the water they bought is more difficult than the payment by the electricity board. Transaction costs of water selling is higher; so, if farmers had received more frequent billing than yearly bills, they would have been incentivised to sell more electricity.
  - **Yashodha (IWMI):** There is a learning effect over the years. We also looked at the number of bills received (frequency of billing) which has an impact on energy use and contributes to the learning effect. 95% of consumers are exporters due to the augmentation of capacity, so all are having enough to pump and excess to sell to the grid. As DISCOMs are aware of the learning effect, there is a plan to introduce bimonthly billing in one of the utilities from October/November 2021.
  - **Aditi Mukherji (IWMI):** The scheme would be more effective to reduce supply to daytime 8 hours (planned under KUSUM), as farmers do not feel any need to make a trade-off between irrigation and selling to the grid.
  - **Tushaar Shah (IWMI):** The scheme had to be gold-plated because it had to encourage farmers to be solarised. In Rajasthan, farmers were not willing to pay upfront 10% of costs and did not see any uptake and in Karnataka, farmers were not required to pay anything.
  - **Divya Kashyap (SDC):** The learnings from these studies have the potential to provide insights for policymakers to ensure farmers continue to benefit from solarisation and contribute to climate goals of the country. A series of policy briefs could be generated on these findings.
  - **Closing remarks by Dr Alok Sikka:** All valuable inputs from the C-PMC members have been well received and the IWMI team will incorporate them.

*Meeting notes prepared by Zeba Ahsan, IWMI and Aditi Sanjay, IWMI.*