Exploring a Solar Energy Transition: Using a Participatory Video with Most Significant Change (PVMSC) Approach with Villagers in Rural India

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doi: https://doi.org/10.21467/proceedings.168.4

ABSTRACT

Renewable energy (RE) transitions are vital in achieving climate change targets and such transitions are gaining momentum globally. India is at the forefront of renewable energies having increased its renewable energy capacity by 250% between 2014-2021. As a solution to sustainable rural energy access, a solar community building (Solar Oasis) has been constructed in a village in Maharashtra, India by the Strategic University Network to Revolutionise Indian Solar Energy (SUNRISE) collaboration. However, currently we do not know if RE transitions are equitably beneficial particularly for those reliant on fossil fuels for daily activities, for example, there are concerns that decarbonizing energy systems may in fact increase the risk of disparities among social groups (including age, sex, economic status). To increase knowledge in this area, a Participatory Video with Most Significant Change (PVMSC) monitoring and evaluation approach was used to obtain local experiences and perspectives of the Solar Oasis building and its use in diverse community members' own words and images. The participants discussed the significant changes to their lives and livelihoods following access to the building and planned, filmed, edited, and presented a film shown at a community screening event. Themes discussed and screened in the final film included: 1) benefits from changes to daily activities; 2) potential for economic changes; 3) opportunities for knowledge and skill development; 4) potential health and wellbeing improvements. Additional requirements and future actions were also identified and discussed regarding the village's ongoing development. The PVMSC approach has been useful in this study where the unique insights offered by the participants are communicated easily back to other members of the community and widely to other stakeholders and the SUNRISE project team, in the words and voices that may not have been adequately captured by other methods.

Key words: Participatory video, renewable energy, energy transition.

1 Introduction

As a solution to sustainable rural energy access, a solar community building (Solar Oasis) has been constructed in a village in Maharashtra, India, by the Strategic University Network to Revolutionise Indian Solar Energy (SUNRISE) collaboration[1]. According to the International Energy Agency (IEA), India is the third biggest emitter of greenhouse gases globally. Increased greenhouse gases cause climate change [1]. Climate change is increasingly impacting both urban and rural India because of extreme rainfall, flooding

[1] SUNRISE – Solar Power For All (sunrisenetwork.org)

Proceedings DOI: 10.21467/proceedings.168; Series: AIJR Proceedings; ISSN: 2582-3922; ISBN: 978-81-970666-6-5

and urban heat negatively affecting infrastructure and livelihoods [2] India has made a commitment to increase renewable energy (RE) technologies, particularly solar energy. Renewable energy transitions, in this case a switch from fossil fuels to renewable energy sources such as solar and wind for power generation are considered sustainable solutions that can limit global warming and simultaneously improve health, well-being and socio-economic opportunity, particularly within developing countries and poorer communities [3]. However, at present there is a paucity of evidence regarding whether RE transitions are equitably beneficial particularly for those reliant on fossil fuels for daily activities such as cooking. Traditional fuels (wood and dung) are predominantly used to meet the energy needs of rural and poor households as they are easily accessible and gathered freely [4]. Women and female children mainly carry out these activities [5]. There is a perception that improving electricity access can particularly benefit women and potentially contribute to gender equality in reducing these time-intensive tasks, but how these linkages occur is less researched [6]. The aim of this study was therefore to further explore energy transitions from the perspective of villagers and identify where inequities may exist. Wide community participation and use of methodologies that can provide insights into the human, historical and cultural contexts about new technologies introduced, can support additional understanding of both the impact and the success of such projects from the community's perspective [7] Nevertheless, little has been published regarding how this is to be achieved, and this is why we wanted to share how we used Participatory Video with Most Significant Change (PVMSC) to gain answers.

PVMSC is a qualitative participatory monitoring and evaluation process that can be used to explore aspects of such a transition. We used the methodology with villagers in Maharashtra following the construction of a solar energy community building (Solar Oasis). Participatory Video (PV) is a well-established methodology that has been used in the field of development communication since the 1970s [8]. It is commonly accepted as a collaborative approach, working with a group to create their own film, where the process involved can provide opportunities for conversations and learning that can facilitate change [9,10]. PV can capture often-overlooked perspectives [11] by working with people (i.e. those likely to be impacted by the research) where they are agents of their own voices and images and who are often excluded from research [12]. PV has been used successfully in similar settings and for those with difficulty using written or spoken mediums [13,14]. The Most Significant Change (MSC) approach has its roots in international development [15, 16]. It is a systematic method to gathering stories and deliberating on differing experiences and values in the search for agreed important outcomes [17]. The process of gathering stories can facilitate descriptions of the changes following an intervention (i.e. Solar Oasis construction) and provide details that can help understand how the intervention is working, thus informing the evaluation [18]. PVMSC combined thus creates an environment for social dialogue, a framework for participants to think about their lives and changes within them, and provides the means to exercise agency through discussion and the collaborative production of films [9,19].This deliberative and democratic process can help participants to understand how an intervention works and how and who it may benefit most or least and thus inform the evaluation and make subsequent developments more relevant to their local contexts [18]. The PVMSC methodology was used because whilst it is increasingly recognized in the literature that energy transitions are complex, multi-dimensional evolutions within specific geographical, social, cultural, historical and economic systems [20], their success still tends to be measured in terms of technical or economic factors [21]. Methodologies that can build a better understanding of the complexity and diversity of lived experiences and the complexity of energy uses and behaviours [22] of the phenomenon of interest are more appropriate. The use of narratives and storytelling are becoming more common in climate change research and policy as they can be used to ensure local perspectives contribute on a more equal footing in the research process using lenses from social sciences, humanities, and practitioners' perspectives [23]. The use of video can enhance the

Proceedings DOI: 10.21467/proceedings.168
ISBN: 978-81-970666-6-5

Series: AIJR Proceedings
ISSN: 2582-3922

power of storytelling by its accessibility to diverse audiences and demonstrate more clearly the role of participants as co-creators of knowledge [24]. This paper critically reflects on the PVMSC approach, the discussions throughout the activities conducted and experiences described in the video.

2 Materials and Methods

The research used Participatory Video with Most Significant Change [25,26] to provide a deeper contextual understanding of the changes experienced following access to the Solar Oasis building from the perspective of 13 villagers from Khuded, a small village in Maharashtra (population of approximately 500; 80 families). The recruitment of different genders and age groups was deliberately sought to better ascertain a variety of perspectives on access and use of RE and perceived benefits or inequities. The PVMSC activities aimed to better understand how the villagers defined and selected the most significant changes (positive and negative) to their lives following the construction of the RE Solar Oasis building. The process involved the participants defining their own measures of success within the identified changes and so provided a more positive cycle of sharing, learning and reflecting.

The research team conducting the activities in the field comprised: The PI (author Maddock); and two senior RAs from the Tata Institute of Social Sciences (TISS). Both RAs were involved in previous SUNRISE qualitative (RA1 Ahire) and quantitative (RA2 Pednekar) data collection over the past 3 years. RAs were familiar with the research village and speak the local language. CoI-1(Siva Raju): Professor at Centre for Population, Health and Development, School of Development Studies at TISS is an expert in community development and methodologies to assess community needs and had a supervisory role of the TISS RAs. CoI-2 (Sunikka-Blank): Associate Professor and Deputy Head Department of Architecture in Cambridge, leads AHRC Research Network Filming Energy (FERN) that uses participatory filmmaking to understand women's lived experience in low-income housing in India and South Africa. All researchers completed InsightShare[2] PVMSC training (including CoI-2) and InsightShare support was available in the field, led by Soledad Muniz. The CoIs were involved in a project advisory capacity. We also recruited a Mumbai based external consultant to carry out the editing of the videos during participatory editing.

TISS researchers had developed a close working relationship with Keshav Srushti, a local non-governmental organisation (NGO) active in Khuded for about 4 years. Two of the NGO employees, the head of the NGO in the Jawar (local) region, and another local villager (male) who took part as a participant, had attended some of the PVMSC training sessions (online). The training was not ideal from their perspective as language was a barrier and there was no internet in Khuded meaning they had to make a trip to a nearby town to access the online training. We had aimed to bring TISS researchers and the two NGO members together for the practical sessions in the training, however this was not possible due to Covid related travel restrictions at the time.

3 PVMSC overview and recruitment to the research

The PVMSC activities took place in a village in Maharashtra over 10 sessions in a two-week period between November 23rd and 4th December 2022 (table 1). Each session lasted from between 90 mins to three hours. The sessions were generally held in the early afternoon to fit around everyday activities and were agreed from one session to the next by the group. Most participants were able to attend most sessions, with all attending at least seven of the sessions. Refreshments, prepared at a local guest house, were provided by the researchers, for a break during these sessions. Researchers from TISS delivered the sessions in the local

[2] Services - InsightShare

language (Marathi) and had met most of the participants previously when conducting other research activities including assessment of community needs, stakeholder mapping and social profiling related to the SUNRISE project.

Table 1*: Summary of PVMSC sessions carried out in the village.*

Session	Key aspects covered	Duration
Recruitment	Overview of planned activities discussed at Solar building inauguration ceremony (October 2022) and/or discussed with the NGO to determine community availability, about one month before planned sessions	
General make up of sessions	Refreshments provided for participants each day during a session break: drinks prepared in a local guest house. Flexibility was required for participants to come and go in sessions/due to other commitments	
1 23/11/22	Information session (Q&A) giving detailed overview of sessions, participant information sheet, consent process and time commitment. Obtained initial consent to participate. Introduced researchers from TISS (already known to most of the group) and UK researcher	1.5 hours
2 24/11/22	Introduction to PVMSC. Games with the phone camera & filming. Use of equipment straight away e.g. disappearing game 'each one teach one', film and pause; storytelling. What makes a good story?	3 hours
3 25/11/22	Showed edited disappearing game film. Storytelling – elaboration of stories using tools e.g. 'River of life', use of camera and filming. Explained a storyboard. Requested that participants would draw their own story board next day (day off) depicting the 'most significant change' for them since the Solar Oasis was built	3 hours
4 27/11/22	Split group into two (men and women separately). Discussed stories separately then as a group; Who is the audience? What are key aspects of the story, who will tell it and how? Speaking to camera – telling the stories. Stories elaborated and recorded.	3 hours
5 28/11/22	Final story? Whose story(s) are we telling? Group discussion. Discussed key messages to share and how to capture them? Completed the storyboard and how to capture. Filmed separate frames.	3 hours
6 29/11/22	Reviewed films. Participatory Editing - how editing can alter stories. Worked with experienced film editor who showed the clips and edited as per groups instructions. Emphasised capturing the film 'right 1st time' as easier than re-filming and editing.	2.5 hours
7 1/12/22	Played film to date, discussed progress – filmed scenes for storyboard; additional filming and editing. Will the film be shown to a wider audience? Do we want to include invited guests beyond the village? Discussed a film show/ community event	2 hrs

Proceedings DOI: 10.21467/proceedings.168
ISBN: 978-81-970666-6-5

Series: AIJR Proceedings
ISSN: 2582-3922

8 2/12/22	Discussed the screening options –all were happy to consent for film to be shown wider (YouTube-possibility global audience)? Credits on film? Consent to share considering this. Additional filming/editing to complete the storyboard	2 hrs
9 3/12/22	Pre-screen event – final editing (one more scene to capture) Filming individual name to camera for credits	1.5 hours
10 4/12/22 am & 6pm community screening	Final editing and completing credits of film. Final screening with invited members of the community (approx. 80)	1hour small group 1 hour with refreshments

3.1 Participant recruitment

The NGO lead in the area facilitated the recruitment of a group of 13 villagers representing different age groups and genders to take part in the PVMSC activities. Negotiations took place from October (the official launch of the Solar Oasis project) between the NGO and the villagers to agree a suitable time frame taking into consideration the community's commitments to agricultural activities such as the main harvesting and any festivals or religious ceremonies that may restrict participation. It was the intention to recruit those who may be some of the most vulnerable or marginalised (e.g. the landless and older women in particular) along with those more usually expected to benefit (e.g. those with land; improved earning capabilities). Although we successfully recruited different age groups and gender mix, the researchers realised during the activities that the group was not as diverse as planned and stipulated to the NGO. Those attending were well known to the NGO and each other and several were closely related to the landowners who had donated the land for the Solar Oasis building to be constructed. There was less diversity in terms of marginalisation (e.g. landless) than we had hoped, nevertheless there was at least one person in that category. TISS colleagues felt that from experience our recruitment of those willing to participate for the duration of the activities was an achievement. We made a concerted effort during the PVMSC activities to encourage reflection on whether the group experience may be the same or different for others in the village.

Information about the study was given verbally to the villagers prior to the research teams arrival at the villages by the NGO. At the first session a group were gathered to discuss in more detail what the research entailed, receive the participant information sheet (PIS) and to give consent where appropriate. A member of the group read out the information to others to ensure that those with more limited literacy had the opportunity to ask questions and make an informed consent.

The sessions progressed through the PVMSC activities following a similar structure to that suggested in the facilitators guide to PVMSC [25] and as advised during the InsightShare training delivered to the researchers earlier that year (3rd to 25th March 2022 online and over ten 90 min sessions). We worked with the participants to teach a set of techniques that they could use to create their own film.

The PVMSC methodology moved progressively from learning about the iPhone and the Filmic Pro[3] app installed on it with additional equipment to support filming interspersed with story collection and discussions, through analysis with the aspects of monitoring and evaluation being integral to the process [8]. In essence the PV-MSC activities were overlapping, integrated and cyclical to ensure that time was

[3] Filmic Pro v7 - Filmic Pro Mobile Video - Smartphone Filmmaking

maximised but that all taking part were engaged and comfortable with activities see Fig 1 for an overview of core activities within the PVMSC process. We used a range of learning activities designed to be both informative and fun, building on the premise of 'action reflection' and 'each one teach one' activities which kept progress constant with a willingness to try new skills.

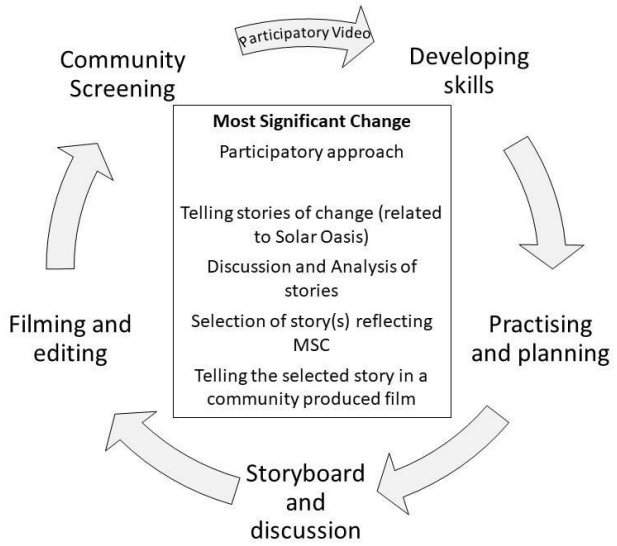

Figure 1 Diagram representing the simultaneous PV-MSC activities during this research.

3.2 Telling and gathering stories of change.

One key question was posed to the participants: "What has been the most significant change in your life/to your livelihood since the solar building has been completed and in use?" The participants were each encouraged to illustrate their responses to this question with their own stories, first in small groups with an active listener and observer, who were asked to encourage elaboration to capture greater depth around the issues within the story, and then back within the main group. The telling, re-telling and discussion of narratives of importance alongside group questioning and critical reflection over the sessions supported the group's decisions of what to include in the main 'story of change' and why. Additional prompts such as "Can you give me some more details about this change?" and "What difference has this made?" ensured fuller accounts of change were given. The telling and gathering stories for The Most Significant Change (MSC) participatory process took place mainly in sessions two to five but still formed part of the discussion at later sessions and during filming where researchers were identifying aspects of the story that were becoming clearer in the retelling and helped tell the stories the villagers wished to share. Most of the sessions with planned discussions were recorded and the researchers made and discussed field notes each evening following the sessions and noted aspects of different stories that were not included and why. Any noted points were taken back to the group the next day for clarification. The recordings were reviewed later to ensure that all stories/issues told had been discussed within the group and dealt with by them. The development of a storyboard facilitated further discussions, as it detailed the direction of the filming and also the participatory analysis (see Fig 2). The storyboard depicts the key scenes or moments of the story, with each drawing representing a specific scene to be filmed, arranged in the sequence that reveals how the story unfolds.

Proceedings DOI: 10.21467/proceedings.168
ISBN: 978-81-970666-6-5

Series: AIJR Proceedings
ISSN: 2582-3922

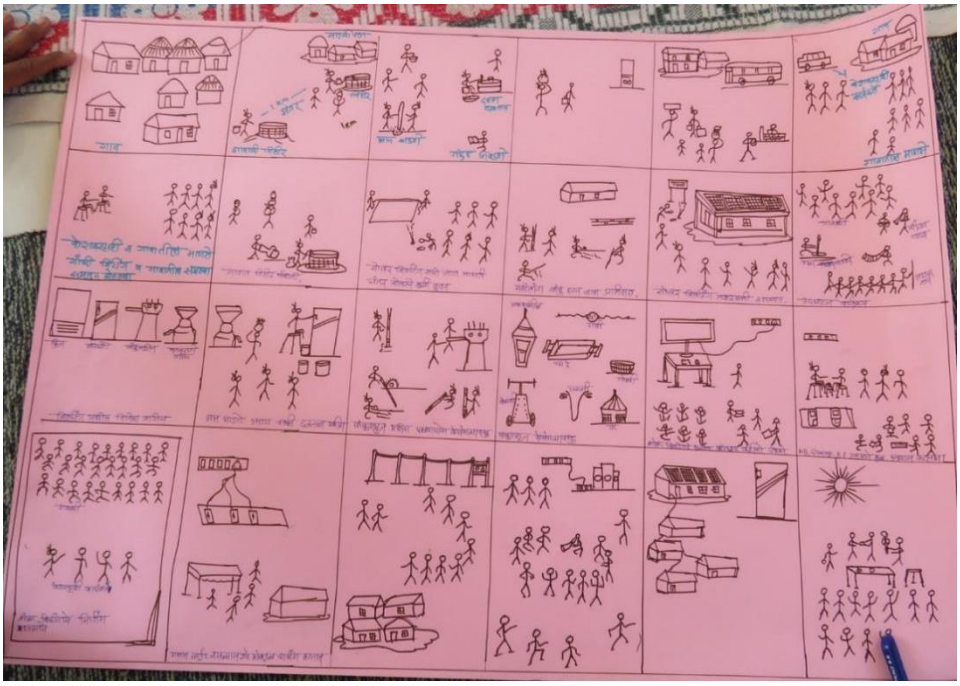

Figure 2: Storyboard produced by Khuded villagers. Photo by author 28/11/2022

Participatory analysis of stories was intuitive and inductive as the group reflected on key changes in terms of themes emerging from the stories. This emic perspective provided the theory of change -without being articulated as such [18]. Our aim was to capture shared stories and perceptions of change from the stakeholders' perspective. The development of a storyboard (ostensibly to facilitate the direction of filming) also supported participatory analysis. Returning to the storyboard and films produced each session provided the opportunity for further exploration of the 'scenes' and ensured that editing captured them accurately as desired by the group, simultaneously allowing the themes to be explored in more depth [27].

The filming of the main narrators selected by the group (one male 18-35 group, and one female 36-59 group) took place in the Solar Oasis as did the filming of the new equipment powered by RE. There were several other scenes that took part in the village, and this encouraged additional reflections of the group to consider their role in accurately portraying their own lives as well as those of other villagers. In addition, filming 'on location' in the village provided the opportunity to share the purpose of the activities being conducted with other villagers. A presentation of the final film organised by the group involved other villagers at a public screening outside the Solar Oasis building on the final day of the activities. It is fairly typical within PV research to show the final film(s) to wider stakeholders as this can create opportunities for wider discussions and social and political influence (depending on invitees)[11]. In this instance, it was viewed by participants as an opportunity for celebration and a chance to share the fortnight's PVMSC activities with invitees including family members and other villagers (approximately 80 people including children).

4 Results and Discussion

Participants used the PVMSC process (discussion, storyboarding, analysis, filming and editing) to describe changes and issues of importance to them as individuals and as they considered reflected community issues related to the use of the Solar Oasis building. The final film produced depicts the negotiated and agreed most significant changes to lives and livelihoods following the building construction and access to it. The film starts with narrators describing the village, homes and daily life and how developments facilitated by

the NGO had already helped villagers, particularly with respect to easier access to water saving considerable time and effort on a daily basis. Participants determined what was important to capture and 'measure' for example, in terms of time saved or economic opportunities enhanced. This resulted in themes observed by the participants and discussed with the researchers around differences between 'before and after/then and now', with respect to:

1) Changes to daily life and reduced pressure of work. The availability of new RE powered equipment in the form of a rice husker and flour grinder had reduced the time spent on what were formerly manual, labour intensive, everyday activities to fulfil the families' requirements for their daily bhakri (bread). The women (whose role this is almost exclusively) described using the equipment and time saved as empowering (see Fig 3).

Figure 3 is an image taken from the community produced film [31] November 2022

2) Economic opportunities. There were two pieces of equipment with potential to directly support economic activities. The first, a bamboo slicer was also used exclusively by women in the village as they had received training on creating decorative bamboo items to sell as a self-help group as part of a social enterprise scheme (see Fig 4). The training was organised by the NGO who also identified potential buyers for the products. An industrial refrigerator was purchased with the aim of supporting jasmine flower farming and sales as a lucrative cash crop as it was hoped it would extend the timeframe for gathering and taking the flowers to market easing pressure on the farmers by keeping the flowers fresher for longer. However, at the time of writing this article both these activities were not running as hoped and depicted in the film produced. For the bamboo slicer, although the equipment was working there were ongoing discussions around future commissions and payment in a timely fashion. Investigations regarding the correct use of the refrigerator were also underway.

Proceedings DOI: 10.21467/proceedings.168
ISBN: 978-81-970666-6-5

Series: AIJR Proceedings
ISSN: 2582-3922

Figure 4 An image taken from the community produced film (bamboo slicing for social enterprise scheme)

3) Health and well-being benefits (including public health opportunities). Electronic testing devices for specific health checks such as blood pressure and diabetes monitoring were now more able to be charged and used in the reliably illuminated Solar Oasis building. A computer had also been purchased by the NGO and was available to show a variety of public health films particularly related to girls and women's health (see Fig 5). The Solar Oasis building itself with the ability to provide a reliably illuminated space was beneficial to members of the village as a place where celebrations could be held and had been used for informal gatherings and charging mobile phones.

4) Educational opportunities. The computer and plans to obtain others were promoted as a means of accessing additional educational opportunities particularly for the children in the village where schooling opportunities were limited with older children needing to travel beyond the village to access secondary education. Additional computers combined with access to the internet (not yet available in the village) would, they stated, provide additional learning opportunities.

Figure 5 An image taken from the community produced film depicting a public health lesson for schoolgirls

Encouraged by the researchers to talk about what may be next in terms of the solar building uses, the villagers proposed future upgrades to the equipment already there and suggested new devices. The group identified that the new equipment (rice husking and grinding machines) was already insufficient to meet the needs of the entire community and required higher capacity machines to supply demand. Additionally, there was an expressed desire to achieve electrification of individual's homes which they considered was important for the development of all. Plans perhaps unrelated to the solar building such as how to ensure availability of water for home and agricultural use were also discussed indicating further developmental plans.

Previous research has similarly demonstrated the benefits of renewable (clean) energy access with a focus on education, livelihoods and health [28,29]. Freeing up time for women from labour intensive food preparation as identified here has also been demonstrated [30].

5 Conclusions

The PVMSC activities carried out and the film produced permitted a more nuanced understanding of some of the impacts of the solar energy building and an RE transition. The processes involved stimulated discussions around key changes and future possibilities of RE which were showcased within the community at the screening and suggested a sense of pride in the RE building, equipment and its future potential. The PVMSC process can facilitate learning within and beyond the group as films were disseminated widely... Viewing villagers describing changes in their lives can be transformative for observers, motivating further dissemination and action . Participatory approaches that put 'people at the centre' of clean energy transitions has been advocated as a key to successfully implementing energy and climate policies. However, this research has also demonstrated that there may still be limitations in accessing voices of those most marginalised such as those without land and those who are not currently engaged in activities such as self-help groups which seem to focus more on younger adults with greater potential for earning capacity (women in the specific example detailed here). There is a need to acquire an understanding of daily practices throughout the year which are critical to learning about energy requirements. Equally important is further exploration of traditions, priorities and values which can better inform project planning around RE interventions. Understanding the specific sociocultural context where energy needs (or specific vulnerability

Proceedings DOI: 10.21467/proceedings.168
ISBN: 978-81-970666-6-5

Series: AIJR Proceedings
ISSN: 2582-3922

are being addressed is essential to addressing them. Further studies to examine equitable energy access over time could be extended to a wider population including less privileged groups. How to access these voices needs careful consideration alongside mechanisms to facilitate participation, including recompense for time which may encourage greater diversity.

6 Declarations

6.1 Acknowledgements

A huge thanks to all our participants, without whom this research would have been impossible. Thanks also to our funders the British Academy/Leverhulme

6.2 Study Limitations

The intention of the researchers was to access the voices and stories of those involved in the PVMSC activities and every effort was made during the process to ensure that power dynamics, both external (between the researchers/other stakeholders and participants) and internal (within the participant group) were minimised to avoid creating or reinforcing structures that reduce agency. It was apparent that the regard for the NGO (and their ongoing involvement in future developmental planning) 'set the scene' and framed the filming from the outset. This resulted in what the researchers thought may be a reluctance to criticise either the NGO or SUNRISE partners resulting in an overly positive portrayal of the Solar Oasis and equipment, considering the issues around some of the equipment already failing to meet the needs of the community. Similarly, there were challenges with respect to recruitment and representation of villagers participating in the activities as those involved and recruited via the NGO were potentially more likely to provide a positive view. When balanced against the difficulties that we may have experienced in recruiting villagers within the project time frame this seemed a reasonable option. To reduce the risk of potential bias we made particular efforts to consider this in our questioning during activities by consistently asking questions such as "and do you think these changes (giving the specific examples being discussed) are the same for other in the village?"- and "may this affect others differently -how?" The role of the NGO cannot be underestimated in terms of supporting access to and the commitment of participants in this research and in previous research has also demonstrated that partnerships between governments and local NGOs can significantly increase the capacity for effective social action. which indicates the importance of improving mechanisms of working successfully alongside them. In addition, it was originally planned that an evaluation of the Solar Oasis would be conducted around one year post Solar Oasis build thus providing the villagers with more time to use the building throughout a typical yearly cycle of activities including agricultural, seasonal and cultural. However, the impacts of Covid 19 meant that both building and research activities were delayed considerably resulting in the evaluation taking place just three months after the building was completed.

6.3 Funding source

Determining Equitable Benefits: Achieving Transitions in renewable Energy (DEBATE) was funded (£9,885.00) by the British Academy Small Research Grants scheme SRG22\220462 (2022)

6.4 Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

6.5 Ethical Approval

The study, Determining Equitable Benefits: Achieving Transitions in renewable Energy (DEBATE) received ethical approval from Swansea University (reference 100822e)

6.6 Informed Consent

Informed consent was obtained from all individual participants included in the study at several stages of the process. Initially consent was taken to take part in the activities and then towards the end of the sessions to grant permission to share the participatory videos and photographs taken to the community and more widely (e.g., social media).

6.7 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in in published maps and institutional affiliations.

How to Cite

Maddock *et al.* (2024). Exploring a Solar Energy Transition: Using a Participatory Video with Most Significant Change (PVMSC) Approach with Villagers in Rural India. *AIJR Proceedings*, 29-41. https://doi.org/10.21467/proceedings.168.4

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