



©FAO/ICIMOD/Jitendra Raj Bajracharya

STRENGTHENING INSTITUTIONAL CAPACITIES FOR SUSTAINABLE MANAGEMENT OF SOLAR POWERED IRRIGATION SYSTEMS (SPIS) WHILE ADDRESSING GROUNDWATER RISK

April 2020

SDGs:



Countries:

Bangladesh and Pakistan

Project Codes:

TCP/RAS/3616

FAO Contribution:

USD 406 000

Duration:

1 May 2018 – 31 December 2019

Contact Info:

FAO Regional Office for Asia and the Pacific

FAO-RAP@fao.org

Implementing Partners

Ministry of Agriculture, Bangladesh; Ministry of National Food Security and Research, Pakistan.

Beneficiaries

Policy-makers, government officials, academics, experts, agricultural extension officers, irrigation managers, representatives from farmer organizations and water user associations, and farmers.

Country Programming Framework (CPF) Outputs

Bangladesh 2014 - 2018

Priority Area 2: Enhance agricultural productivity through diversification/intensification, sustainable management of natural resources, use of quality inputs and mechanization.

Output 2.2: Strengthened technical capacity (institutional and individual) for developing and implementing sustainable production programmes.

Output 2.6: Sustainable natural resources management practices promoted for protection of environment and conservation of natural resources and biodiversity

Pakistan 2012-2017

Priority Area 2: Support to Pakistan New Growth Strategy for Sustainable Agricultural Economic Growth.

Output 2.2.1. Adaptive research & participatory extension approaches adopted & practiced by agricultural support service providers in targeted areas.

Priority Area 3: Disaster Risk Reduction/Management and Emergency Response including Natural Resource Management.

Output 3.4.1. Increased capacity of Government institutions related to Natural Resource Management (NRM) at federal and provincial level for design and implementation of the policies and strategies for integrated Natural Resource management and climate change adaptation and mitigation.

Output 3.4.2. Increased capacity of communities in the design and implementation of the sustainable natural resource management strategies and action plans.



BACKGROUND

Solar-powered irrigation systems (SPIS) provide a source of reliable and clean energy for use in agriculture. Initially a costly option that was not accessible to many, the price of solar cells has fallen drastically in recent years. This, coupled with the fact that many governments subsidize this technology as a means of reducing carbon emissions in the agriculture sector, has made them a more affordable option for farmers all over the world.

These SPIS can be particularly effective in rural areas, where access to electricity is often limited, and the price of diesel for running fuel-powered irrigation systems is high. That being said, it is important to consider the unique context of countries individually and to address the risks and challenges of implementing this technology as it continues to be expanded and promoted.

This TCP project was designed to explore the possibilities for the use of SPIS in Bangladesh and Pakistan by taking into account the positive aspects it offers, such as increasing access to energy in rural areas, as well as the potential issues, including how SPIS could affect the regulation and use of groundwater. Emphasis was also placed on ensuring that the technology would be accessible to the poorest farmers.

Agriculture plays a crucial role in the economy of Bangladesh, accounting for 20 percent of the country's GDP and employing 45 percent of its workforce. Roughly 60 percent of the land is irrigated by groundwater. Farmers in Bangladesh have traditionally relied on diesel- or electricity-powered irrigation pumps; however, the country's climate and location make it an ideal place for utilizing solar energy. Some investments in SPIS had been made in Bangladesh prior to the inception of this TCP project.



The role of agriculture in the economy of Pakistan is also an important one. It accounts for approximately 25 percent of the GDP and employs about 45 percent of working people. Major crops in the country are irrigated. Because of Pakistan's semi-arid climate and its growing population, water availability is a critical issue. Groundwater is often extracted in an unregulated and unplanned manner, which causes a number of issues, including significant lowering of the water table, salinization and high pumping costs. Like Bangladesh, the climate and location of Pakistan are conducive to the production of solar energy, and some investments in SPIS had also been made there prior to the formulation of this project. Owing to the fact that the cost of SPIS is competitive when compared to diesel and electric pumps, reports indicate that some large farms have been able to afford this technology; however, smaller farms cannot. Taking into account the specific contexts of Bangladesh and Pakistan, this TCP project allowed stakeholders to gain a comprehensive understanding of the potential for the use of SPIS in both countries through the creation of suitability maps. The main objectives of the project were to ensure that current and future investments in SPIS promote sustainable agricultural production and equitable access to groundwater, and ultimately to support the livelihoods of rural farmers.

IMPACT

Under this project, knowledge was developed and shared, reports and policy briefs were drafted, and SPIS suitability maps were created. These outputs are expected to strengthen the institutional capacities of the Governments of Bangladesh and Pakistan in the sustainable management of SPIS, in order to increase agricultural production and boost rural livelihoods in both countries.

ACHIEVEMENT OF RESULTS

This project worked towards the achievement of SDG 2 (Zero Hunger) and SDG 7 (Affordable and Clean Energy) by contributing to a greater understanding of sustainable groundwater use in the context of SPIS, which ultimately supports the sustainability of food production in the targeted countries. Furthermore, as the project highlighted the environmental and social risks associated with SPIS, the level of understanding as to how to promote new energy technologies in a sustainable manner was increased.

The outcome identified in the project document was achieved. The project followed a methodical approach, assessing current in-country SPIS practices and identifying gaps. Once the gaps were identified, the project developed a mapping system that supported policy-makers to make informed decisions with regard to SPIS implementation, as the maps enabled a greater understanding of the social and environmental risks associated with it.

All Outputs were delivered in a timely manner, except for the training sessions under Output 3, which were postponed indefinitely due to the COVID-19 Pandemic that hit in March of 2020. Opportunities for conducting these training sessions at a later date are being explored.

Output 1 began with the drafting of assessment reports. These reports detailed the existing uses of SPIS in the targeted countries, as well as the associated risks, the key factors surrounding the success or failure of SPIS, the legal, policy and financial instruments for their regulation, and recommendations for the sustainable planning and use of SPIS technologies. A study on farmers utilizing SPIS was also conducted.

Under Output 2, policy briefs were drafted for both countries. They focused on the sustainability of groundwater use, social equity in the context of water scarcity, and increasing agricultural production, and they were distributed at national dialogues that were carried out in both Bangladesh and Pakistan. These sessions provided an opportunity for stakeholders to discuss the risks and benefits of SPIS. Feedback on the policy briefs was also provided, and the Governments of both countries expressed a commitment to achieving the project's Outcome.

A regional dialogue was also held to discuss the sustainability of SPIS, as well as the possibility for future innovations. The revised policy briefs were presented, along with a first draft of the SPIS mapping methodology, and the preliminary designs of the maps themselves. Experts from India and Nepal also participated in the regional dialogue, which allowed for the dissemination of findings from Bangladesh and Pakistan to other countries in the region. Feedback was taken into consideration to improve the maps and the project Outputs. Documentation and communication materials to promote the sustainable use of SPIS were developed at each stage of the project.

The final Output focused on capacity development; however, the activities under this Output were reformulated. The first activity that was meant to be carried out was a study tour to allow participants to gain insight into the sustainability and equitable use of SPIS. It was decided that investing in the creation of the interactive SPIS suitability maps would be more beneficial and would provide stakeholders with the necessary input for policy-making in both countries. Environmental suitability, groundwater, solar irradiation and social equity were the focus of the maps.

E-learning and blended courses were also planned under this Output. The e-learning courses were first reformulated to be carried out in-person, as it was decided that collaboration between experts and policy-makers at face-to-face sessions would have been beneficial; however, the outbreak of COVID-19 in March 2020 meant that these sessions were not carried out. The blended courses that were envisioned were also not carried out because of the outbreak. That being said, at the time of this report, the project team was looking for opportunities to conduct these capacity-building activities at some point in the future.

IMPLEMENTATION OF WORK PLAN

As mentioned above, some activities were reformulated. As such, a budget revision was requested and approved to accommodate these changes.

Unfortunately, the COVID-19 pandemic hit in March 2020, the exact time when the project intended to conduct the final national dialogues and training sessions. There was too little time to come up with alternative modes of delivery; however, as stated above, possibilities for conducting the training sessions in the future are being explored. The International Centre for Integrated Mountain Development (ICIMOD), who partnered with FAO for the implementation of this project, produced a user's manual for the interactive maps for policy-makers to utilize in the meantime. The residual funding that remained from the cancellation of the planned capacity development sessions will be absorbed back into the TCP fund.



The identified risks in the project document included: (i) the commitment of participating countries to project implementation; (ii) the collaboration of the political, research and community partners in the region; (iii) political instability in the region and national or local sensitivities between the countries; and (iv) an inability to engage ministries that had not traditionally partnered with FAO in the past.

Fortunately, the ministries involved in the project were enthusiastic about project implementation. This was particularly evident in Bangladesh, where local agencies proactively engaged with the national project consultant and the country office to further the study of the environmental and social risks of SPIS. Furthermore, there was great collaboration of the political, research and community partners in the region, even in countries where political sensitivities exist. A broad spectrum of national policy-makers and experts were involved in the dialogues at both national and regional level, and they facilitated rich and enthusiastic discussions. The only risk that had to be actively managed was the engagement of ministries that had not previously partnered with FAO. In order to manage this risk, the project selected national consultants with experience and connections to these ministries, who expanded the network of FAO and promoted cooperation.

FOLLOW-UP FOR GOVERNMENT ATTENTION

There are no suggested follow-up actions; however, there is a vested interest in the success of the maps on the part of the countries and other interested stakeholders, such as the *Gesellschaft für Technische Zusammenarbeit* (German Agency for International Cooperation [GIZ]), who have expressed an interest in working with the maps in the future. While there were no planned activities at the time of this report, there were conversations taking place about how to continue mapping activities across the region and how to improve the methodology and approach, all of which will be made possible with more time and funding.

SUSTAINABILITY

1. Capacity development

In conversations at the national and regional dialogues, policy-makers discussed possible policies to introduce in the future. Specifically, in Bangladesh, the Ministry of Power, Energy and Mineral Resources, who drafted the policy guidelines for the grid integration of solar irrigation pumps, was engaged by the project team. The Ministry asked for comments and recommendations from FAO based on the findings of the SPIS country assessment report and policy brief to strengthen the policy document. If comments and recommendations made by FAO are integrated, it will be considered a significant achievement for the project.

The SPIS interactive maps will be handed over to the country for use by policy-makers. The countries are expected to receive a back-end log in, which will be formally delivered at a meeting with the Ministries of Water Resources in both Bangladesh and Pakistan after the COVID-19 pandemic. In addition, the environmental thresholds set within the maps will be based on the direct advice of the Ministries of Water Resources in both countries, and they will be the sole custodians of those controls. As a result, the thresholds will dictate the results of any user that accesses the maps online via the website. The countries having this level of control over the maps is expected to lead to a full and sustainable integration of the mapping system into national organizational structures. This handover of the SPIS interactive maps to the involved Governments is the exit strategy of the project.

The project created a stronger alliance between GIZ and FAO, as GIZ previously developed the Toolbox on Solar Powered Irrigations Systems (<https://bit.ly/2K9Tc0l>). Furthermore, GIZ has expressed interest in investing in and utilizing the maps that were developed as part of this project in the future.

Finally, this TCP project is part of the Water Scarcity Programme of the Regional Office for Asia and the Pacific (RAP). All findings from this project are expected to be used and incorporated in the regional programme.



2. Gender equality

Through consultation and dialogue, the project targeted existing gaps to meet the needs of project beneficiaries, who were policy-makers, academics, and experts, to strengthen their knowledge and understanding with regard to the sustainable use of SPIS. The consultations included people from all backgrounds, minorities and genders.

The mapping exercise collected data on social equity with regard to SPIS, taking female farmers and farmers from low socioeconomic backgrounds into consideration. This data is expected to be used within the SPIS interactive maps to assist government policy-makers to make better decisions about where to direct subsidy schemes, in order to ensure SPIS policies and the associated subsidies are targeting those who need them the most.

3. Environmental sustainability

The project focused on mainstreaming environmental sustainability into a new and innovative nexus technology that spans three key sectors: agriculture, water and energy. The project design was innovative, in that it assessed the environmental risks associated with a climate-friendly technology. Expectations were surpassed in achieving SPIS mainstreaming for environmental sustainability, and this was further emphasized by the Ministry of Power, Energy and Mineral Resources of Bangladesh, in their request for recommendations for their policy guidelines for the grid integration of solar irrigation pumps.

4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

The promotion of SPIS directly contributed to the improvement of labour conditions in rural areas, as SPIS are less labour intensive than other traditional modes of irrigating (i.e. with diesel-powered systems). This makes irrigating more accessible for all users, including women. Within this context, it is well documented that increasing sustainable access to fresh water improves development outcomes for all populations.

5. Technological sustainability

The technology introduced by this project are the SPIS interactive maps, which can be accessed online and via a mobile application. These were the desired platforms as outlined by stakeholders during the national and regional dialogues. The technology is free and easily accessible for everyone.

Through the policy brief, policy-makers, academics and key stakeholders increased their knowledge of challenges and solutions associated with SPIS. Furthermore, through the mapping exercises, policy-makers, academics and key stakeholders are expected to gain a better understanding of the risks of SPIS at state and national level. They are expected to access this resource to increase their own knowledge and capacity in the future.

The capacity of stakeholders in the targeted countries is strong. The major challenge they must overcome is in recognizing risks that had previously not been considered by different sectors working in isolation from one another. The interactive maps are expected to prompt stakeholders to do this, as they fall outside the responsibilities of most sectors, therefore requiring risk mitigation and management from different parties.

6. Economic sustainability

At the time of this report, no additional financial resources had been allocated or mobilized; however, discussions had taken place with GIZ regarding the hosting of the maps in the future, in order to ensure the sustainability of the online system.

All products and services developed within the project are free of charge for anyone who wishes to access them.



DOCUMENTS AND OUTREACH PRODUCTS

- Bangladesh Country Assessment Report on SPIS. B. Nishat. 8 pp.
- Bangladesh Policy Brief on SPIS. B. Nishat. 20 pp.
- Interactive GIS Maps. ICIMOD.
- National Dialogue Report (Bangladesh). ICIMOD. 4 pp.
- National Dialogue Report (Pakistan). ICIMOD. 4 pp.
- Pakistan Country Assessment Report on SPIS. A. Mahmood. 20 pp.
- Pakistan Policy Brief on SPIS. A. Watto. 8 pp.
- Regional Dialogue Report (Bangladesh & Pakistan). ICIMOD. 10 pp.
- SPIS Farmer Behaviour Study. C. Turner & B. Nishat. 6 pp.
- Tool/Guide on Policy Training for SPIS. H. Hartung. 6 pp.
- User guide for exploring the SPIS feasibility maps. V. Khadgi. 5 pp.

ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

Expected Impact	The project seeks to strengthen the institutional capacities of the national governments to ensure the sustainable management of solar powered irrigation systems by addressing ground water risk, to promote sustainable agricultural production and ensure rural livelihoods	
Outcome	Improved knowledge, developed capacities and empowered relevant stakeholders in the selected countries to make informed decisions about how to adopt and regulate the use of SPIS	
	Indicator	Number of SPIS-related activities to foster knowledge transfer and regional exchange of experiences as a result of FAO support.
	Baseline	Zero
	End Target	Two country assessment reports, one regional policy forum and one study tour conducted, documentation and communication material produced.
	Comments and follow-up action to be taken	By the closure stage of the project, two country assessment reports had been produced, two policy briefs had been produced, one economic behavioural study on farmers utilizing SPIS had been completed and one national dialogue had been carried out in each country. The regional policy forum was held in August 2019, and further documentation and communication material was produced at each stage of the project to promote the sustainable use of SPIS. The study tour was not conducted. Through conversations and dialogue with national and regional governments, it was concluded that funding was to be directed to produce interactive SPIS suitability maps instead, which can be accessed online and via a mobile application. The lack of information about suitability parameters and the understanding of the local environment were deemed more important and useful for building capacity within the government to address the environmental and social issues associated with SPIS. Interactive training sessions and capacity building workshops in both Bangladesh and Pakistan were planned. The workshops were meant to run simulations on the environmental risks of SPIS and to encourage policy-makers to plan, coordinate and identify tangible solutions using existing resources. However, due to the outbreak of COVID-19 in March 2020, it was impossible to proceed with these activities. Once travel restrictions are lifted, FAO will consider whether it is possible to deliver these workshops, as additional funding is required. In lieu of the workshops, ICIMOD produced an instructive user's manual for the interactive maps, so policy-makers can familiarize themselves with the platform in their own time.
	Indicator	Number of countries provided with support for the design, monitoring and implementation of approaches, policies, and interventions that promote equitable access to and sustainable management of SPIS technology as a result of FAO support.
	Baseline	Zero
	End Target	<ul style="list-style-type: none"> – Two national policy briefs developed. – Two national policy dialogues conducted.
	Comments and follow-up action to be taken	At the closure stage of the project, two national policy briefs had been completed and had been distributed to key stakeholders at the national and regional dialogues. It was also planned to make the policy briefs available online on the FAO website. National dialogues were conducted in both countries (Bangladesh and Pakistan) and a regional dialogue was successfully organized by the project. It is worth noting that the project managed to reach beyond Bangladesh and Pakistan, as experts and colleagues from India and Nepal also joined the regional dialogue, which enabled more countries to benefit from the findings of the studies and research carried out under this project.
	Indicator	Number of stakeholders (those involved in regulation, planning, finance, design and management) trained in the SPIS technology as a result of FAO support.
Baseline	Zero	
End Target	<ul style="list-style-type: none"> – Developed training materials on SPIS. – Series of training (e-learning and blended learning) workshops conducted. 	
Comments and follow-up action to be taken	Unfortunately, the training was not delivered, due to the COVID-19 outbreak in March 2020. However, a user's manual was developed in lieu of the training to allow policy-makers to familiarize themselves with the platform used to develop the maps. While this was a disappointing but unavoidable circumstance, the project team intended to investigate alternative mechanisms to deliver the training in the near future, either online via distance, or in person in Bangladesh and Pakistan. Future opportunities with GIZ were being discussed at the time of this report for the further development of the interactive maps. These discussions are expected to lead to more SPIS-focused activities and potentially to the delivery of the planned training.	

Output 1	Country assessments to provide evidence for policy advice. Conclusions on the policy environment for SPIS in two countries are formalized in two reports containing recommendations on how to plan, finance and manage SPIS programmes in a sustainable manner, building on the successes, failures and emerging risks of existing systems		
	Indicators	Target	Achieved
			Yes
Baseline			
Comments			
Activity 1.1	Country assessment reports. Assessing potential for SPIS (in terms of suitability, technical and economic feasibility and enabling environment) and identifying risks.		
	Achieved	Yes	
	Comments	Country assessment reports on the state of SPIS in Bangladesh and Pakistan were successfully completed by national consultants. The country assessment reports detailed: 1. the current in-country uses of SPIS and the related environmental and social impacts; 2. the existing and potential risks associated with SPIS; 3. key factors determining the success and failure of SPIS on the ground (i.e. biophysical, technical, agronomic, managerial, organisational, financial and gender-related aspects); 4. relevant legal, policy and financial instruments by the Governments, financial institutions and the private sector to regulate SPIS; and 5. recommendations towards technical, financial, capacity building, regulatory and policy mechanisms to ensure that SPIS technologies are planned and used sustainably.	
Output 2	Policy support, policy dialogue and a regional forum. Governments (national, state, local) and development partners (ADB, World Bank, IFC, DFAT, etc.) in Bangladesh and Pakistan are supported through policy briefs on SPIS-related challenges. Their approach to investing in and regulating the use of SPIS is coordinated through national dialogue and at regional level through a regional forum		
	Indicators	Target	Achieved
			Yes
Baseline			
Comments			
Activity 2.1	National policy briefs. Elaborating policy options for the regulation of sustainable SPIS		
	Achieved	Yes	
	Comments	National policy briefs were produced on Bangladesh and Pakistan by national consultants who were engaged in discussions on SPIS. The briefs focused on assessing groundwater sustainability and social equity in the face of water scarcity and increasing agricultural production.	
Activity 2.2	National policy dialogues. Facilitating dialogue to identify ways to finance and regulate SPIS use		
	Achieved	Yes	
	Comments	The project held very successful national dialogues in both Pakistan and Bangladesh. The dialogues focused on discussing the risks and benefits of SPIS, and how to best manage these. The policy briefs were used as a background for discussion, and feedback was received for the improvement of the policy briefs. Strong buy-in was communicated by the Governments of both Pakistan and Bangladesh.	
Activity 2.3	Regional Policy Forum. Facilitating dialogue to identify ways to finance and regulate SPIS use (open to all countries in South Asia, TCP support to participants from Bangladesh and Pakistan)		
	Achieved	Yes	
	Comments	The project held a very successful regional dialogue. Countries in attendance included Bangladesh, India, Nepal and Pakistan. The regional dialogue allowed for discussion on the sustainability of SPIS and the space for future innovations. The project team presented the revised versions of the policy briefs, along with the first draft of the SPIS mapping methodology and initial designs of the interactive maps, to the policy-makers and experts in attendance. The project team also collected feedback from the audience on public policy needs that were then used to improve the project outputs and maps.	

Output 3	Capacity Development. In-country capacities of technical, financial and policy staff on how to finance and manage SPIS, with a particular emphasis on risk management		
	Indicators	Target	Achieved
			Changed
Baseline			
Comments			
Activity 3.1	Study tour to gain insights into how SPIS can be sustainably and equitably adopted		
	Achieved	Changed	
	Comments	<p>The project team decided that in order to truly enhance the in-country capacities of technical, financial and policy staff on how to finance and manage SPIS, with a particular emphasis on risk management, what was really needed was a technology that could provide the countries and policy-makers with better information.</p> <p>As a result, it was determined that interactive SPIS suitability maps would be a much better investment for the project, as the suitability maps had an unlimited audience and would provide policy-makers with a tool to create policy. They are also a platform that can be built on, improved, and sustained as SPIS technology continues to evolve.</p> <p>The maps focused on environmental suitability, groundwater, solar irradiation, and social equity.</p>	
Activity 3.2	E-learning course for decision-makers (on local, regional and national level), and professionals (in public, governmental institutions and companies)		
	Achieved	Changed	
	Comments	<p>SPIS is a nexus technology, meaning that issues associated with it cross three different sectors: water, energy, and agriculture. Typically, policy-makers have access to all the available information they need on these three sectors; however, the reflex to think across all three sectors when encountering a nexus technology was found to be lacking. This was communicated to FAO through the national dialogues.</p> <p>Due to the interactive and informative nature of the SPIS mapping technology developed in the project, it was decided that a more innovative type of training was required. A decision was made that in-person workshops that presented policy-makers with scenarios (via the interactive maps) of environmental and social risks as a result of SPIS and then prompted the audience to work in teams across sectors to solve these issues would have been more impactful, not only within the training, but also by getting experts and policy-makers across all three sectors in the same room working together.</p> <p>However, unfortunately due to the COVID-19 outbreak in March 2020, this training was unable to be delivered. The project team is currently brainstorming ways to deliver this training via an online platform or via other funding sources in the future.</p>	
Activity 3.3	Blended learning courses. Deepening e-learning courses with practical knowledge		
	Achieved	Changed	
	Comments	See above (Activity 3.2).	

Outreach, Marketing and Reporting Unit (PSRR)
Business Development and Resource Mobilization Division (PSR)

For more information please contact: Reporting@fao.org