

**International Centre for Integrated Mountain
Development (ICIMOD)
Khumaltar, Lalitpur, Nepal**

**Terms of Reference (TOR)
for
Consultancy Services for Preparation of Detailed
Feasibility Study Report (DFS) and Technical
Bid Documents for Solar Irrigation Water
Pumping Projects, Bhutan**

Lalitpur, October 2024

1. Background

Agriculture is Bhutan's largest employer, employing 60 per cent of the population, of which 53 per cent are women. Agriculture's share in the country's GDP has been declining steadily and self-sufficiency in terms of staple crops is at a critical point. Without climate change adaptation, agriculture is projected to decline by 4–10 per cent in the near future. Gravity-fed open channels dominate current irrigation practices in Bhutan. However, they are seasonal and vulnerable to climate change. Due to the country's mountainous topography, water has to be lifted from the source for irrigation, often from rivers at lower elevations. Considered in conjunction with its abundant renewable energy (RE) resources, this threat presents Bhutan with a unique opportunity.

Women Empowerment through Renewable Energy and Energy Efficiency (REEE)-Powered Decentralised Lift Irrigation Systems in Bhutan (WERELIS – Bhutan), a project funded by International Development Research Center (IDRC), Canada, is to be jointly implemented by ICIMOD and the Department of Energy, Royal Government of Bhutan.

The project will generate evidence on the economic, environmental, social, and gender equality dimensions of deploying such systems, and support a case for scaling. WERELIS will contribute to demonstrating the viability of greener technology in increasing agricultural productivity, thereby creating employment opportunities for women and mitigating emissions and environmental degradation.

One of the key objectives of the project is to pilot solutions for building the capacity of women to increase their income, access new employment opportunities, and act as agents of change in the sustainable and gender-responsive REEE-powered lift irrigation sector, both as service providers and business development managers; thus, empowering them to play a leadership role in the emerging sector.

2. Objective

The objective of the assignment is to select a substantially responsive consulting firm (hereby referred as consultant) for the preparation of a detailed feasibility study report (DFS) and technical bidding document for solar irrigation pumping projects for 6 pilot sites in Punakha, Bhutan (refer to Annexe 1). 6 individual farmers from the listed sites and their details will be provided after the signing of the contract.

3. Scope of work

The DFS report of the 6 pilot sites shall be guided by the document titled, 'Detailed Feasibility Study Framework for Renewable Energy Irrigation Systems' (<https://lib.icimod.org/record/36563>). The consultant is encouraged to propose any additional improvements in the methodology and survey. The DFS activities should be conducted through comprehensive discussions with respective governments and other relevant stakeholders (see DFS Framework, Step I).

System design approach



Figure 1. An example of an individually owned solar PV pumping system designed to efficiently extract water and distribute it to nearby clusters, thus enabling sustainable water access and income generation through local water sales.

A low lift, individually owned solar PV pumping system will be installed near the river, designed to efficiently extract water for the owner's farmland and nearby clusters. This set-up ensures sustainable water access while also

generating income through local water sales. To achieve this, the solar PV system will be oversized beyond the owner's needs to irrigate an additional 15–20 acres, thereby benefiting both the owner and surrounding farmers. The GESI-friendly solution will feature a sump well or a cost-effective intake structure along the riverbank. Water will be transported via a pipeline to the owner's farm, with multiple distribution points controlled by valves to regulate the water flow to each neighboring plot. The system owner will enter into agreements with neighbouring farmers to sell water, thus fostering a cooperative irrigation model.

The study must contain but is not limited to the following sections:

Section 1: Baseline and socio-economic surveys

- a. The consultant is expected to carry out a socio-economic survey. (Refer to DFS Framework, Step II: site survey pages 9 & 10.)
- b. The consultant must design a survey and collect primary baseline information to measure and assess the following indicators.

SN	Indicators
Irrigation access	
A	Reliable year-round irrigation access
B	Increase in net cultivable area
C	Cropping intensity
D	Increase or decrease in crop yield
Income	
A	Increase or decrease in agricultural income
B	Increase or decrease in additional income (via water sales)
Mitigation	
A	Increase or decrease in diesel fuel saving
Social	
A	Food security and nutrition

B	GESI-responsive and beneficial irrigation system
C	Time saved in irrigation
D	Increase or decrease in the number of jobs in farmlands (system owner's plot plus neighbouring farms)
E	Women's capacity in agriculture, renewable energy, and entrepreneurship
F	Access to and control over resources
Affordability	
A	Solar system affordability (viability gap)

Section 2: Technical

a. Technical survey

This survey relates to agriculture practices and irrigation needs, as well as to the civil and electromechanical aspects of the DFS. The information gathered from this survey will feed into the design of the cluster irrigation system. Refer to DFS Framework, Step II, page 10.

b. Technical design

Refer to DFS Framework, Step III, for guidance to technical design. The technical design will include but is not limited to all the civil, electromechanical sizing and detailed engineering design drawings. All the design works must comply with the requirement and standard code of the practices approved by the Royal Government of Bhutan for similar facilities. The study report should include:

- Elements such as design intake (sump well or cost-effective intake, flood protection), piping (transmission and distribution with regulators), vertical head from source to farmland, pump housing, etc. which are suitable for solar irrigation pumping projects, all along guided by the measure of water required for irrigation. The consultant should conduct a structural analysis of the major civil components if needed.
- The consultant should design suitable electromechanical components – solar PV pumped irrigation system (solar PV array, controller, pump, remote monitoring system with control option, grid tied where there is a possibility with use a VFD+ grid-interactive controller and balance of system) – for the water required.

- The consultant should design solution optimisation in terms of the use of local resources and related technical aspects, including site-specific requirement. The designs shall include RCC structures, prefabricated structures, brickwork, or stone masonry as appropriate. The Consultant should optimise the civil construction to less than 10 square metres.
- The consultant should provide detailed engineering specifications and construction drawings.
- The consultant should produce detailed technical and working drawings using computer-aided design. The drawings shall provide adequate details on construction, schedule, splicing schedule, and detailed material estimation considering the available materials in Bhutan or nearby import point.
- The consultant should generate detailed bill of quantities (BoQ) and cost estimation.
- Cost estimation has to be based on local government rates and at least 3 quotation references should be cited from suppliers.
- The consultant should prepare an estimated work plan for the project cycle.
- The consultant should conduct necessary investigation such as carrying out groundwater exploration (water table) if relevant to ensure water availability.
- The consultant should conduct a cost-benefit analysis (CBA). For this, refer to DFS Framework, Step III; such an analysis is valuable in terms of the financial and economic considerations related to developing an irrigation system in a specific location. The CBA allows for optimisation of the project costs and should also factor in the viability of the project operation model; this will influence the financial decisions that are to be made later for project implementation.
- The Consultant should provide a financial analysis of the water sales model and of the viability gap related to the solar PV system. Along with a sensitivity analysis.
- The Consultant should provide financial and economic indicators – NPV, IRR, payback, and B/c ratio.

Section 3: Enabling environment

The Consultant is expected to provide an assessment of the enabling environment that could potentially increase the success of the project. Refer to the DFS Framework on meso-level enablers, page 5. It covers: market access and absorption; financial access; regulatory policies; partnerships; infrastructure; and supply chain.

Additionally, the Consultant should be providing recommendations on operationalising the system and on adoption of the water sales model by the neighbouring farms.

Section 4: Compliances

The Consultant has to conduct site surveys, meetings, and coordinate with the relevant government agencies in order to compile all the information and the necessary documents and forms to obtain permits for, but not limited to, water-source use, intake construction, right of way for water line transmission and distribution, and solar PV grid connection.

Section 5: Environment, social safeguards, and project risks

The Consultant is expected to assess the environmental, social, and project risks, and provide recommendations adhering to government requirement. This includes environmental impacts, social impacts, climate-induced technical (hydrological investigations involving rainfall, drainage, floods, slope failures, and landslide risks, among others), social risks, cultural risks, and project management risks (logistics, site access for equipment and machinery, etc.)

The key expected outputs of the study report are:

Key outputs	
Socio-economic, baseline, and technical surveys	
Detailed technical design, BoQ, and the estimated cost involving the bidding document	
Mapping of project risks and enablers	
Documents, signed minutes, etc. prepared for permits	
Signed meeting minutes with the farmer and the cluster farmers for project implementation	
Preparation of an irrigation operation plan and presenting the	

water sales model to the neighbouring farms	
Neighbouring farmers signing up for the water sales model	

4. Required key expertise

The bidding firm shall have the following key expertise and propose other human resources as per requirements.

a. Team Leader

The Team Leader should have at least a master's degree in science/management/engineering or a related discipline with 15 years of professional experience. S/he must have at least 5 years of experience as a Team Leader managing a multidisciplinary team and must have a proven track record in project management where s/he has coordinated and collaborated with multiple stakeholders and governments. The Team Leader should also have led the design and implementation of project monitoring and evaluation; developed comprehensive social and economic surveys; and ensured compliance with social and environmental safeguarding standards.

b. Civil Expert

The Civil Expert should have at least a bachelor's degree in civil engineering and 7 years of professional experience. The candidate must have at least 5 years of specific experience in designing, implementing, and supervising pumped water supply projects.

The Civil Expert must also have experience in designing and constructing intake structures on riverbanks, e.g. sump wells on at least 5 sites.

Besides, the candidate must have experience in designing and developing water supply and irrigation distribution network projects on at least 5 sites.

c. Solar Pumping Expert

The Solar Pumping Expert should have a bachelor's degree in engineering and 5 years of professional experience in renewable energy, especially in solar pumping. The candidate must have at least 3 years of specific experience in solar pumping. S/he must also have experience in designing, installing, and supervising solar pumping projects on at least 5 sites.

d. Agricultural Expert

The Agricultural Expert should have at least a bachelor's degree in agriculture and 5 years of professional experience in agriculture, especially horticulture.

S/he must have experience in assessing crop water requirement using appropriate tools.

S/he should also have conducted detailed field investigations on analysing farming practices, cost of production, and designing suitable cropping calendars.

e. Economist

The Economist should have at least a master's degree in economics/ management or a related discipline with at least 5 years of professional experience. S/he must have experience of economic analysis involving irrigation and drinking water systems or similar projects.

f. GESI Analyst

The GESI Analyst should have at least a master's degree in gender studies/ anthropology/development studies or a related discipline with at least 5 years of professional experience. S/he must have previous experience in conducting gender review and analysis, and socio-economic surveys in agriculture and water management or similar projects. A comprehensive understanding of the gender and inclusion dynamics in the aforementioned sectors in Bhutan is preferred.

Estimated person days

The tentative estimated person days are below , the consultant can propose as required.

Team Leader	30 days
Civil Expert	30 days
Solar Pumping Expert	10 days
Agricultural Expert	20 days
Economist	10 days
GESI Analyst	10 days
Field data collector	20 days

5. Deliverables and payment schedule

The Consultant shall be recruited for 2.5 months. The Consultant shall submit 2 hard copies, along with an electronic copy of the study report and drawing files, as follows:

Milestone	Key Dates	Payments
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Contract Signing		50%
Inception Report	1st week from the date of signing of the contract	
Field Report	5th week from the date of signing of the contract	
Draft Report and bid document	7th week from the date of signing of the contract	
Final Report and Technical Bid Document	10th week from the date of signing of the contract	50%

6. Proposal

The bidder has to submit technical and financial proposals in separate files. The technical proposal must include but is not limited to:

- Signed application cover letter
- All parties letter with clear roles and responsibilities if a JV .
- Company profile
- Team profile, including roles and responsibilities, which clearly highlights the team members' experiences as required in Section 4.
- Methodology
- Final report chapter layouts and brief explanations about the respective contents
- Company legal documents Signed CV of all the team members

The financial bid must include:

- Signed cover letter with bid validity of at least 90 days from submission.
- Signed detailed financial breakdown table, mentioning person days unit rate , travel details, equipment hires, communication/IT, etc.

7. Selection procedure

The selection will be based on ICIMOD's standard procurement practice. The consulting firm will be selected on the basis of the highest-ranked technical proposal (60% weightage) and the lowest-cost financial proposal (40% weightage).

The consulting firm will be selected on the basis of the highest cumulative scores obtained in the technical and financial proposals using the following formula:

- Technical score = Score obtained based on the technical proposal (total 100)
- Financial score = Score obtained based on the financial proposal (total 100)
- Total score = 60% for technical proposal + 40% for financial proposal

The consulting firm with the maximum score and fulfilling the relevant criteria will be awarded the contract. However, the consulting firm should score at least 70 points in the technical proposal.

The evaluation of the technical proposal comprises:

- 50 marks for team composition and experience
- 30 marks for the methodology, which involves understanding the objectives of the assignment and approach to the services, as well as a detailed plan to obtain the outputs
- 10 marks for the final report chapter layouts and brief explanations about the respective contents
- 10 marks for the project management approach, including the management and operation plan as well as the quality management plan

8. Reporting

The consultant will report to ICIMOD on the progress of the project once every two weeks or when requested. The report format must be discussed and approved by ICIMOD in advance.

9. Client's Input and counterpart personnel

The Client shall provide relevant reports and documents to the Consulting firm and facilitate coordination between the Consultant and the stakeholders/institutions concerned as and when necessary. The focal officer of Bhutan's Department of Energy will act as the support counterpart personnel to this consultancy service for any necessary assistance.

10. Eligibility criteria for the Consulting Firm

The Consulting Firm should submit the following documents and fulfil the following criteria:

- i) A copy of the company/firm registration certificate

- ii) A copy of the tax registration certificate
- iii) A copy of the tax clearance certificate for last fiscal year
- iv) At least 1 project experience of conducting a similar study in the RE sector in Bhutan
- v) At least USD 25,000 annual turnover in the last fiscal year
- vi) For international bidders, preference will be given to those who have local counterparts in Bhutan.

11. Proposal submission

The completed proposal should be submitted through email to Consultancy.int@icimod.org by 5:30 PM (Bhutan Standard Time), 3rd November 2024. Separate files of technical and financial proposals should be submitted.

12. Ethical consideration

The Consultant will be required to take all the necessary actions to handle the collected data responsibly (see ICIMOD Responsible Data Policy) to ensure data privacy, anonymity, and confidentiality. The Consultant also needs to adhere to the in-country regulations while executing the project.

13. Our commitment to prevention of sexual harassment

ICIMOD is committed to the prevention and redressal of sexual harassment at the workplace and promotes the welfare of children, young people, and adults, and expects all staff, consultants, and volunteers to share this

commitment. We will do everything possible to ensure that only those who abide by our values are selected to work for us.

14. Confidentiality/Non-disclosure

All the materials issued in connection with this ToR shall remain the property of ICIMOD and shall be used only for the purpose of this procurement exercise. All the information provided shall be either returned to ICIMOD or securely destroyed by unsuccessful applicants at the conclusion of the procurement exercise.

During the performance of the assignment or at any time after expiry or termination of the Agreement, the Consultant shall not disclose to any person or otherwise make use of any confidential information which s/he has obtained or may obtain relating to partner organisation/ICIMOD, the respondents, or otherwise.

The Consultant will be required to sign a non-disclosure/confidentiality agreement as part of the undertaking of this work.

15. Intellectual property, copyright, and ownership of all prepared information

The Consultant shall retain all rights to pre-existing (background) intellectual property or materials used by the Consultant in the delivery of this study. All arising intellectual property, ideas, materials, processes, or processes formed

in contemplation, in the course of, or as a result of this study, shall be passed on to ICIMOD without restriction.

The Consultant shall warrant that all arising intellectual property, materials, and/or products produced in pursuit of this study shall be original and shall not infringe on any third party's claim. All technical or business information, in whatever medium or format, originated, collated, or prepared by or for the Consultant in contemplation, in the course of, or as result of this assignment, shall be transferred to ICIMOD without restriction on completion of the project and shall not be used by the Consultant for any other purpose without the express written permission of ICIMOD.

The copyright on all arising documents, data, information, or reports produced by the Consultant under this agreement shall belong to ICIMOD and will be passed on to ICIMOD without restriction. Such documents, data, information, and reports shall not be used by the Consultant for any other purpose other than in conjunction with this assignment, without the express written permission of ICIMOD's Head of Programme Funding.

Annexe

1. List of the irrigation projects in Punakha

SN	Project site	Lat long
1	Zomlingthang	27.598929, 89.852768
2	Changyul	27.589333, 89.859645
3	Temakha	27.629363, 89.864892
4	Humptang	27.656610, 89.879906
5	Lorina	27.645808, 89.868357

