

Topics under Detail Feasibility Study Report for Solar Lift Irrigation

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Executive Summary

Describe briefly in **one page** the design and outcomes of the detail feasibility study. The Executive Summary should include the key information of the study.

Paragraph #1

- i. Site location
- ii. Number of households/farmers/groups
- iii. Date when the on-site survey was carried out

Paragraph #2

- i. Current status of electricity access
- ii. Catchment area
- iii. Daily crop water requirement
- iv. Ownership model

Paragraph #3

- i. Land availability for solar array, pump intake, reservoir tanks and water transmission and distribution path
- ii. System description (solar array capacity, pump capacity, inverter capacity, reservoir tank capacities)

Paragraph #4

- i. Total system cost
- ii. Cost of electromechanical, civil and water transmission & distribution system

Paragraph #5

- i. Major project risks and mitigations
- ii. Conclusion

Site details

Location

Describe the location of the site and provide information about,

- i. Site address (ward number, rural municipality, district and province)
- ii. Site coordinates

Site Access

Describe the accessibility of the site. Provide information about,

- i. Access route description (vehicle access, type of road/path, seasonal, all-weather or earthen, gravelled, black-topped etc.)



- ii. Observations of population and irrigation land density in the site area (for example, dense/sparse farming fields etc.) (in case of community SIP)
- iii. Name and distance from the nearest market center with vehicle access
- iv. Name and distance from the nearest city and airport
- v. Vehicle accessibility-month wise

Photo suggestions

- i. Access road/path

Site assessment

Existing infrastructure

Describe any existing infrastructures already present on the site that can be utilized by the new SIP system. For example, existing reservoir tanks, distribution pipes etc. If present, describe their features in detail. For example, land coverage of distribution pipes, diameter and length of distribution pipes, the capacity of the reservoir tank etc.

Include photos of existing infrastructure.

Water source and security

Describe the water source for SIP. Provide information about,

- i. Location and security (distance from the nearest household, access path etc.)
- ii. Type of water source, seasonal variations, water quality, risks such as landslides
- iii. Other existing or planned uses of water sources upstream and downstream
- iv. Any potential conflicts in water use and its resolutions
- v. Is the water source registered or not, because it may cause further conflicts between villages?

Photo suggestion

- i. Photo of the water source

Technical design

Water requirement and vertical head

Describe the calculation of water requirement per day and vertical head. Provide information about,

- i. Details of daily water requirement calculation (m^3/sec or litres per day)
- ii. Vertical head, total dynamic head

Pump

Describe the selection of the pump and its details. Provide information about,

- i. Pump's rated capacity (kW/HP)
- ii. Justification for the type of pump selected. For example, surface, submersible etc.
- iii. Any assumptions and estimations (such as average pumping hours per day etc.)
- iv. Details of reference pump that was taken for the selection (market available pump)
- v. Requirements of pump housing/protection features
- vi. Month-wise water output simulation graph

Solar array location

- i. Must include the available land area, ownership details, GPS coordinates, topography, orientation and azimuth, near and far shading, current land use description, local land use regulation and policy, slope and soil type, wind loading etc.
- ii. Should have a general assessment of usability concerning natural calamities such as floods, landslides, lightning etc.
- iii. Should have assessment related to safety from humans, fencing needs
- iv. Details of any land treatment needed to make it suitable for a solar array installation
- v. The site should be selected from an adequate distance from the road to allow for any future road expansions, and infrastructure plans and reduce soiling losses in the PV array

Photo suggestions

- i. Site photo of the solar array location

Solar array and controller sizing

Describe details of the solar array and controller. Provide information about,

- i. Details of the solar array including array capacity individual panel size, key technical parameters, series and parallel configuration
- ii. Positioning of the solar array. For example, orientation, tilt, number of rows, row spacings
- iii. Near and far shading analysis
- iv. Details of the controller including controller capacity, protection, mounting mechanism, key technical parameters, compatibility with solar array and pump, need for controller box etc.
- v. Details of reference solar panel and controller that was taken for the selection (market available panel and controller)

Figure suggestion

- i. Photos of near shading and relevant analysis

Pump intake and distribution reservoir (if applicable)

- i. Describe the type of pump intake system (sump well, concrete tank, borewell etc.), dimensions and capacity
- ii. Describe the type of distribution reservoir (concrete closed tank, concrete open tank etc.), dimensions and capacity (if applicable)
- iii. Pump fixture (type, construction material etc.) in the pump intake

- iv. *Must include the available land area, ownership details and commitment letter, GPS coordinates, topography, current land use description, local land use regulation and policy, slope and soil type etc.*
- v. *Should have a general assessment of risks concerning natural calamities such as floods, landslides etc.*
- vi. *Plan of the site or location considering the safety of the pump to be installed or the sump well to be made at the bank of the river*

Photo suggestions

- i. *Photo of the pump intake and distribution reservoir locations*

Transmission and distribution of water

Describe the transmission and distribution plan of water. Provide information about,

- i. *Details of transmission pipe (ground length, diameter, material(s), number of joints, anchor blocks etc.)*
- ii. *Details of distribution pipe (ground length, diameter, material(s), branches and joints, anchor blocks, flow meters, gate valves etc.)*

Balance of systems

Describe the balance of systems for SIP completion. Provide information about,

- i. *Provide details of how cables will be routed and secured from the solar array to the controller box. Then from the controller box to the pump*
- ii. *Include a table describing detailed specifications of the balance of systems such as protection equipment (DC MCBs, SPDs, lightning air terminals/ESEs, earthing points, cable sizes and respective losses, conduits etc.)*
- iii. *Details of the solar array mounting structure. Calculations related to wind loading requirements, civil foundation requirements, size of vertical legs, purlins, braces and struts, rafters, base plates, joints, mid-clamps, end clamps etc. must be presented*
- iv. *Include a single-line diagram and suggest including an infographic illustrating the system architecture with key information*
- v. *Include an illustration showing earthing locations, positioning of the lightning protection system, controller box etc.*

Bill of quantity and cost

Electromechanical system

- i. *Detailed BoQ for the proposed system with a breakdown of each component must be done*
- ii. *Detailing in the BoQ should be such that, if possible, every component used such as the breakdown of combiner boxes and its components, MCBs, MCCBs, busbars, etc. must be proposed in specifics instead of a lump sum*

- iii. *BoQ for services and goods must be separated*
- iv. *Vatable and non-vatable items must be distinguished*
- v. *The currency used must be in NPR with commas as a separator*

Civil works

- i. *Separate BoQ for civil works (pump intake and distribution reservoir, transmission and distribution network, PV array foundations etc.) must be prepared, however, all the BoQ will be compiled to form a single BoQ*
- ii. *Other points mentioned above apply to this section as well*

Conclusion

- *Provide a summary of the SIP architecture, agriculture potential, project cost and outcomes of the economic analysis.*

Annex

Meeting minutes from the community

- i. *User committee registration at the LG (if applicable)*
- ii. *Water source registration document if it is registered*

Site photos

Product datasheets

- List of separate attachments to be submitted along with this report:
 - Meeting minutes/permission letters for conducting DFS
 - Single Line Diagram

Solar Irrigation Site Survey Form

Note to surveyor: Please take as many photographs, GPS location tagging and videos of the project location specific to the sections in the survey below (for example, solar array location, controller location, water source, surrounding areas, community, irrigation land extension etc.)

 means, take photos  means, record the GPS point(s)

The following section gathers information about the community and operational modality of the project to understand how the project management structure will be set up.

General information	
Date of survey	
Name of the Published Irrigation Scheme	
Published Serial Number	
Name of surveyor	
Organization	
Name of the client/s <i>Include names of the main local people who contributed to the information on the survey</i>	Phone no.
1.	1.
2.	2.
3.	3.
4.	4.
Type of SIP types	<input type="checkbox"/> Individual <input type="checkbox"/> Community
If community-owned, describe how they plan to distribute water	<input type="checkbox"/> No plans yet <input type="checkbox"/> Sell water to beneficiaries <input type="checkbox"/> Free distribution, no schedule <input type="checkbox"/> Free distribution, water distribution scheduled by the community
SIP management structure	<input type="checkbox"/> User group (non-registered) <input type="checkbox"/> User committee (registered) <input type="checkbox"/> Other arrangements:
If the user committee is registered, provide the details:	The legal name of the user committee
	Number of members in the user committee
The planned SIP funding mechanism (other than AEPC subsidy)	
Is there any conflict within the community regarding the potential SIP project?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe the conflict: Describe the resolution of the conflict:
Location information	
Tole name	
Village	
Ward no.	



Rural municipality/municipality	
District	
Province	
Is the vehicle accessible up to the village?	<input type="checkbox"/> Yes <input type="checkbox"/> No Describe road type: Functionality: <input type="checkbox"/> Year-round <input type="checkbox"/> Seasonal, months of inaccessibility:
Is the vehicle accessible up to the solar array location?	<input type="checkbox"/> Yes <input type="checkbox"/> No Describe road type: Functionality: <input type="checkbox"/> Year-round <input type="checkbox"/> Seasonal, months of inaccessibility:
Is the vehicle accessible up to the water source?	<input type="checkbox"/> Yes <input type="checkbox"/> No Describe road type: Functionality: <input type="checkbox"/> Year-round <input type="checkbox"/> Seasonal, months of inaccessibility:
Name and distance of the nearest city/town from the site	Name
	Distance
	.....km

The following section gathers information on the agriculture value chain to gauge the utilization of solar water pump, their sustainability and their impact on the community.

Agriculture value chain			
Name of the nearest market centre for crop sales			
Distance to the market centre from the village	.....km	Time to reach the market centre by vehicle	.....hrs
Are there financial institutions (FIs) present in the village?	<input type="checkbox"/> Yes <input type="checkbox"/> No If no, the location of the nearest FI (banks, cooperatives etc.): Time to reach nearest FI: If yes, what type of FI? <input type="checkbox"/> Bank Bank name: <input type="checkbox"/> Cooperative Cooperative name: <input type="checkbox"/> Others:		
Are there loan options available for agri-related business?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, agri-related loan purpose: Interest rate:% Loan term: .....years Other details:		

Are there loan options available for solar water pumping systems?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, is there a ceiling to the loan amount? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, max. amount: NPR Interest rate:% Loan term: .....years Other details:
Accessibility of agriculture knowledge centre (AKC)	Location of nearest AKC: Distance from the village: Time to reach AKC:
Describe any other agri-related support available to the community	.....
What agri-related enterprises are present in the village?	<input type="checkbox"/> Agro mill, how many? <input type="checkbox"/> Rice mill, how many? <input type="checkbox"/> Dairy production, how many? <input type="checkbox"/> Cold store, how many? <input type="checkbox"/> Others:
Are there AC or DC pump repair centres nearby?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, location: Time to reach repair centre by vehicle:

List crop names and their coverage areas **currently practised** in the community.

Crop name	Coverage area	
	Area	Unit (ropani, ana, bigha etc.)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

List crop names **currently practised** and tick respective months of the plantation.

Crop name	Baisakh	Jestha	Asadh	Shrawan	Bhadra	Asoj	Kartik	Mangsir	Poush	Magh	Falgun	Chaitra
	1.											
2.												
3.												
4.												
5.												
6.												
7.												
8.												

9.																			
10.																			

Method of irrigation	<input type="checkbox"/> Surface irrigation	<input type="checkbox"/> Sprinkler irrigation	<input type="checkbox"/> Drip irrigation
	<input type="checkbox"/> Others:		

Cost details of crops in current practice

Crop name	Amount (kg) grown per year	Unit selling price in NPR/kg
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Cost details of potential crops after solar water pump intervention – preferably cash crops (vegetables, cardamom, tea, coffee etc.). This is just to gauge the community’s understanding and awareness of crop potential on their land.

Cash crop name	Coverage area		Anticipated harvest in the respective coverage area	Anticipated selling price in0 NPR/kg
	Area	Unit (ropani, ana, bigha etc.)		
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

The following section gathers information on irrigation and water to understand current practices and improvements that solar water pumps can bring.

Land information	
The total size of land to be irrigated <i>Mention the unit of measurement correctly.</i>	Area: Unit: <i>(bigha, lattha, ropani, ana etc.)</i>
Types of soil	<input type="checkbox"/> Loamy soil <input type="checkbox"/> Clay soil <input type="checkbox"/> Sandy soil <input type="checkbox"/> Sil soil Other observation:
Is the entire land privately owned?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how many owners? If no, describe ownership:
If the land is leased:	



	Lease tenure:
	Detail out lease terms:

Water information	
Water requirement per day <i>(if known, otherwise, must calculate it by the irrigation requirement)</i>	..... ltrs/day
Name of the water source	.....
Type of water source	<input type="checkbox"/> Bore-well <input type="checkbox"/> Open-well <input type="checkbox"/> Canal <input type="checkbox"/> River <input type="checkbox"/> Pond <input type="checkbox"/> Others:
Describe the physical location of the water source	.....
Water source ownership	<input type="checkbox"/> Public <input type="checkbox"/> Private If private, is the owner willing to share the water source for pumping? <input type="checkbox"/> Yes <input type="checkbox"/> No Any concerns?.....
Is there any conflict within the community regarding water use?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe the conflict: Describe the resolution of the conflict:
GPS location of water source i.e. pump intake	Latitude: Longitude:
If river pumping, is the pump intake location at risk of flood damage during monsoon?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, discard pump intake location or mention mitigation strategy:
If river pumping, will there be adequate water level in the pump intake throughout the year?	<input type="checkbox"/> Yes <input type="checkbox"/> No If no, discard pump intake location or mention mitigation strategy:
If river pumping, what is the distance between the river and the sump well?	.....
If bore-well, what is the diameter of the bore-well (inches)?	Diameter of the bore-well (inches): The total depth of the bore-well: <input type="checkbox"/> ft <input type="checkbox"/> meter The static water level of the bore-well: <input type="checkbox"/> ft <input type="checkbox"/> meter Describe how the static water level is measured:

If open-well, what is the depth of the bore-well (meters)?	Diameter of the open-well: <input type="checkbox"/> ft <input type="checkbox"/> meter The total depth of the open-well: <input type="checkbox"/> ft <input type="checkbox"/> meter The static water level of the open-well: <input type="checkbox"/> ft <input type="checkbox"/> meter Describe how the static water level is measured:																														
If canal or stream, what is the water flow rate?ltrs/min Describe measuring method: <input type="checkbox"/> Bucket measurement <input type="checkbox"/> Others:																														
Any risks of water source drying?	<input type="checkbox"/> No, consistent year-round <input type="checkbox"/> Yes, drying in certain months If risk of drying, mention which months:.....																														
Any risks of water source depletion (inadequate for pumping)?	<input type="checkbox"/> No, consistent year-round <input type="checkbox"/> Yes, low water in certain months If the risk of depletion, mention which months:.....																														
Describe the quality of water <i>(clear/murky/sandy etc.)</i>																															
Describe the current uses of the water source	<table border="1"> <thead> <tr> <th colspan="2">Purposes of water use</th> <th colspan="2">% of households</th> </tr> </thead> <tbody> <tr> <td colspan="2">Irrigation</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Drinking water</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Livestock</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Other:</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Other:</td> <td colspan="2"></td> </tr> </tbody> </table>					Purposes of water use		% of households		Irrigation				Drinking water				Livestock				Other:				Other:					
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Drinking water																															
Livestock																															
Other:																															
Other:																															
The existing water-pumping mechanism																															
What is the current mechanism for irrigation?	<input type="checkbox"/> Rainwater <input type="checkbox"/> Canal <input type="checkbox"/> Diesel pumps <input type="checkbox"/> Electric pumps <input type="checkbox"/> Handpump <input type="checkbox"/> None <input type="checkbox"/> Others:																														
What is the limiting factor of the current mechanism for irrigation that justifies the intervention of a solar water pump?																															
If electric pump(s) are also used, what is the reason for pursuing a solar water pump?																															
If a diesel pump(s) are used, provide details		<table border="1"> <thead> <tr> <th>Ownership type</th> <th>Size</th> <th>Fuel consumption per hour</th> <th>Daily usage hour</th> <th>Days per week used</th> </tr> </thead> <tbody> <tr> <td>1 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent</td> <td>..... <input type="checkbox"/> HP <input type="checkbox"/> kW</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent</td> <td>..... <input type="checkbox"/> HP <input type="checkbox"/> kW</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent</td> <td>..... <input type="checkbox"/> HP <input type="checkbox"/> kW</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent</td> <td>..... <input type="checkbox"/> HP <input type="checkbox"/> kW</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Ownership type	Size	Fuel consumption per hour	Daily usage hour	Days per week used	1 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW				2 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW				3 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW				4 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW							
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3 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW																														
4 <input type="checkbox"/> Purchase <input type="checkbox"/> Rent <input type="checkbox"/> HP <input type="checkbox"/> kW																														
If any diesel pumps are rented, what is the rental cost per hour?NPR/hour																														
Cost (per litre) of diesel in the location?																															

The following section gathers technical information for the solar water pumping system.

Note to surveyor: If the solar array location is on a river bank, then discard the location because it will be at risk of flooding.

Solar array location	
Land ownership type	<input type="checkbox"/> Private <input type="checkbox"/> Public <input type="checkbox"/> Others:
Is the concerned owner willing to allocate the land for solar array installation?	<input type="checkbox"/> Yes <input type="checkbox"/> No Any concerns?.....
GPS location of solar array location	Latitude: Longitude:
Area available for the array installation	..... sq.m
Topography type	<input type="checkbox"/> Flat <input type="checkbox"/> Slope <input type="checkbox"/> Uneven
If the land is sloped, what is the direction and degree of the slope?	The direction of slope:..... (north/south/east-west etc.) Slope degrees:
Are there any nearby obstacles that may cause shading in the array? Describe. <i>Trees, buildings, electric poles etc.</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No Describe:.....
Collection reservoir (pump intake)	
Is there an existing collection reservoir?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, capacity: <input type="checkbox"/> litres <input type="checkbox"/> m ³ Reservoir structure (concrete, HDPE etc.):
GPS location of the existing collection reservoir	Latitude: Longitude:
If a collection reservoir is to be constructed, is there land available?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, land ownership type: <input type="checkbox"/> Private <input type="checkbox"/> Public <input type="checkbox"/> Others: Is the concerned owner willing to allocate the land for a collection reservoir? <input type="checkbox"/> Yes <input type="checkbox"/> No Any concerns?.....
What type of collection reservoir is planned to be constructed? (concrete, HDPE etc.)	
GPS location of the new collection reservoir	Latitude: Longitude:
Distribution reservoir (for water storage and distribution)	
Is there an existing distribution reservoir?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, capacity: <input type="checkbox"/> litres <input type="checkbox"/> m ³ Reservoir structure (concrete, HDPE etc.):

GPS location of existing distribution reservoir	Latitude: Longitude:
If a distribution reservoir is to be constructed, is there land available?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, land ownership type: <input type="checkbox"/> Private <input type="checkbox"/> Public <input type="checkbox"/> Others: Is the concerned owner willing to allocate the land for a distribution reservoir? <input type="checkbox"/> Yes <input type="checkbox"/> No Any concerns?.....
What type of distribution reservoir is planned to be constructed? (concrete, HDPE etc.)	
GPS location of the new distribution reservoir	Latitude: Longitude:

System head	
Is the vertical height from the pump intake to the highest distribution point measured on-site?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, mention the vertical height: .....m Describe how the vertical height is measured. If not, how will the vertical height be determined? <input type="checkbox"/> Google Earth (less accurate) <input type="checkbox"/> Others:

Transmission and distribution network	
How is the water distribution planned?	<input type="checkbox"/> Open canal flow <input type="checkbox"/> Distribution pipe <input type="checkbox"/> Others:
If open canal flow, provide details	Does the open canal cover the entire catchment area? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, how much land area does it cover?.....
Are there existing distribution pipes?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, does the existing distribution pipe cover the entire catchment area? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, how much land area does it cover?..... Mention the diameters of the distribution pipes: Main pipe: inches Branch pipes: inches Type of pipe material (Cl, HDPE etc.):

Grid information	
Estimated distance of the national grid from the project location	..... m
Estimate timeline when the grid will be available in the project location	<input type="checkbox"/> No plans <input type="checkbox"/> Soon If soon, by when?

Additional information	
Remarks (any other relevant information)	