

ASSESSING THE POTENTIAL OF MICROFINANCED SOLAR WATER PUMPING TO ENABLE PRODUCTIVE USE OF ENERGY IN RURAL AREAS OF BURKINA FASO:

A CASE STUDY OF KORSIMORO RESERVOIR

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PAUWES

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Outline of presentation

- Background information
- Problem statement and objectives
- Methodology
- Results and discussion
- Conclusion
- Recommendations

Background of study



Fig 1: Agroecological Zones of Burkina Faso (FAO 2012)

Problem statement

In spite of the huge solar resource, due to lack of initial capital, Irrigation is based on diesel water pumps which emit green house gases, contaminate water and soil, operation costs are vulnerable to volatile diesel price, and require fuel each time they are used.



Fig 2: Diesel pumps used around Korsimoro Reservoir

Proposed solution: Microfinanced solar water pumps

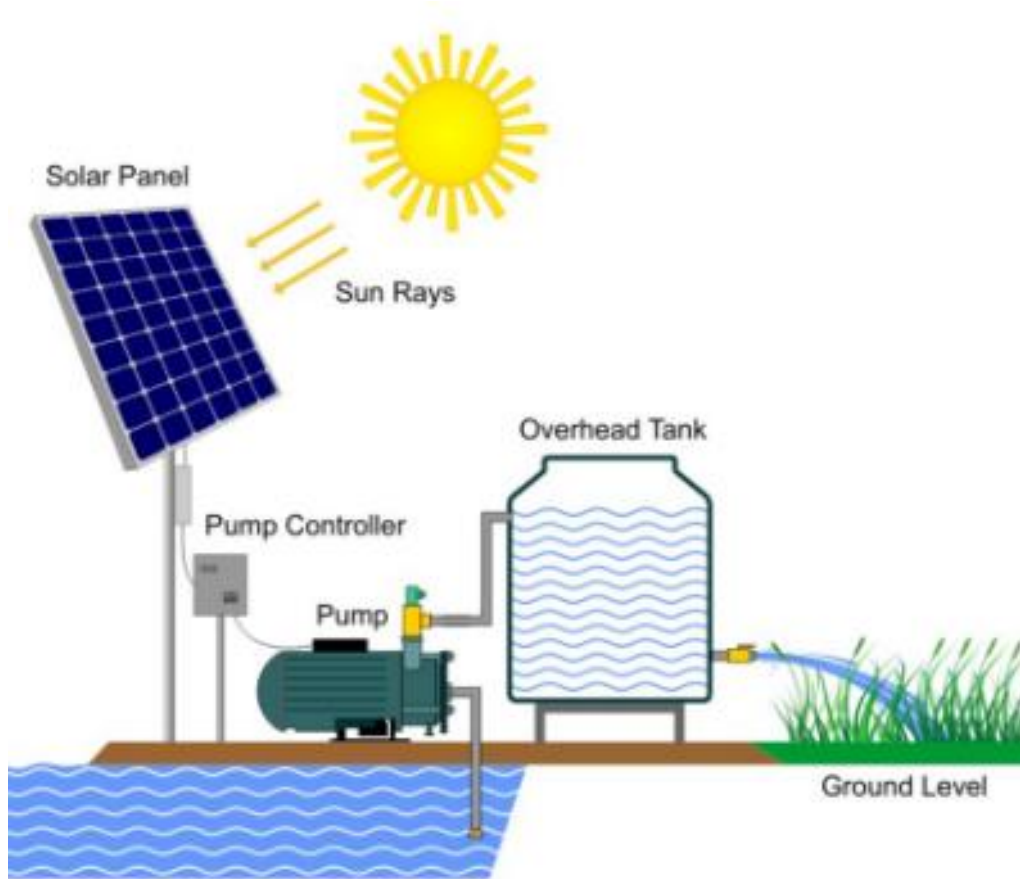


Fig 3 Schematic of SWPS (www.indiamart.com)

Table 1: Monthly Weather Data for Ouagadougou

Month	Sun Rad (KWh/m ² /d) hours	Eto (mm/d)	Eff. Rain (mm/d)	
Jan	8.2	5.25	5.77	0.00
Feb	8.1	5.61	6.38	0.12
Mar	8	5.92	7.12	0.05
Apr	7.1	5.69	7.38	0.27
May	7.8	5.92	6.88	1.15
Jun	7.6	5.72	5.63	1.91
Jul	6.8	5.44	4.29	2.48
Aug	6.1	5.22	4.06	2.55
Sep	6.5	5.31	4.33	3.09
Oct	8.2	5.69	5.29	2.32
Nov	8.6	5.44	5.38	0.63
Dec	8.2	5.08	5.22	0.05
Average	7.6	5.53	5.64	1.22

Source: CLIMWAT 2.0

Objectives

To determine the potential of micro-financed solar water pumping for productive use in rural areas of Burkina Faso with Korsimoro reservoir as a case study. The specific objectives are to;

1. Identify the main market segments for SWPS.
2. Determine the appropriate sizes of SWPS for the main market segments.
3. Determine the profitability of SWPS for the main market segments.
4. Calculate the main features of SWPS loan for MFIs in Burkina Faso

Methodology: Logical framework

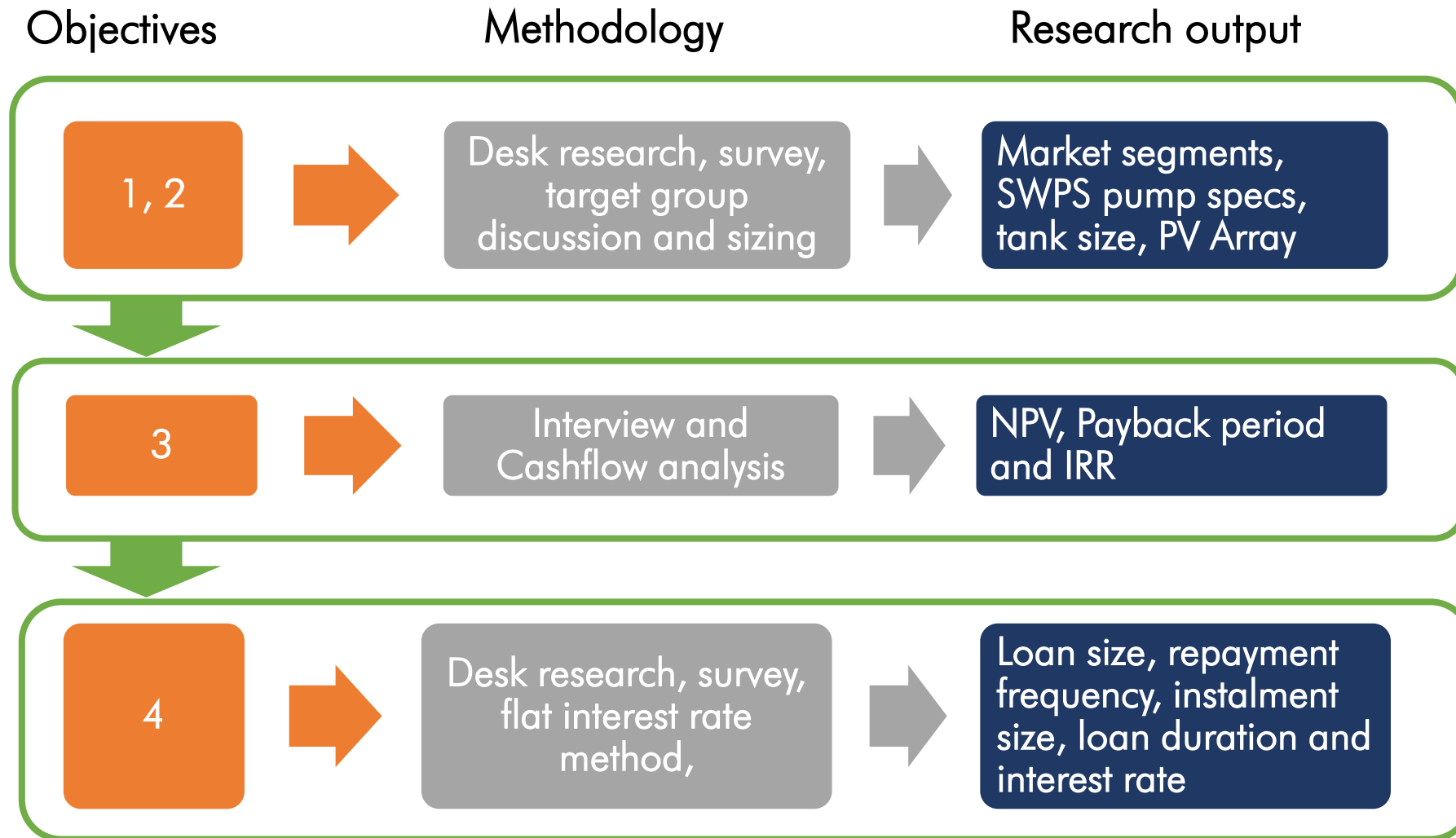


Fig 4. Logical Framework of the research

Result 1: Market Segments

	Market segment 1	Market segment 2	Market segment 3
Existing DWPS	<ul style="list-style-type: none">• 1.5 – 3 kW	<ul style="list-style-type: none">• 4- 7.5 kW	<ul style="list-style-type: none">• Paying for pumping services provided by segment 2
Ownership	<ul style="list-style-type: none">• Individually owned and individually used	<ul style="list-style-type: none">• Individually owned but shared use	
Av. area	<ul style="list-style-type: none">• 10,350 m²	<ul style="list-style-type: none">• 28,770 m²	
Common brand	<ul style="list-style-type: none">• Robin/Koshin	<ul style="list-style-type: none">• Rhino/Kirloskar	<ul style="list-style-type: none">• 400 m²

Results 2: SWPS for the Market Segments

Parameters for selection of SWPS

NB: Calculations based on Onion Crop

	Market segment 1	Market segment 2	Market segment 3
Flow rate	18.3 m ³ hr	50.8 m ³ hr	0.71 m ³ hr
TDH	26 m	14.5 m	14.5 m
Mini rated power	1297 W	2008 W	101.7 W

Results 2: SWPS for the Market Segments

Table 2: Sizes of SWPS with water storage

System component	Market segment 1		Market segment 2		Market segment 3	
	AC	DC	AC	DC	AC	DC
Pump (W)	2200	3000	3000	4000	120	120
Inverter (W)	2500	—	3500	—	180	—
Tank size (m ³)	100	100	300	300	5	5
PV Array (W _p)	2400	3120	3200	4160	160	160

Results 3: Profitability analysis

Table 3: Capital cost of SWPS with water storage

SWPS	Capital cost (US\$)	Percentage of capital cost				
		PV system	Pump	Storage	Pipes	Installation
1. Market seg. 1 AC SWPS	18,755.5	20%	10%	53%	6%	11%
2. Market seg. 1 DC SWPS	21,937.7	14%	23%	46%	6%	11%
3. Market seg. 2 AC SWPS	41,487.7	12%	10%	61%	6%	11%
4. Market seg. 2 DC SWPS	47,848.0	10%	11%	63%	6%	11%
5. Market seg. 3 AC SWPS	1,637.2	22%	16%	45%	6%	11%
6. Market seg. 3 DC SWPS	1,512.8	16%	20%	47%	6%	10%

Table 3: Savings and income from SWPS

Table 4: Savings and income from SWPS

Cost Items	Market segment 1		Market segment 1		Market segment 1	
	AC	DC	AC	DC	AC	DC
Annual diesel savings (US\$/year)	786.4	786.4	1,694.1	1,694.1	133.3	133.3
Transporting saving (US\$/year)	40.5	40.5	87.7	87.7	0.0	0.0
Income from sale Excess energy (US\$/year)	399.1	518.8	532.1	691.7	26.6	26.6
Total	1,226.0	1,345.7	2,314.0	2,473.6	159.9	159.9

Results 3: Profitability analysis

Table 5: NPV, PBP and IRR

S/No	SWPS	Capital cost (US\$)	NPV (US\$)	PBP (years)	IRR (%)
1.	Market seg. 1 AC SWPS	18,755.5	-4,499.1	>20	2.1%
2.	Market seg. 1 DC SWPS	21,937.7	-7,146.1	>20	0.9%
3.	Market seg. 1 AC SWPS/DWP	7,221.8	3,812.9	11.3	11.2%
4.	Market seg. 2 AC SWPS	41,487.7	-13,748.3	>20	0.8%
5.	Market seg. 2 DC SWPS	47,848.0	-18,202.2	>20	0.0%
6.	Market seg. 2 AC SWPS/DWP	12,025.5	8,425.2	10.1	13.0%
7.	Market seg. 3 AC SWPS	1,637.2	-0.6	>20	5.3%
8.	Market seg. 3 DC SWPS	1,512.8	270.9	15.6	7.4%
9.	Market seg. 3 DC SWPS/DWP	689.5	913.5	7.1	17.9%

Results 4: Main loan features for SWPS for MFIs

Table 7: Loan features for SWPS

Main loan terms	Market segment 2 AC SWPS/DWP	Market segment 3 DC SWPS/DWP
Loan size (US\$)	12,026.0	689.0
Interest rate (% semi-annually)	4.64	4.64
Instalment size (US\$)	1,359.5	89.0
Repayment frequency	Semi-annually	Semi-annually
Loan duration (years)	5	4.5

Conclusion

- Three main SWPS marketing segment identified.
- Storage contributes enormously to capital cost of SWPS.
- Complete replacement of DWPs with SWPS/PVC tank not profitable thus no potential for microfinance support.
- SWPS and DWP for cloudy days is profitable for all market segments thus there is a potential for microfinance support.

Recommendations and areas of cooperation with PAUWES

- Analysis based on other forms of storage: Battery and concrete
- Weather data from area for simulation and optimisation
- Excess energy throughout and possibility of swarm electrification
- SWPS for other crops and productive uses should be investigated
- Business models for SWPS/DWP, other roles of MFIs as well as farmers' willingness be determined
- GHG emission reduction and possible benefits through carbon markets be examined.

What are the potential aspects of the research that can be transformed into practice?

- ▶ Adapted findings
- ▶ Established partnership with suppliers
- ▶ Already looking for funding in Uganda

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