Solar powered water pumping can boost smallholder income: A business model based on action research from LIVES and Africa RISING sites

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CGIAR | ILRI International Livestock Research Institute | IWMI International Water Management Institute | LIVES | EIAR | Ministry of Agriculture | Africa RISING | CGIAR Research Program on Water, Land and Ecosystems

Description of the Technology

- Developed to provide smallholder farmers an affordable water lifting technology
- The lifting is limited to 7 m head.
- Capacity can be increased by adding a additional panel.
- Potential to irrigate 2500 m^2
- Expected lifespan 20 years
- Costs 650 USD in Ethiopia (according to Solar pump development)

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Description of the demonstration

- Different application methods (drip, furrow, overhead)
- Demonstration plot size vary between 50 and 200 m^2
- Different crops (pepper, cabbage, carrot, fodder)
- Additional investment in tanker, drip systems and installation

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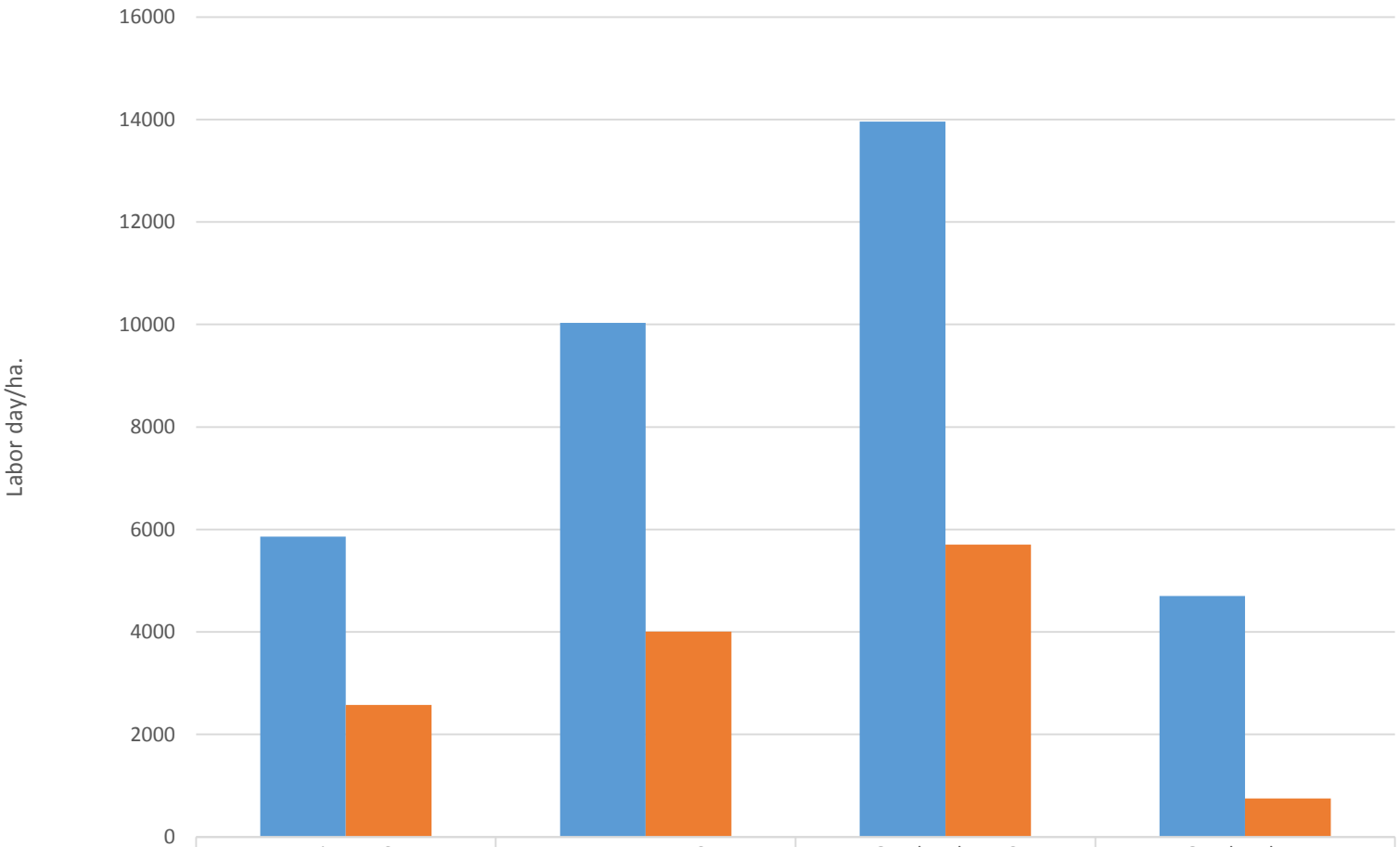
Drip system reduces workload



	Drip-LIVES	Furrow-LIVES	Overhead-LIVES	Overhead-AR
Male labor/ha.	5863	10029	13960	4703
Female labor/ha.	2575	4007	5702	754

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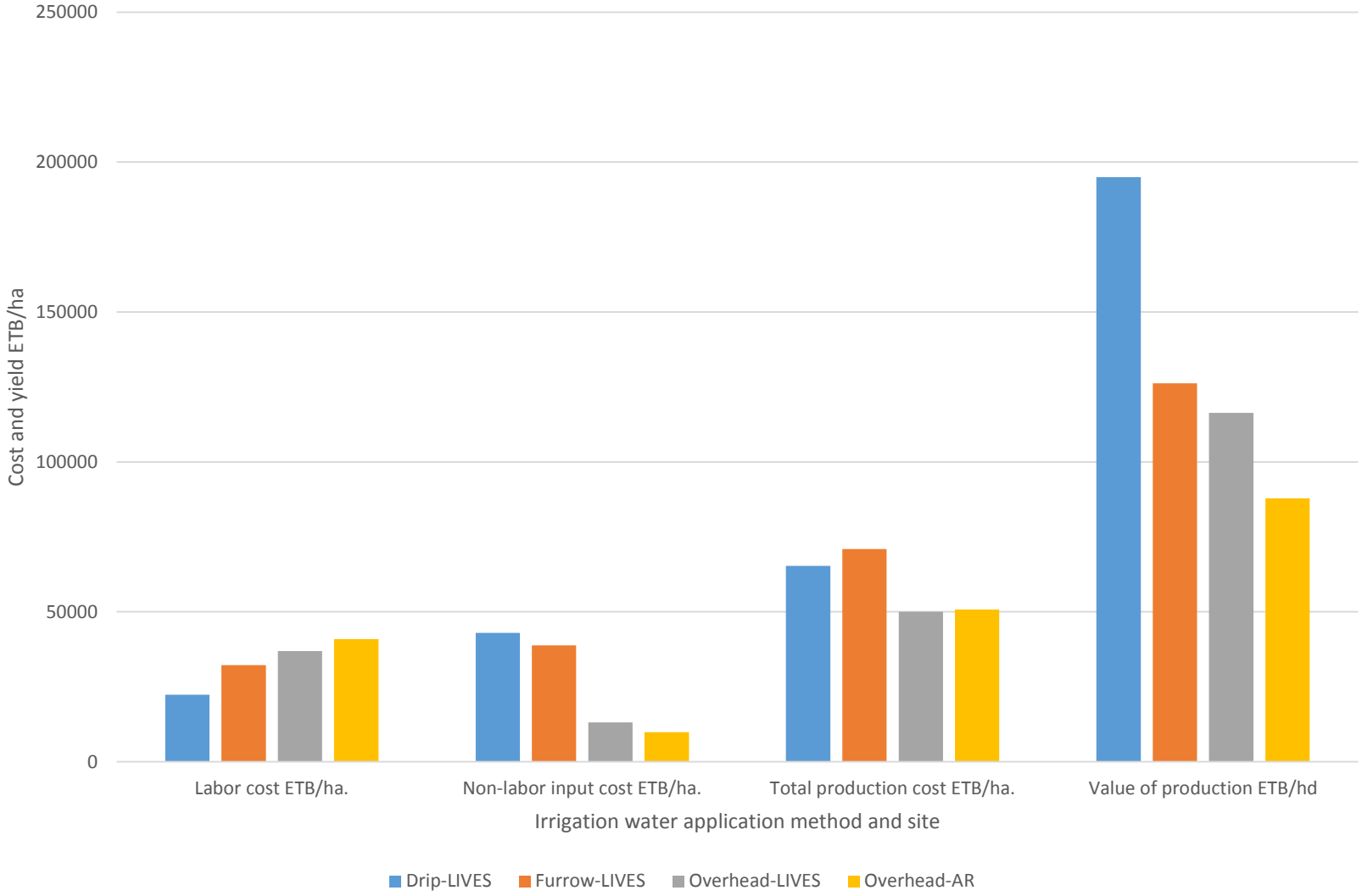
Cost and production per hectare



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With drip system capacity boost

	Drip	Furrow	Overhead-LIVES	Overhead-AR
Crop type	Pepper	Pepper	Pepper	Cabbage, carrot, fodder
Demonstration plot (m^2)	200	200	100	68
Amount of water used m3/demonstration plot	52	105.3	41.2	27.4
Amount of water m3/ha	2600	5266.1	4118.5	4028.1
Pumping capacity l/second	0.5	0.5	0.5	0.24
Total discharge l/hr.	1800	1800	1800	864
Total discharge m3/day	14.4	14.4	14.4	6.9
Cropping season (days)	80	80	80	131
Total discharge m3/season	1152	1152	1152	905.5
Potential irrigable land (m2)	4431	2188	2797	2248

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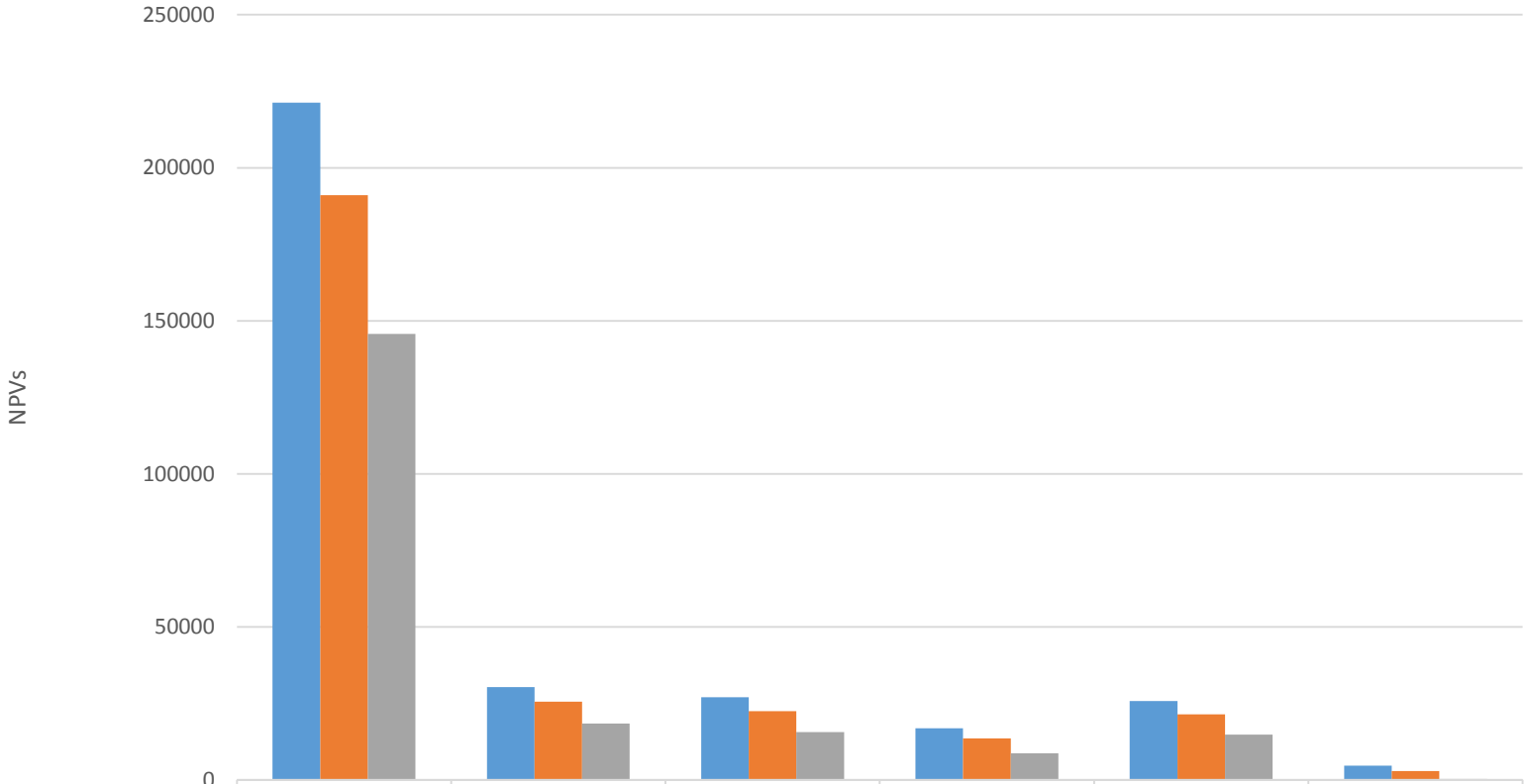
Feasibility analysis of investment in solar pump for smallholder irrigation



	Drip-pepper	Furrow-pepper	Overhead -Pepper	Overhead-Cabbage	Overhead-Carrot	Overhead-fodder
Discount rate (15%)	221294	30323	27061	16889	25817	4626
Discount rate (18%)	191100	25532	22464	13587	21378	2885
Discount rate (24%)	145670	18375	15619	8698	14772	354

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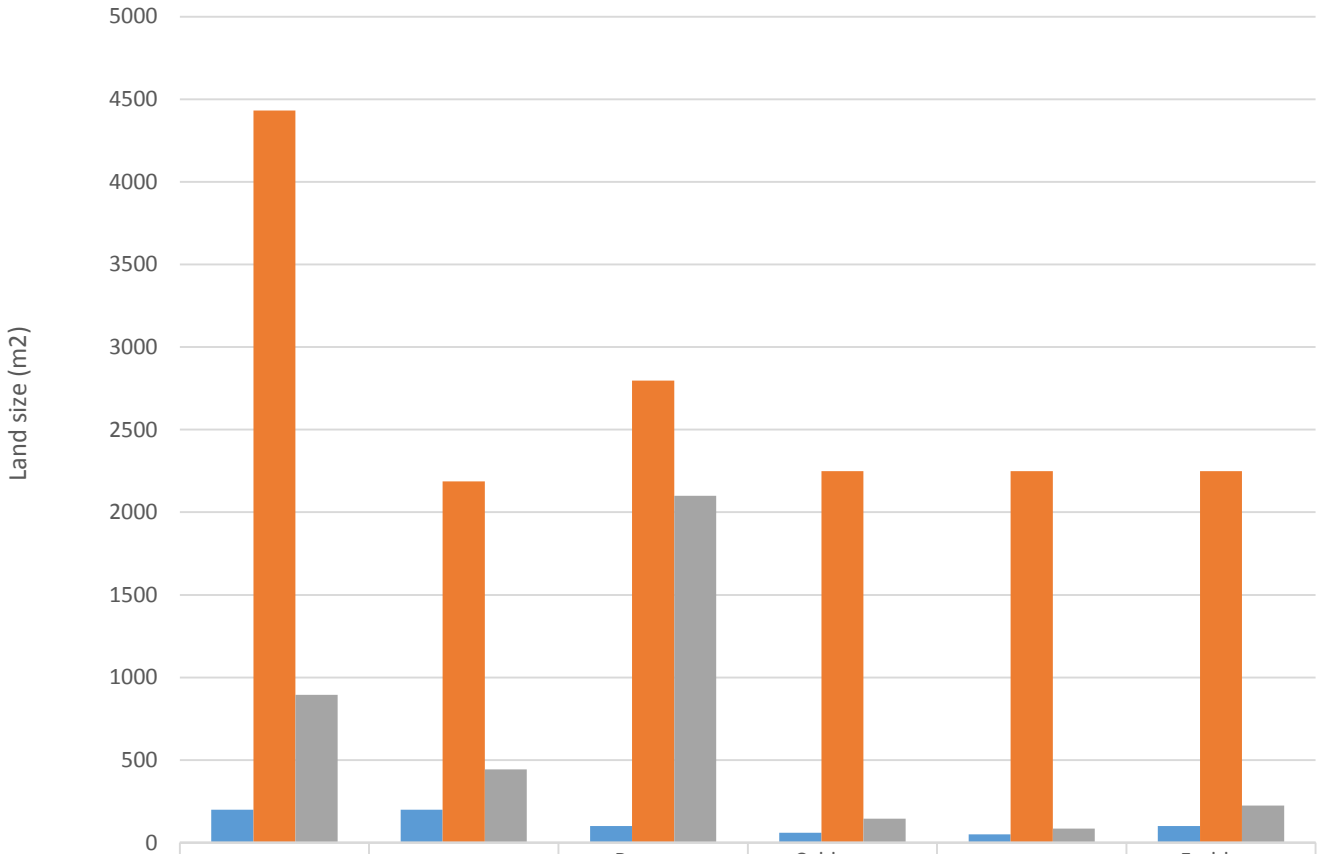
Facts and assumption for the feasibility analysis and implication

- Expected span of life is 10 years
- One crop per year
- 8 hours/day effective solar radiation
- Rural MFIs where interest rates (varying between 15 and 24%) are relatively higher than the formal banks are the main credit sources
- Cost of solar pump >=13000 Birr
- Additional cost on tanker, drip kit, instantiation >= 27000 Birr

Land size by water application and crop type



	Pepper-Drip	Pepper-Furrow	Pepper-Overhead	Cabbage-Overhead	Carrot-Overhead	Fodder-Overhead
	LIVES-Intervention			AR-Intervention		
Domonestration Plot size (m2)	200	200	100	60	50	100
maximu irrigable plot size (m2)	4431	2188	2797	2248	2248	2248
Minimum plotsize (m2)	895	443	2100	145	85	225

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Conclusion

- Given that the minimum land size is available, investment in solar pump is feasible and worthy investment
- Profitability depends on crop type and water delivery system
- Drip system reduces workload and drudgery
- MFIs can server as a reliable source of finance than the formal banking system.
- Clean and harmonious with nature
- Inline with the Ethiopian Government Climate Resilient Green Economy (CRGE) strategy

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Conclusion (cont….)

However, the analysis was made within the scope and limitations of the technology, for example:

a) The piloted type is not suitable for large scale commercial farms,

b) Water yield vary according to the sunlight and water level depth

c) High initial investment cost, but cost sharing can be a solution, especially when drip system is in use.

d) Not commercialized and lack of information

Finally, solar water pumps can be widely adopted with some support, such as:

- ✓ Improved access to credit/financing mechanism
- ✓ Access to the technology (commercialization)
- ✓ Addressing the affordability of initial investment cost (subsidy, tax exemption, etc.)
- ✓ Complement with power storage battery to apply the irrigation either late in the afternoon or in the morning.