Policy and Engineering Solutions for Transboundary Groundwater Sustainability in Madhesh

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Story of Self

Roads in my life

Become a Farmer	Become a Priest
Continue family tradition of farming	Pursue Sanskrit education and religious path

My Educational Journey

Sanskrit School in Village
Limited exposure to science, math and English

Electrical Engineering (2002)
Secured scholarship from national competitive entrance examination

M.Tech in Power Systems at IIT Delhi
ADB/JSP scholarship recipient

Harvard Kennedy School
MCMPA-John F Kennedy Fellowship

People’s Movement

Challenges of Irrigation in Nepal

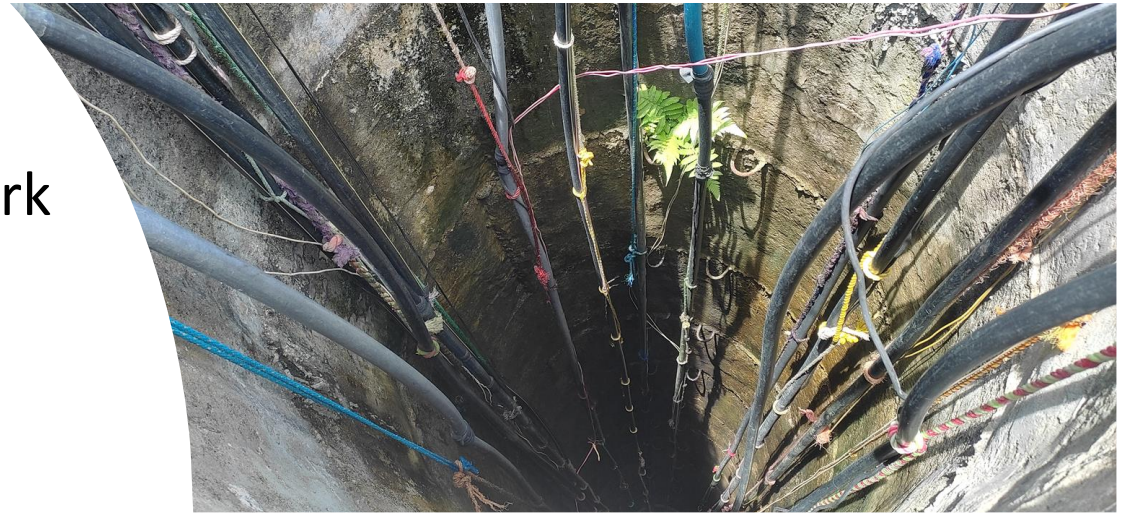
Primary Canal, Secondary Canal but no tertiary canals	
Limited electricity distribution lines in the agriculture farm	
Low voltage due to long T&D lines	draw higher current chances of burning out of motor winding
Making subsidies on efficient water usages	Habit of flood irrigation Very limited knowledge on sprinkler or drip irrigation
Pumping without water recharge system	Raising awareness for sustainable water usage amongst farmers, civil society, public institutions, and solar pump installers.
Limited local capacity	Capacity building to farmers, NGOs, service providers on repair and maintaincce

Drinking Water Crisis

Without action, **forced migration** will rise, burdening host regions and abandoning fertile land.

Drying-up of water sources

- Deforestation
- Chaotic development work
- Sand and Aggregate extraction
- Drying of rivers and shrinking of pond- no water recharge
- Water sources are disappearing
- Failure of water pumps
- Excessive extraction in low-land



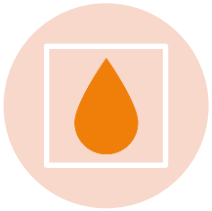
Proposed Engineering Solutions

Build recharge ponds, check dams in every settlement for water percolation

Use stone boulder packing around boreholes to retain water.

Launch reforestation programs near springs and rivers.

Regulate sand mining and unplanned construction.



Educate communities on water conservation and efficient usage.

Holistic development for

Community-Based Large Irrigation Pumps

- Encourages community ownership and involvement in management

Grid Connected

- additional income for farmers through sale of surplus energy sales.

Water Recharge Systems

- Prevents groundwater depletion
- Boulder packing around boreholes, check dams in water streams, excavation of pits in upstream, pondage, bio-engineering etc

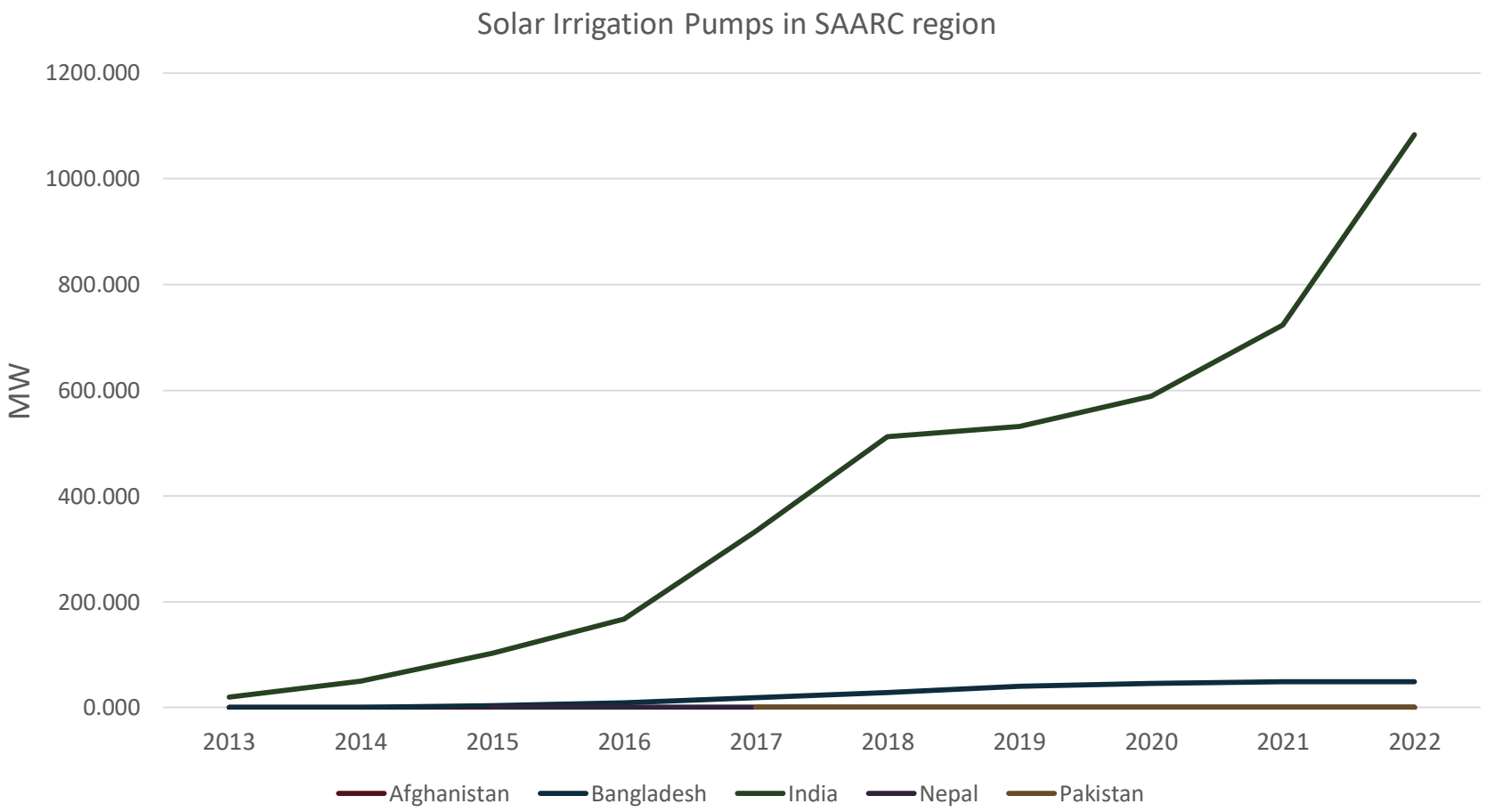
Integration of drinking water

- Sense of ownership

Agrovoltaic system

- Harvest the sun for both agriculture and energy uses

Solar Irrigation Pumps in SAARC countries



IRENA Off-grid Report 2023

Solar Irrigation Pump Policies in SAARC countries

- **PM KUSUM-India (MNRE)**
  - Ambitious program of 34.8GW solar systems in agriculture sector by 2026 with financial support of $4.13billion from central government
  - The central government provides a subsidy of up to 30% or 50% of the total cost of installing a standalone solar pump or solarizing an existing grid-connected agricultural pump.
  - The state government provides a minimum subsidy of 30%, and the remaining amount is paid by the farmer.
- Nepal- 60% of CAPEX (GoN Subsidy Policy 2022)
- The subsidy for BREB model ranges from 62%–66%
  - IDCOL: 50%
- Pakistan: 60% of capital cost not exceeding (Rs. 720,000)

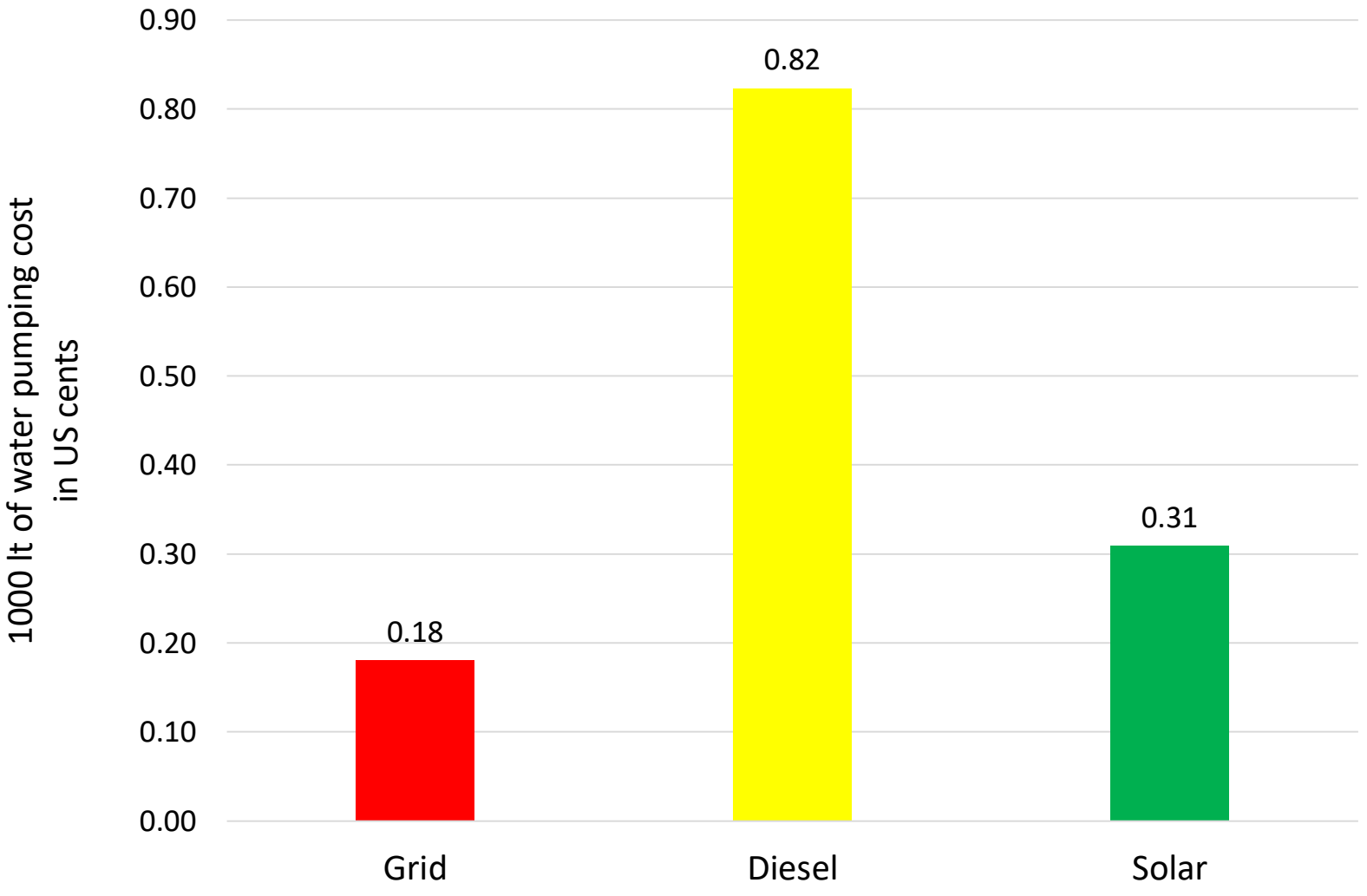
Cross-Border and Governance

Groundwater depletion is transboundary—requires Nepal–India cooperation.

A comprehensive, collaborative strategy is needed—linking water, land, and cross-border policy.

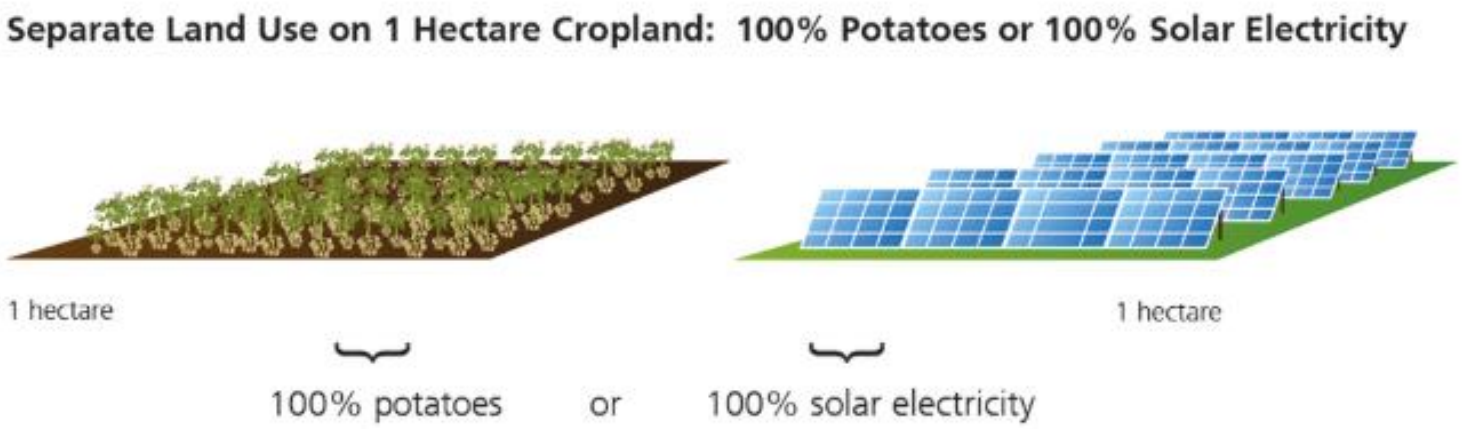
Immediate action is vital to protect human rights and prevent displacement

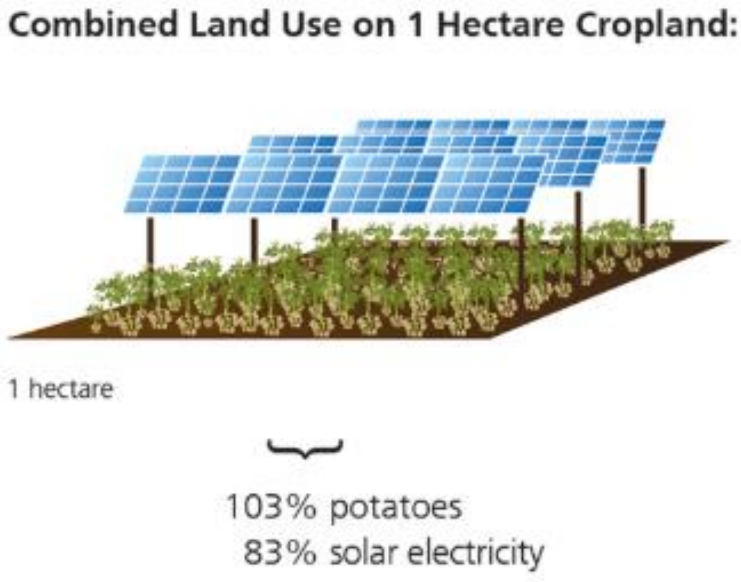
Cost comparison of pumping systems



Pump Comparison sheet

Agrophotovoltaic (agri+solar)





Doubling the harvesting

Agrophotovoltaic (APV)

- More agriculture production due to partial shedding of solar panels on crop
- Need to conduct study on suitable crops on partial shedding of solar panel in context of Terai.

Photo: APV in Germany

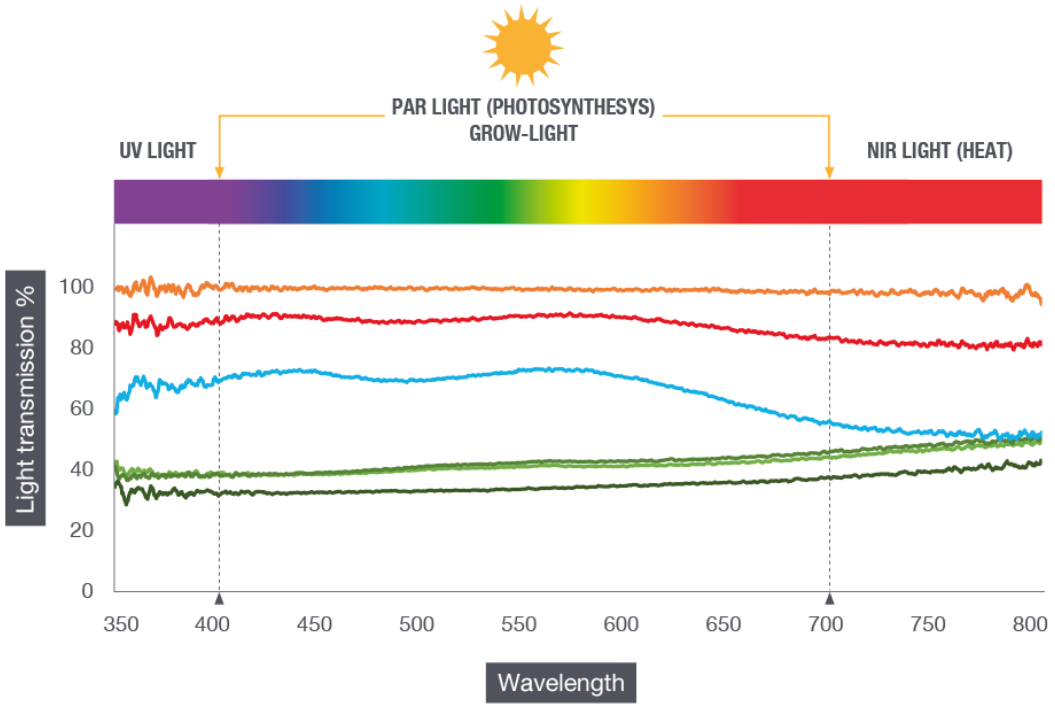
Photo: APV in India

- APV-CAZARI.mp4

Sunlight requirement for plants

Plants like lemon grass, aloe-vera, cumin seed etc requires less sunlight and perfect to grow under the PV plant

Plant type	Web-length (nano-meter)
Cabbage	660
Tomato	660
Mustered	638
Green bay leaf	638
Sweet pepper	660
Cucumber	455



Ref:horti-growlight.com

Some of initiative

- 5HP, 4kWp of Solar Pumping in Telkuwa Bara
- Implemented in 2016

Pilot for modern agriculture farming; nursery, poly house, organic farming, floriculture etc

30kWp Integrated Drinking water and Irrigation Project-Nepal

Location:	**Belhi Village, Hanspur Municipality-5, Dhanusha Nepal**	
Intervention:	Solar Powered Drinking Water facility to 256 households of Belhi and Irrigation water for drip and sprinkler irrigation	
Water Demand	270,000 litre per day (150,000+120,000)	
Major Works:	RCC Overhead Tank	75m^3
	Water Supply Distribution Pipe Line	4,363.69m
	Mechanical Water Treatment Plant (Pressure Filter)	
	Solar PV Array	30kWp

Devidanda Solar Drinking Water Project
Ishworpur Municipality - 12, Guidung, Sarlahi

Solar Array	20 kWp
Household	60
Intake source	Sump well, Banke Khola
Water demand	38,000 litres per day
Head	240 m
Pump size	12 HP
Overhead tank size	20,000 lts. (2x10,000)
Cost of solar & pipleline	NRs. 5,199,149
Cost of civil works	NRs. 9,354,299
Start	November 2022
Completion	June 2023

Tinghare Solar Drinking Water Project- Nepal

Solar Array	40 kWp
Household	450
Intake source	Sump well, Jharjhare Khola
Water demand	370,000 litres per day
Head	48 m
Pump size	17 HP
Reservoir tank size	270,000 lts.
Start	January 2023
Learning:	• Civil works through community saves money upto 28% (15% contractor overhead and 13% VAT) • 6 months construction time- a record breaking time in Nepal • Work didn't stop even while there was crusher industry was shutdown

Agrovoltaic Project

(Tinghare Sarlahi Nepal)

Thank You

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