

Solar Powered Irrigation to enhance climate resilience in the agricultural sector of Bangladesh



16 March 2022



Bangladesh: Country Profile

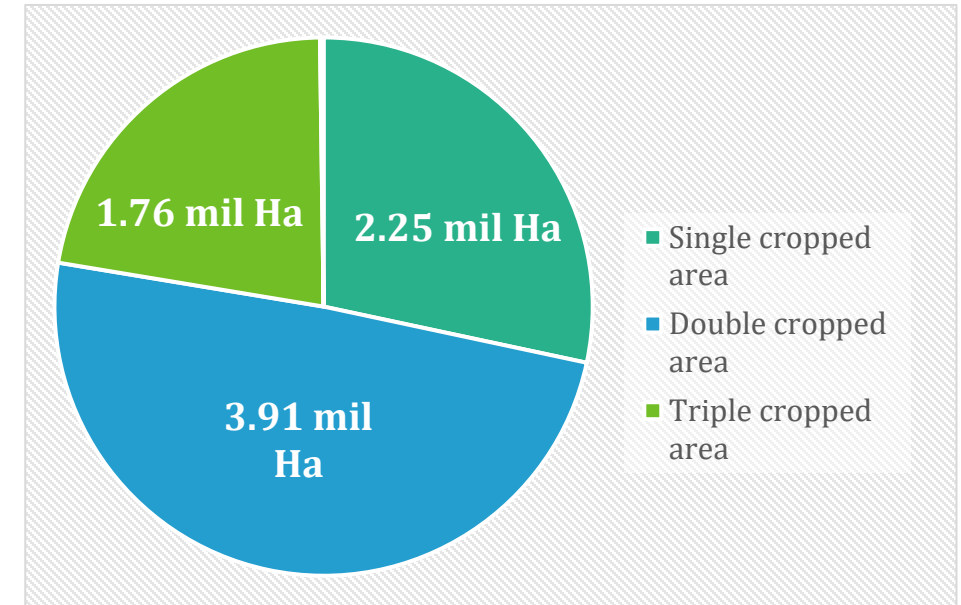


- **Latitude:** $20^{\circ}34'$ & $26^{\circ}38'N$ &
Longitude: $88^{\circ}01'$ & $92^{\circ}41'E$
- **Total Area:** 148,460 km²
- **Population:** 167.43 Million
- **Per Capita Income:** \$ 2,227 (FY 2020-21)
- **GDP Growth Rate:** 5.2 % (FY 2020-21)



- **Total Agricultural Land** : 8.58 million Hectare
- **Intensity of Cropping** : 194%
- **GDP Contribution** : 13.29%
- **Employment Contribution** : 40.60%
- **Major Seasons** : 3 Seasons
- **Major Crops** : Rice, Wheat, Maize, Potato, Jute, Pulses, & Oil seeds
- **Dominant Food Crop** : Rice (covering 75% agricultural land)
- **Achievements** : 3rd Largest Rice Producer
2nd Largest Jute Producer
3rd Largest Vegetable Producer
7th Largest Potato Producer

Distribution of Agricultural Land



Impact of Climate Change on Agriculture of Bangladesh

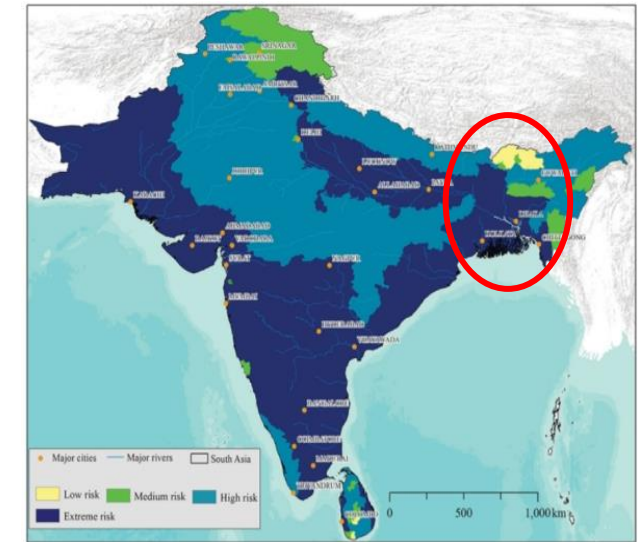
- **South Asia:**

- Most of the countries are climate vulnerable
- Climate impacts can reduce GDP by 1.8% annually by 2050 (ADB)
- Annual temperature increase in the region between 1990 and 2100
 - ~4.8°C – high emissions scenario and
 - ~1.4°C – rapid emission reduction scenario

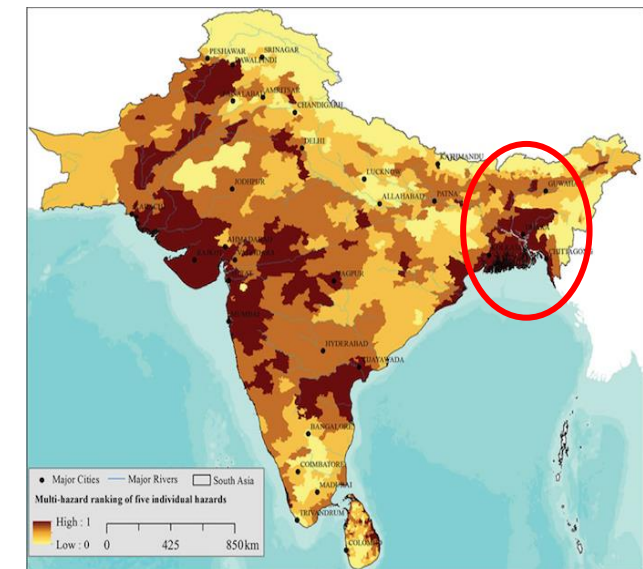
- **Bangladesh:**

- Climate Change Vulnerability Index –most vulnerable country (IFC)
- Increased risks of floods and droughts due to:
 - changing precipitation patterns and
 - higher temperatures
- Observed trends – shift in seasonal precipitation patterns and erratic rainy days
- Temperature rise is impacting crop yield – **irrigation requirement increases**

Climate change vulnerability map of South Asia, Source : CGIAR & IWMI



Multi-hazard exposure map of South Asia, Source : CGIAR & IWMI



Irrigation Scenario of Bangladesh



Irrigation pumps run by electricity

- No. of pumps: 340,000
- Area coverage : 2.3 million hectare
- Electricity Consumption : 1,500 MW

Irrigation pumps run by diesel

- No. of pumps: 1.24 million
- Area coverage: 3 million hectare
- Diesel Consumption: 1.3 million tons/year

*Source: Bangladesh Agriculture Development Corporation
Energy and Mineral Resource Division, Bangladesh*

Impact of Diesel Pumps: Benefit of SIPs



Burns diesel – emits CO₂



Spills fuel – contaminates water



Uses earthen channel, distance between pumps not maintained



Farmers need to carry pump and diesel to field



Requires frequent maintenance, effective life 5 years.



Difficult for supplementary irrigation - reduces crop yield

- **SIP involves zero emission, lower water loss, less O&M expenses, third-party, after-sales services, long equipment life & 20-30% lower irrigation costs.**

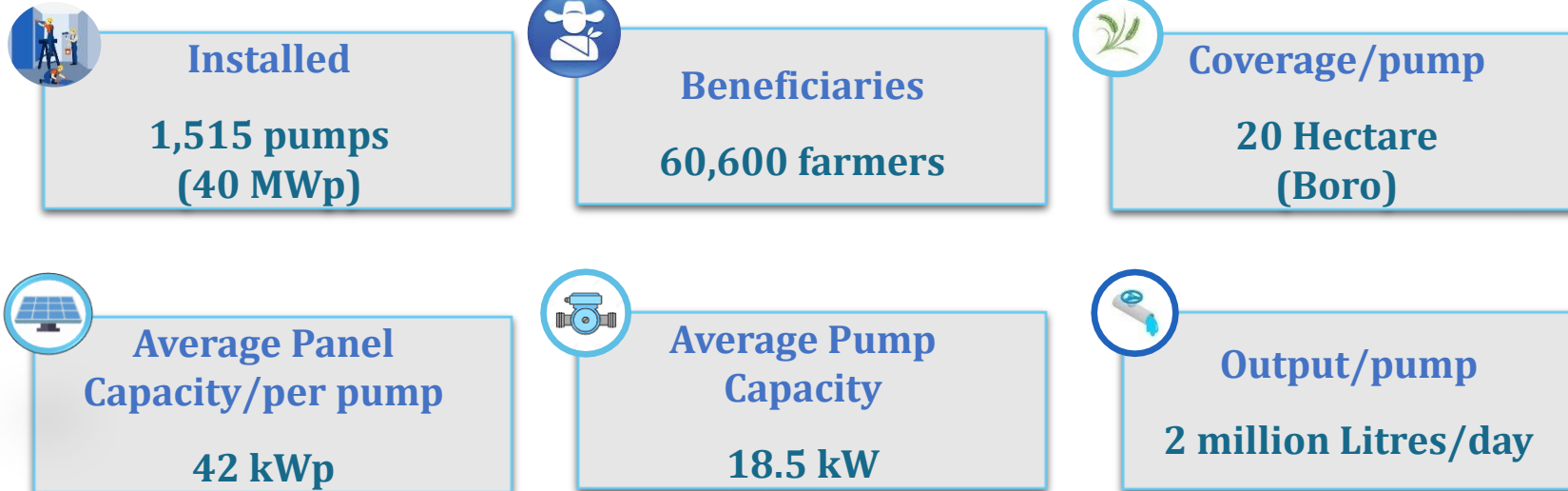
Solar Irrigation Scenario in Bangladesh

Organization	No. of pumps	Installed Capacity [MWp]	Operation modality
IDCOL	1,515	40.00	Private sector led business model – combination of grant, loan & equity
BMDA	661	3.44	Subsidized lease arrangement with the community
BADC	24	0.36	
RDA	2	0.03	
BRRI	7	0.02	
BARD	1	0.10	
Total	2,210	43.95	

In terms of capacity **91%** solar pumps have been installed under IDCOL program.

Source: National Renewable Energy Database-SREDA

IDCOL Solar Irrigation Program



Targets to be achieved by 2030 :



Targeted SDGs:



Development Support



THE WORLD BANK



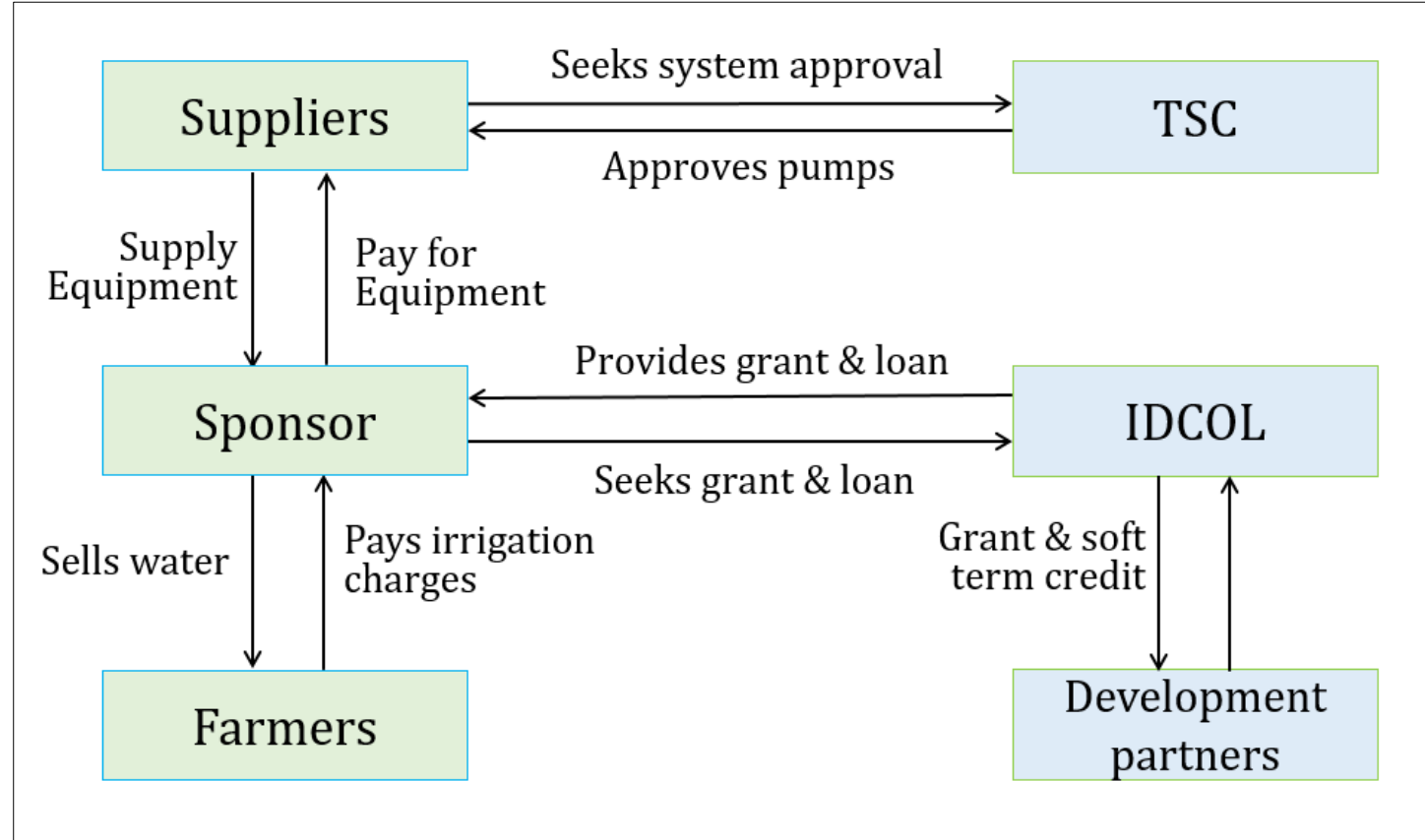
KfW



The Global Partnership on Output-Based Aid

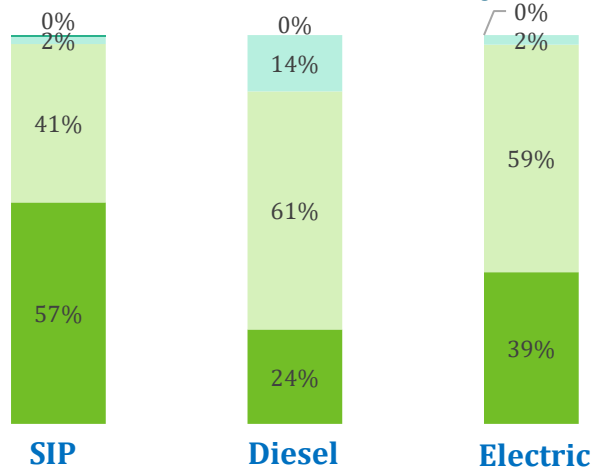


Fee-for-Service Model

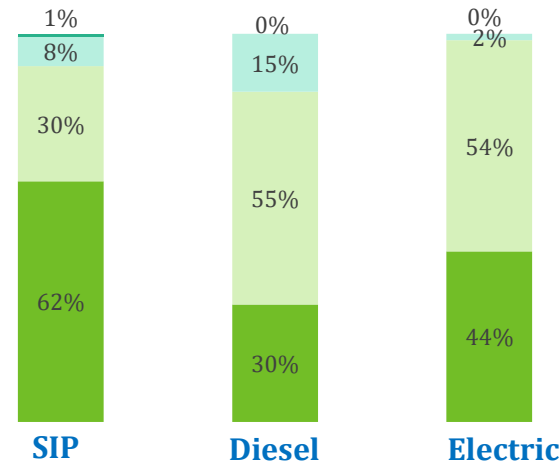


Survey on Different Types of Irrigation Pumps – IWMI

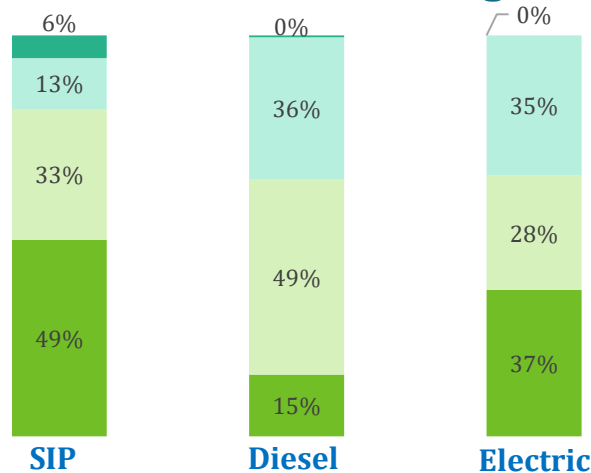
Satisfied with Quality



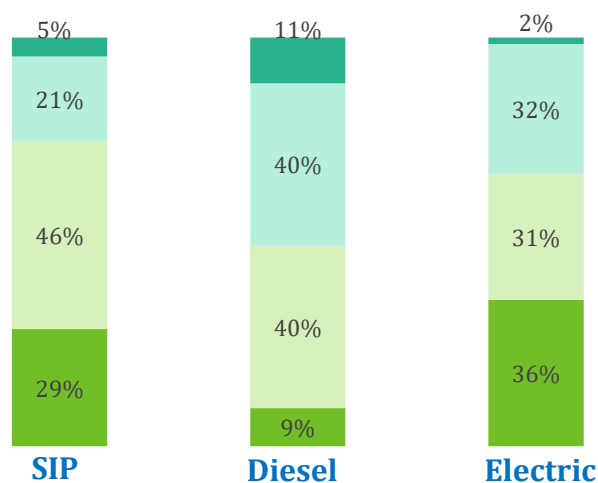
Satisfied with Quantity



Satisfied with Timing



Satisfied with Tariff



■ Strongly agree ■ Agree ■ Disagree ■ Strongly disagree

☐ Quality and Quantity –

- SIP preference is highest
- Dissatisfaction for SIP is low

☐ Irrigation Timing –

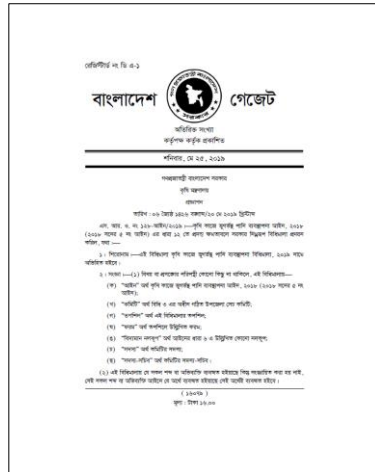
- SIP preference is highest

☐ Satisfaction on Tariff –

- Satisfaction rate is much higher than diesel

Source: HH survey of 900 farmers in 2021 by IWMI and NGO Forum.

Efficient Groundwater Management



Ground Water Management Rule, 2019



Underground pipeline for reduction of water loss



Awareness training on efficient water management



Monitoring static water level



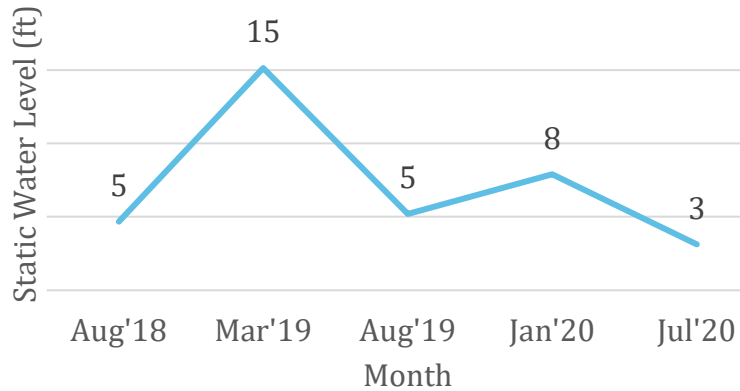
Digital water meter setting training



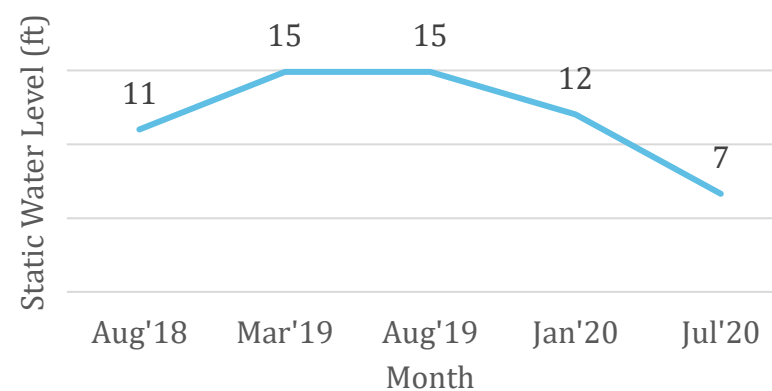
Demonstration of short-duration crop and water management

SIP Impact on Ground Water (Survey of 1150 pumps)

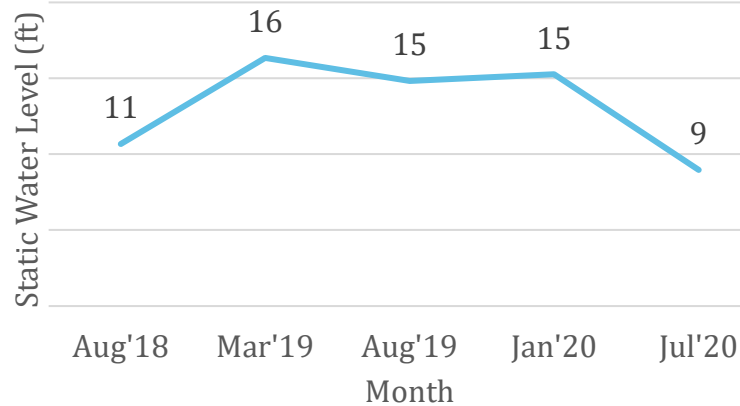
Rangpur



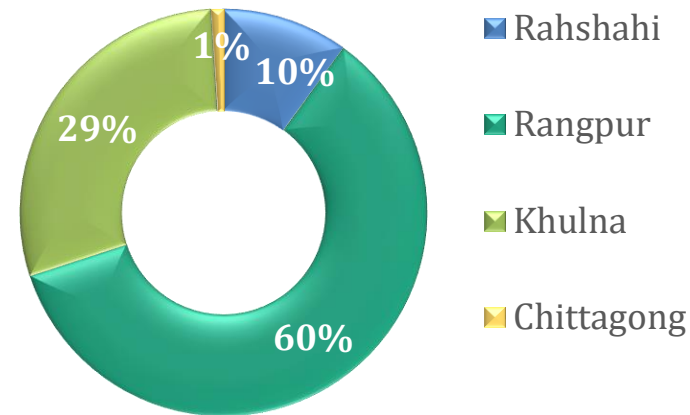
Rajshahi



Khulna



Geographical Coverage



Sound GW replenishment ensured by:

SIPs are installed maintaining required distance from nearby irrigation systems



Efficient and systematic withdrawal of GW compared to diesel pumps



Field level monitoring mechanism



Loan-based irrigation service model & operation limited by day hours



Capacity development of stakeholders

Awareness and Capacity Development



Training of Farmers:
527 Nos.



Training of Pump Operators:
68 Nos.



Training of Pump Supervisors:
29 Nos.



Technical Training for Suppliers:
2 Nos.

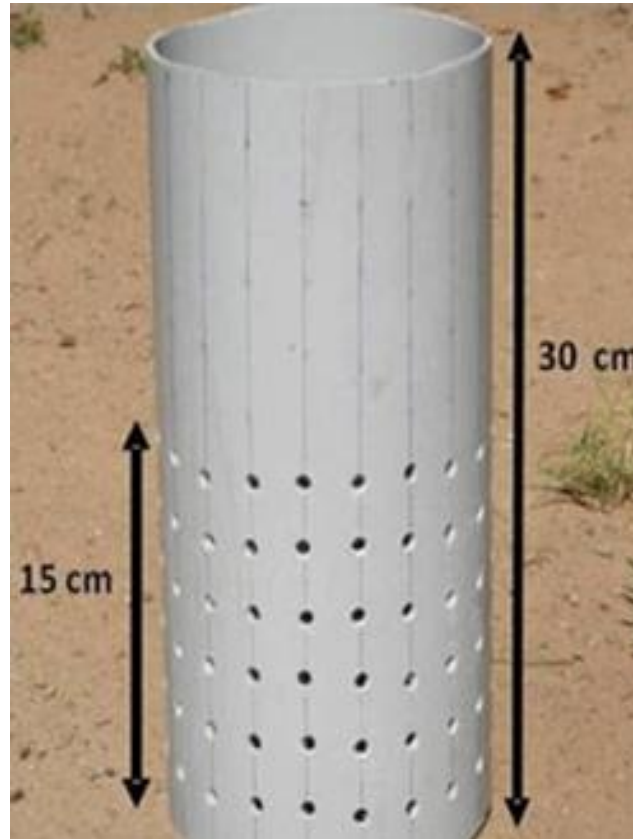
- 15,810 farmers were trained on water management, crop scheduling, fertilizer management, pest control, AWD & seed preservation techniques.
- 2,970 individuals were trained on operation, maintenance & technical aspects of solar irrigation

Efficient Water Management: AWD

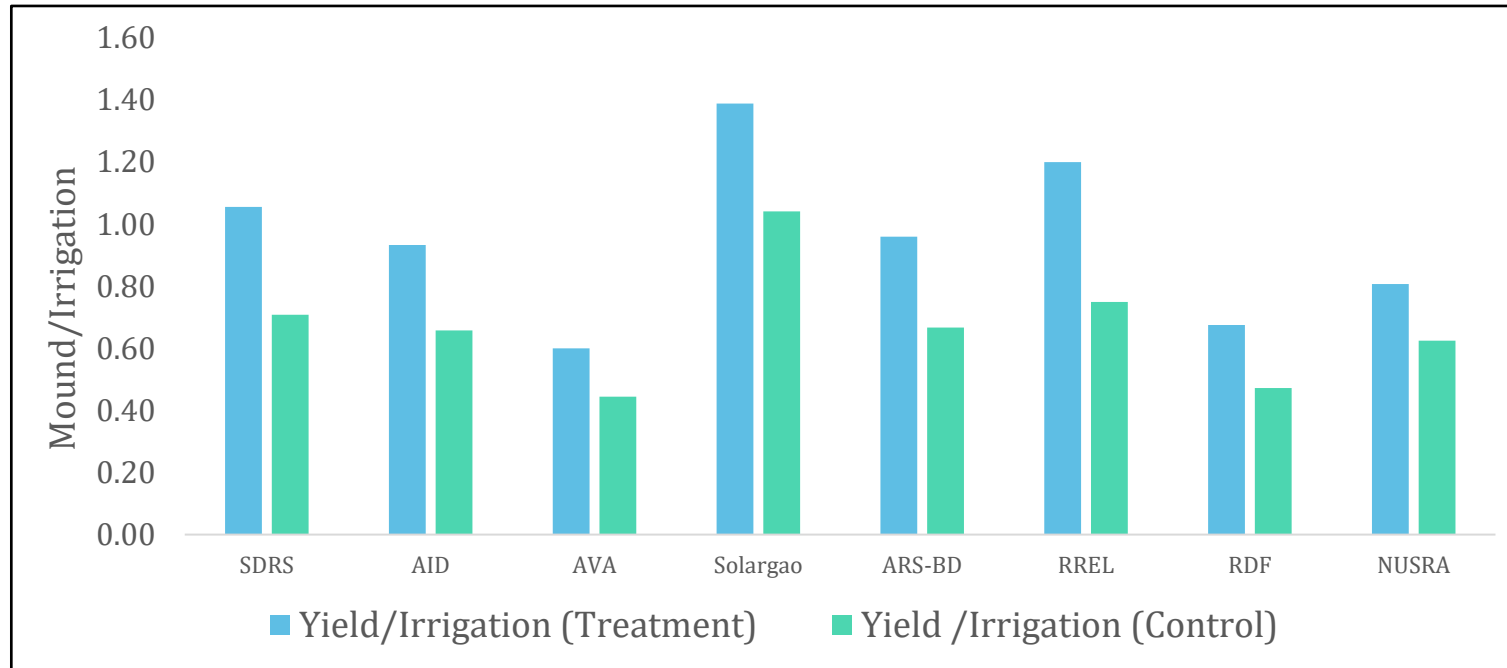
- IDCOL has conducted 124 no. demonstrations since 2018.
- This is now being followed in most of SIP sites.

❖ Alternate wetting and drying (AWD)

- A method of controlled and intermittent irrigation in which the fields are allowed to dry for few days before re-irrigation, without stressing the plants.
- It reduces water demand for irrigation without reducing crop yields.



Result of AWD Field Demonstration (1/2)



- Irrigation requirement in treatment plot is **24.5% lower** than the control.
- Yield in treatment plot is **7.5% higher** than in the control plot.

Crop Scheduling

Demonstrations	No.
Boro (AWD)	125
Aus (High Yielding Variety)	105
Aman (Short-duration)	115
Rabi	43
Total	388



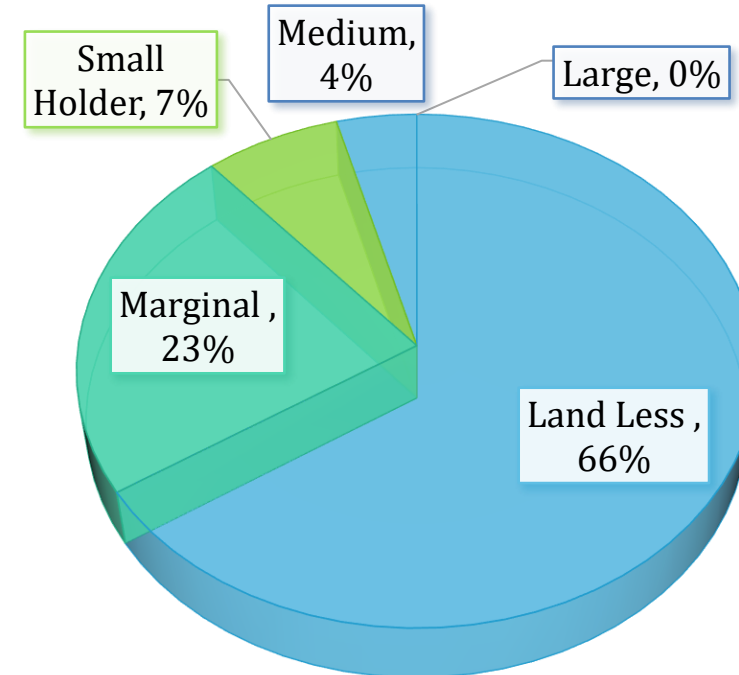
Major impacts of demonstration activities:

- Increased land coverage in 1,157 SIP sites
- Farmers now grow Aus (paddy) before heavy rainfall and flood.
- They now can avail irrigation from SIPs, without relying on rainfall.
- Sponsors assist farmers to schedule their crop seedling and transplanting efficiently.



Categorization of Farmers (Data of 157 SLPs in 2020)

Category of farmers	Land ownership ¹	No. of farmers
Landless	0 to 0.5 acre	7,853
Marginal	0.51 to 1 acre	2,731
Small Holder	1.01 to 2.5 acre	840
Medium	2.51 to 5.0 acre	508
Large	5.01 acre and above	-
Total		11,932



- 19.6% farmers (2,341 farmers) do not have any land.

^[1] Conversion of Agricultural Land to Non-agricultural Uses in Bangladesh: Extent and Determinants, MD ABUL QUASEM, Bangladesh Development Studies, Vol. XXXIV, March 2011, No. 1, Page 64, section I.3

Financial Benefits to Farmers (157 sites)....1/2

IDCOL recently conducted a survey on **157 SIPs** (10.4% pumps under the program).

- In 24% sites a new crop was grown because of water availability.
- Introduction of new crop has increased farmer revenue by 18%.
- Through AWD, paddy yield increased by 7.5%.
- Irrigation tariff is 25% lower in SIP compared to diesel pump.
- Farmer's net income has increased by 38% due to reduced tariff and higher yield.

Financial Benefits to Farmers (157 sites)....2/2

Sl.		Diesel pump	Solar irrigation	Variation
1	Paddy yield (kg/ha)	105	113	7.5%
2	Price of rice (USD/kg)	13	13	-
3	Revenue from rice (USD/ha) (1) x (2)	1,358	1,460	7.5%
4	Revenue from straw (USD/ha)	37	37	-
5	Revenue (USD/ha) (3) + (4)	1,395	1,496	7.3%
6	Other costs (USD/ha)	631	631	-
7	Irrigation tariff (USD/ha)	297	222	-25%
8	Net profit (USD/ha) (5)-(6)-(7)	467	643	38%

Net profit per bigha increases by 38%

Employment Generation under SIP Program

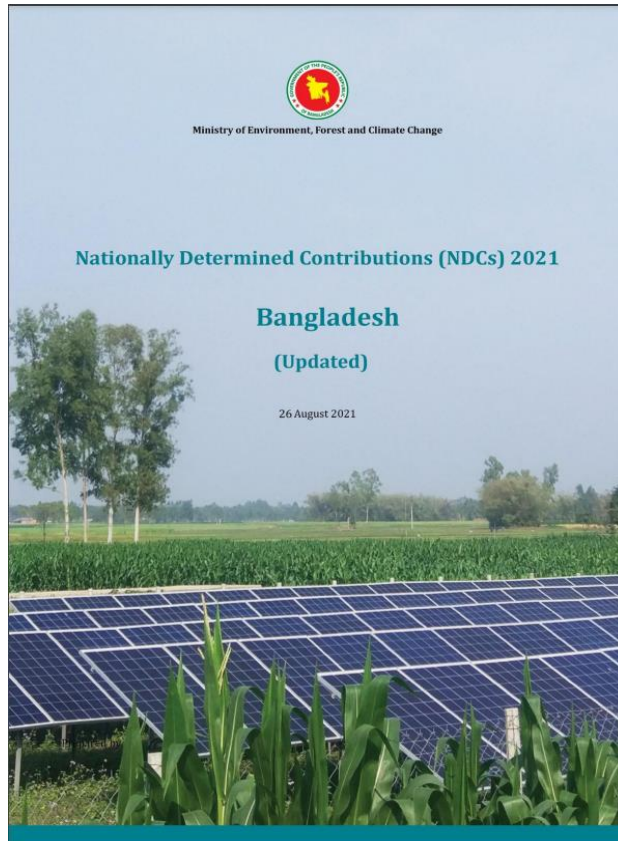
	Sponsors	Suppliers	IDCOL	Total
Administrative employees	55	73	7	135
Field supervisor/field engineer/quality inspector	95	90	23	208
Pump operator	1,515	-	-	1,515
Contractual employee	-	320	-	320
Total	1,665	483	30	2,178

Total employment generation: 2,178 no.

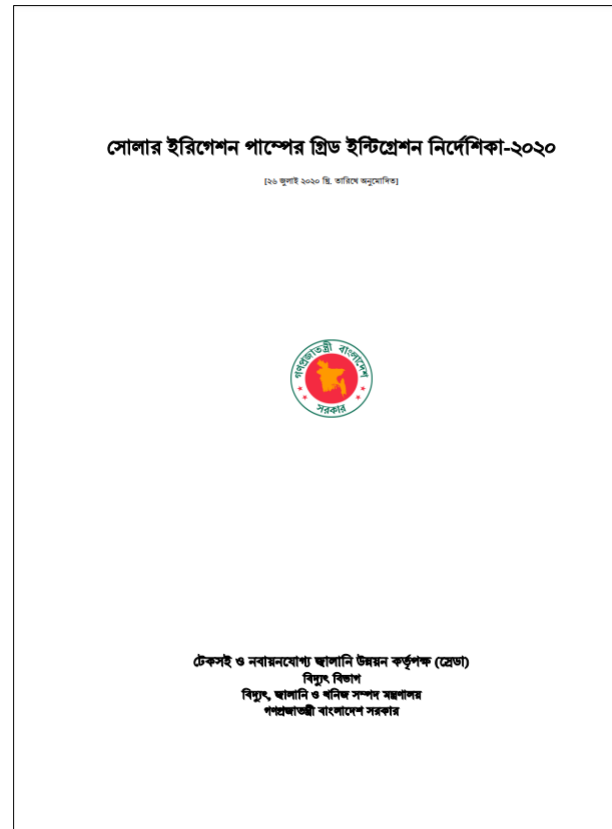
- Direct employment : 1,858 no.
- Indirect employment : 320 no.

Policy Level Interventions of Solar Irrigation

The NDC targets scaling up of SIPs .















Grid integration guideline to utilize excess energy in SIP



- Mujib Climate Prosperity Plan Decade 2030
- Solar Energy Roadmap
- Solar Irrigation Roadmap

Achievements at a glance

 <p>Presence in 5 divisions, 18 districts and 63 upazilas</p>	 <p>Developed 29 project sponsors</p>	 <p>Multiple crops produced against previous 1/2 crops</p>
 <p>Gradually improved business model as per field experience</p>	 <p>A pool of 16 equipment suppliers from 8 countries</p>	 <p>Created 2,178 jobs</p>
 <p>System cost reduced by 68% in last 8 years</p>	 <p>Irrigation Database of 200 Upazilas</p>	 <p>Successful pilot done on grid integration</p>
 <p>Irrigation rates reduced by 25% in last 8 years</p>	 <p>Set product standard & quality control mechanism</p>	 <p>'Grid Integration for Solar Irrigation' guideline drafted by Power Division</p>

Thank You!

