Learnings from Integrating Solar in Agriculture by JISL – Achievements and Impacts

Surinder Makhija
Sr VP & Strategic Advisor

Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

“Leave this world better than you found it.”

One man's desire to improve the lot of his fellow men, spearheaded a revolution in sustainable agriculture that has transformed the lives of millions of farmers, associates, stakeholders and the society around the world.

Every business of Jains, ensures that it creates shared value, nurtures the environment and contributes significantly to the water and food security of the world.

Corporate Overview

Touching lives in more than one way

DRIP IRRIGATION

SPRINKLER IRRIGATION

RESOURCE TO ROOT

DRINKING WATER SOLUTION

FOOD PROCESSING

PROTECTED CULTIVATION

PVC PIPES & FITTINGS

PLASTIC PRODUCTS

PLUMBING SYSTEMS

RENEWABLE ENERGY

TISSUE CULTURE

PE PIPE & FITTINGS

Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

Jain Climate Smart Precision Farming Solutions (JCSPFS)

Jain Climate Smart Precision Farming Solutions (JCSPFS)

- Agriculture is one of the largest and most important sectors in the Indian economy. Such interest has been more so in the developing countries such as India, where agricultural output is often determined by the unpredictability of nature. Agriculture sector in India is highly vulnerable to climate change.
- The increasing temperature and changing pattern of rains reduce crop yields. With the threat of possible climate change gaining momentum, the focus has now shifted to the exploration of the relationship between agricultural performance and the long-term climate variables such as temperature, rainfall and atmospheric CO2 concentration level.
- Frugality is the Mantra. Produce lot more with Lot less.

Impact of Climate Change on Agriculture

- Higher or lower temperatures and unanticipated rainfall across the country resulting in reduced crop yields and overall food production.
- Increased frequency and intensity of extreme weather events such as droughts, floods, cyclones, hail, frost etc.
- Deterioration of water quality due to sea water intrusion, transport of salts etc.

Jain Climate Smart Precision Farming Solution

Jain Climate Smart Precision Farming (JCSPF) is an integrated approach which provides most efficient irrigation strategy to mitigate the impacts of climate change and achieve food security and helps to guide actions to transform agri-food systems towards green and climate resilient practices. JCSPF mapping with the sustainable development goals of India and the G20 countries' Sustainable Development Goals (SDGs) vision

Advantages

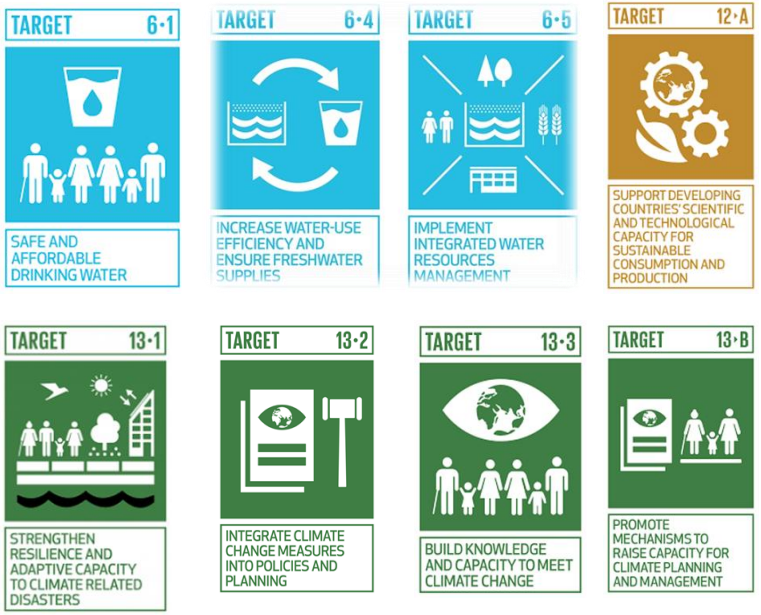
- Increases the efficiency of irrigation (e.g. through deficit irrigation, precise water applications, high-efficiency systems),
- Optimizes yields per volume of water applied.
- Reduces greenhouse gas emissions and improves energy efficiency.
- Optimize the use of water, fertilizers, chemicals and energy, and reduce the sector's vulnerability to climate change,
- Help farmers adapt to changing weather patterns and extreme weather events by optimizing irrigation practices with reducing water waste, reducing fertilizer waste to grow crops under climate change and optimizing the crop yields.

Advantages

- Uses advanced technologies, IoT, sensors, and AI-based data analytics, and control systems, to monitor real time crop water requirements, and weather conditions.
- Help farmers make informed decisions about when and how much water and fertilizers to apply to crops, reducing waste and improving crop yields.
- Can play a role in understanding local soil types, improving soil quality, making realistic crop choices, managing irrigation timing, planting and harvest moments, planning and application of disease, pest and weed management, nutrient application, monitoring and yield prediction.
- JCSPF helps to attain higher crop yield and reduced greenhouse gas emissions by providing accurate information on soil moisture levels and crop water requirements.

Goals of Jain Climate Smart Precision Farming

- To provide most efficient irrigation strategy to mitigate the impacts of climate change and achieve food security and helps to guide actions to transform agri-food systems towards green and climate resilient practices.
- Supporting smallholding farmers and large agricultural enterprises.
- Improving farming activities to achieve higher crop yields.
- Reducing the impact agriculture makes on the environment.
- Ensuring the preservation of soil fertility and biodiversity.
- To allow farmers to retrieve valuable insights from vegetation indices, weather analysis, and field historical data for smart farm management.



Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

JCSPFS- Renewable Energy Applications in the Agriculture Sector

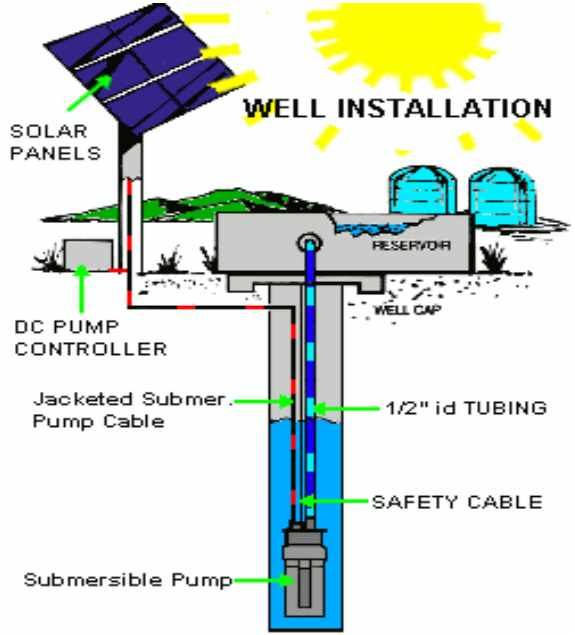
Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

Jain Solar Agri- Pump

Jain Solar Agri Pump

The concept of Jain Solar pump

- Solar panels produce DC power, which is fed to the controller
- Controller regulates & feeds it to the motor
- The motor is Brush-Less Direct Current (BLDC) type
- The pump works in diffused radiation and even in pouring rains!
- The motor can accept AC (single/three phase) input, with the provision of a power pack system, that can be coupled with the controller



Jain Solar Agri Pump

Ganganagar, Rajasthan - 2011

- Pump type : Submersible
- Model : JSP 21K
- PV panel power: 23 KW
- Total head : 25 m
- Avg. discharge: 3,00,000 LPD
- Area covered: 15 Acres

- Pump type : Submersible
- Model : JSP 4000 C
- PV panel power: 3000 Watts
- Total head : 25 meters
- Avg. discharge: 1,20,000 LPD
- Crop : Kinnu
- Area covered: 6 Acres

JRBT, Jalgon

Jain Solar Agri Pump

Solar pump for drip irrigation with Floating platform (Ganganagar, Rajasthan)

- Pump type : Submersible
- Model : JSP 4000 C
- PV panel power : 3000 Watts
- Total head : 20 m
- Avg. discharge: 1,60,000 LPD

Jain Solar Agri Pump with Drip Irrigation System installed at the Highest Point in the world at Leh in J&K - 2012

First large Capacity Solar Pumping Systems for Industrial Applications (Jalgaon - 2009)

Pump Details

- **Pump Type:** Submersible
- **PV panel power:** 15 KWp
- **Total head:** 25 m
- **Max discharge:** 4,80,000 LPD

Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

Jain Agrovoltaic – Agriculture Revolution under Solar Panels

Agrovoltaic – Product for Sustainable Future

Jain AgroVoltaic

Jain has successfully used AgroVoltaic technology on various crops (including, Banana, Turmeric, Cattle Feed and Various Vegetables).

•AgroVoltaic Farming method, consists of a grid connected solar pumping cum power generation and precision (Drip, Fertigation, Mulching, Hi-tech practices & GAP), farming technologies.

•In addition to Hi-Tech Agri inputs, Jain also manufactures solar panels for this purpose. These panels provide shade based on crop needs and weather conditions. Panels can be installed vertically, optimizing unused vertical space, enabling simultaneous solar energy production and agriculture without land use interruptions.

Potential of AgroVoltaic

Food and Fuel from Same Land: Generates Food and Fuel from the same Land Resource. Which leads to Optimized Use of Water ,Energy and other inputs.

Climate Adaptation: Helps farmers adapt to climate change and diversify income through land lease payments.

Water Conservation: Reduces soil water evaporation, potentially lowering irrigation needs.

Enhanced Crop Yield: Improves crop yield and resistance to extreme weather conditions like droughts.

Increased Income: Solar (power generation) comes as a third crop to the farmer, hence, agrovoltaic has potential to increase the income of the farmers without any additional land resource.

One Acre Agrovoltaic Model for Indian Farmers (Banana and Turmeric as Main Crops)

Model Parameters	Banana	Turmeric and Vegetables
Area	4047 Sq mt	1 acre (4,047 Sq mt)
Panels	72 KW	240 kW
Crop	Banana with crop rotation of Papaya, Turmeric, Cotton etc	Turmeric with crop rotation of Papaya, Turmeric, Cotton etc.
Spacing	1.82 x 1.82 m	0.6 x 0.23 m
Structure Height	6 m	4 m
Operating Hours	6 Hours per day	6 Hours per day
Dripline Type	6 mm x 4 LPH x 40 cm	16 mm x 4 LPH x 40 cm
Pump HP	1 HP/Acre	1 HP/Acre

One Acre Agrovoltaic Model for Indian Farmers (Banana and Turmeric as Main Crops)

Crop	Tentative Cost (INR/Acre) (Capital Cost and Cultivation Cost)	Payback Period with Jain's Agro Voltaic Model (Years)
Banana	8,54,287 (Farmer's Share 10%)	2
Turmeric + Vegetable	13,18,560 (Farmer's Share 10%)	2

Jain Irrigation Systems Ltd.
Small Ideas. Big Revolutions.®

Case Study:

Solar Powered Community Lift-Micro Irrigation Project in Talwara and Hazipur Blocks of District, Hoshiarpur- ‘World's Largest Solar Powered Standalone Lift-Micro Irrigation Project’

Kandi Belt – Solar Powered Micro Irrigation Project

- The Kandi belt in Talwara, Punjab, covering 10% of the state's area, faces severe water shortages and soil erosion due to its rainfed, undulating terrain.
- Farmers in the Hoshiarpur district struggle with poor crop productivity, relying solely on rainfall, as the Kandi canal cannot irrigate higher-elevation areas.
- Jain Irrigation Systems Ltd. implemented a Solar-Powered Community Micro Irrigation Project, integrating solar pumping with "resource to root" irrigation technology.
- The project includes Water User Associations (WUA's) to build farmers' technical and fiscal capacity, addressing socio-economic challenges.
- The innovative project, designed with solar power and automation, supports water conservation, equitable distribution, and irrigation of higher-elevation lands using lift systems.

Kandi Belt – Solar Powered Micro Irrigation Project

Location	Kandi Belt, Talwara and Hajipur Blocks of Hoshiarpur District
Area Irrigated	1642 Acre
No of Beneficiaries	1200 Nos
Water Source	Kandi Canal (Mukherian Canal)
Project Cost,	Rs. 40.93 crore
Cost per acre,	Rs. 2,49,270
Period from Completion	Year 2015 to 2017
Maintenance Contract	7 Years
System Type	Solar Powered Pressurised Sprinkler/Drip Irrigation Project

Technical Details

Name of the System	Total Units Installed
Siphons	3
Sump Wells	12
Pump Houses	12
Training Hall	1
HDPE pipe(450mm to 180mm)	8610m
PVC (180 mm to 110mm)	10600m
Micro Irrigation systems(each section of 3 to 5.5 acres)	378 sections
Solar pumps (20hp to 25hp)	46
Solar panels	1.1 megawatt
Automation(SCADA, Hydraulic valves, Remote Terminal Units, Level transmitters, Pressure Transmitters)	664 hectares
Forest Fencing	11000m
Secondary Fencing around solar panels and pump houses	4307m
LLDPE Pipe	650624m
Sprinklers	40015 pieces
Floating solar panels on the surface of pond (one unit)	41760 watts

Kandi Belt – Pre and Post Project Comparison

S. No.	Crop	Pre-Project		Post-Project		% Income Increase
		Yield (qt/ha)	Avg Income (INR)	Yield (qt/ha)	Average Income	
1	Maize	12-14	16900	22-25	31200	85
2	Wheat	14-16	21750	32-36	49300	127
3	Mustard	3-5	13200	7-10	29700	125
4	Sesamum	0.5	2350	3-4.5	16450	229
5	Vegetables	Nil	Nil	varied	125000	NA

Impact on Water Use Efficiency and Agriculture Water Usage Reductions

•The project has resulted in Water Conveyance Efficiency up to 99% and the Field Application Efficiency up to 90%. Thus, bringing the overall efficiency up to 89% - making the project one of the most efficient solar powered micro irrigation technology based integrated community irrigation projects equipped with automation.

•In addition to the above substantial impact on yield increase and income of the farmers (please refer section B), the project has resulted in estimated savings of 13,340 m3 per day (32,01,600 m3 per year OR 3.2 million m3 per annum).

Impact on Water Factor Productivity

The Solar Powered Based IIS technology of Kandi Project has made significant improvements in the water factor productivity for the 4 major crops of the area, ranging from 72% to 93%.

Crop Data			Pre-Project Water Factor Productivity			Post-Project Water Factor Productivity			Improvem-ent in Water Factor Productiv-ity
Sr. No.	Crop Type	Approx. % of crops	Average Yield (qt/ha)	Estimated Water use (m3)	Water factor Productivi-ty (kg/m3)	Average Yield (qt/ha)	Estimated Water use (m3)	Water factor Productiv-ity (kg/m3)	
1	Maize	20	13	640320	0.271	23.5	320160	0.979	72%
2	Wheat	20	15	640320	0.313	34	320160	1.417	78%
3	Mustard	20	4	640320	0.083	1-8	320160	0.354	76%
4	Sesamum	20	0.5	640320	0.010	3.75	320160	0.156	93%

Other Impacts

Further, due to solar power and increased water efficiency the project has created following impacts:

- A total of 1,642 acres have been covered
- 1,200 farmers have been benefited
- Increase in yields and income of the farmers
- Minimal usage of water because of drip and sprinkler irrigation
- Reliable energy at zero costs have resulted into reduced input cost to the farmers
- Solar power generation
- Training of farmers for advance farming and cropping pattern
- Network is made up of HDPE/PVC Pipes, where the designed life is 100 plus years

Thank you

Jain Irrigation Systems Ltd.

Small Ideas. Big Revolutions.®

NH 53, Bambhori, Taluka: Dharangaon, Dist:
Jalgaon - 425002. MH, India

1800 599 5000 customercare@jains.com www.jains.com