बिहार सरकार
जल संसाधन विभाग, बिहार

LARGE-SCALE ADOPTION OF WATER SAVING AND CLIMATE SMART TECHNOLOGY

Lessons from States: Bihar's ASHA™ Model

Presented by

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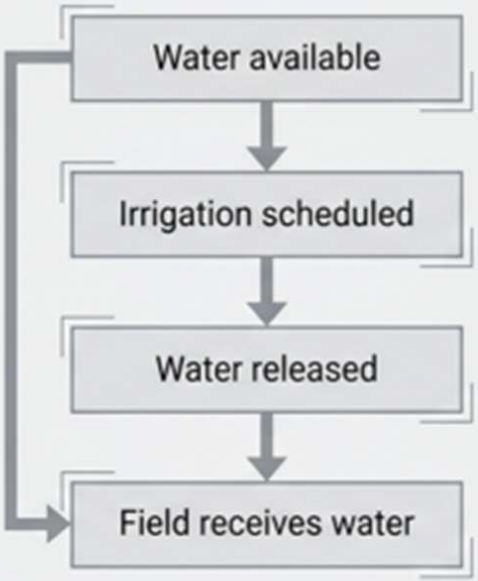
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Water Efficiency | Solar Energy | Smart Automation | Climate Resilience

Per Drop More Crop

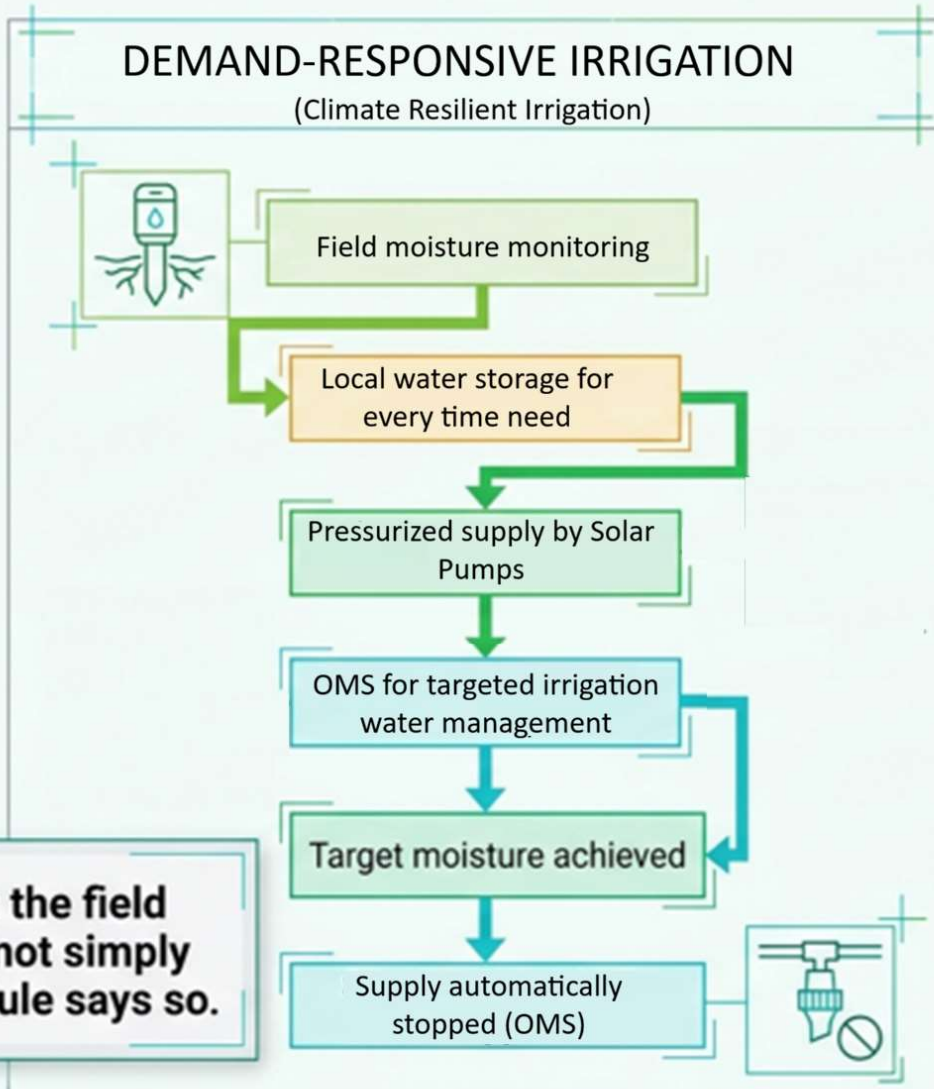
SUPPLY-DRIVEN IRRIGATION



Critical Flaw: The irrigation decision ignores the actual moisture requirement of the crop root zone.

DEMAND-RESPONSIVE IRRIGATION

(Climate Resilient Irrigation)



Irrigate when the field needs water—not simply when the schedule says so.

INTRODUCING **ASHA**

Local Water Storage

Pressurized Irrigation



Efficient conveyance and controlled application.

Sensing & SCADA



Real-time moisture detection and central automated control via OMS.

ASHA

Automated Solar-powered High-efficiency Irrigation Water Application

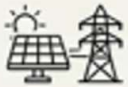
A Bihar Government Pilot

Greywater Reuse



Treatment and recovery of local greywater.

Net-Grid Solar



Renewable energy powering project operations.

Revenue Generation



Surplus solar power exported to the grid.

What Gets Measured Gets Scaled

The pilot is designed to generate hard evidence across every operational vector.



Water

- Water saved
- Water productivity
- Applied per hectare



Soil

- Moisture thresholds
- Sensor reliability



Energy

- Pump consumption
- Grid export volume



Agriculture

- Yield improvements
- Farmer income
- Cost of cultivation



Greywater

- Volume collected
- Treatment performance metrics



Finance

- O&M expenditure avoided
- Net annual benefit

What is ASHA™ Model?



Traditional Structures

Restoration of Ahar-Pyne System

(Revival of traditional water bodies)

+



Modern Technology

Solar-powered, pressure-based efficient Outlet Management System (OMS)

+



Water Conservation

Scientific and judicious use of water

Field-level application, Soil Moisture Sensor and use of Soak Pit

(Reuse water and recharge groundwater)

=

ASHA™ Model

(Automated Solar-powered high-efficiency irrigation water application model)

Integrated Water Management System

(From source to field)

Water Security and Prosperous Farmers

Per Drop More Crop

Paradigm Shift: Introducing the ASHA™ Model

	Conventional	ASHA™
Control	Manual and labour-intensive	Smart, sensor-based and automated
Energy	Dependent on grid or diesel	400 kW Solar Power Plant with Net Metering
Financial Model	Recurring expenditure	Revenue-generating and self-sustaining
Environmental Impact	High water wastage and carbon emissions	Water conservation and low carbon footprint

ASHA's Main Feature

Smart | Sustainable | Efficient

ASHA
Smart Water Management

1 Local Water Storage



Local water storage to ensure reliable supply and better water availability.

2 Solar Power Plant (400 kilo watt)



Solar power plant of 400 kilo watt capacity with net grid connection.

3 Magic Soak Pit for Greywater Management



Magic soak pit for greywater management.

4 Outlet Management System (OMS)



Outlet Management System (OMS) for efficient and controlled water distribution.

5 Soil Moisture Sensor



Real-time soil moisture data for optimized irrigation and water use.

6 SCADA System



SCADA system for centralized monitoring and control of the entire water management network.

7 Underground Pipeline Network



Underground pipeline network for safe and efficient water transport.

8 24*7 Pumping System



24*7 pumping system for continuous water supply and operation.

9 Zero Maintenance Cost



Zero maintenance cost with carbon-credits.

1 ASHA's Main Feature

Local Water Storage

Harnessing rainwater and canal water for a reliable irrigation future

ASHA
Smart Water Management



Key Highlights

- **0.25 MCM** water storage in natural pond (Ahar-Pyne System)
- **7 Nos. of** solar operated sluice gates for water storage
- **Two water sources** Rainwater and conventional canal water
- **Ensures availability** of water for irrigation throughout the year
- **Helps farmers grow** cash crops apart from conventional crops, providing additional income for their livelihood

Key Benefits

- **Water Availability** All year round
- **Higher Productivity** Supports cash crops
- **Improved Livelihood** Extra income for farmers
- **Sustainable Farming** Better water management

2 ASHA's Main Feature

Solar Power Plant – 400 kW with Net Grid Connection

Clean energy for sustainable and reliable irrigation

ASHA
Smart Water Management



How It Works

Sun (Renewable Energy) → Solar (400 kW) → Irrigation Pump (Powering Irrigation) → 24×7 Irrigation (Crop Growth)

Solar (Excess Energy) → Grid (Surplus Export) → Revenue (Approx. ₹11 lakh/year)

Key Highlights

- **400 kW** Solar Power Plant
- **24×7** power availability for irrigation
- Surplus energy exported to the grid
- Approx. **₹11 lakh/year** revenue
- Supports self-sustaining / zero-maintenance-cost operation

Key Benefits

- **Reliable Irrigation** — 24×7 water supply
- **Higher Productivity** — Better crop yield
- **Improved Livelihood** — Increased income for farmers
- **Clean & Green Energy** — Renewable and sustainable

3 ASHA's Main Feature
Magic Soak Pit for Greywater Management

ASHA
Smart Water Management



Key Highlights

- **20 Magic Soak Pits** provided in the project area
- **Diverts household greywater** Prevents direct mixing with pond water
- **Improves water quality** Filters and treats greywater naturally
- **Recharges groundwater** Supports local water resources
- **Better ecosystem** Enables improved water quality for aquatic flora and fauna

How It Works?

Household Greywater (from kitchen, bathroom, washing) → **Piped to Soak Pit** (no direct mixing with pond water) → **Filtration through Soak Pit** (soil, gravel and natural media) → **Filtered Water** (recharges groundwater) → **Cleaner Environment** (healthier pond and aquatic ecosystem)

4 ASHA's Main Feature

Outlet Management System (OMS)

ASHA
Smart Water Management

Field Layout (300 Ha)

Divided into Chaks of 2 Ha each



Solar Operated OMS

- Solar Powered
- Automated Operation
- Controlled Outlet
- Reliable & Low Maintenance

Key Highlights

- **29** Solar operated OMS in the field
- **6** Outlet points (through one OMS)
- **300 hectare (Ha)** Total field area
- Divided into **Chaks**
- **2 hectare (Ha)** Area of each chak

How It Works?

Solar Energy **Powers OMS** → **Automated** Outlet Control → Water Distribution to Chaks → Irrigation to 300 Ha Field → **Efficient & Sustainable Use of Water**

5 ASHA's Main Feature
Soil Moisture Sensor

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Smart Water Management



Sensor data (Soil moisture level)

SCADA – OMS
(Control Command Center)



Command to open / close outlet



Up to 29 outlets can be operated at a time

Outlet Management System (OMS)

How It Works?

Soil moisture sensor checks soil moisture level → Data sent to SCADA – OMS → If moisture is below set value, OMS opens the respective outlet → Irrigation continues till desired moisture is reached → OMS closes the outlet automatically

Key Highlights

- Sensors installed throughout the field at intervals
- Calibrated for local crop and soil moisture requirements
- Sends command to open outlet when moisture falls below set value
- Integrated with SCADA through OMS for automatic operation
- Closes outlet when desired moisture level is reached
- Enables judicious use of water and demand based irrigation
- Up to 29 outlets can be operated at a time

6 ASHA's Main Feature
SCADA System

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Smart Water Management



How It Works?

Field sensors (Soil moisture, flow, pressure, solar data) → **Data sent to SCADA System** → **SCADA processes data and issues commands** → **OMS operates valves / outlets / pumps** → **Optimized, demand based irrigation**

Key Highlights

Centralized, Command and Control
Unified monitoring and control of the entire system

Automates irrigation management
Operates outlets based on real-time field conditions

Monitors water supply and pipeline distribution
Real-time monitoring of flow, pressure and system performance

Controls and monitors valves and pumps
Ensures efficient and reliable operation

Tracks solar power generation
Real-time data on solar energy production and usage

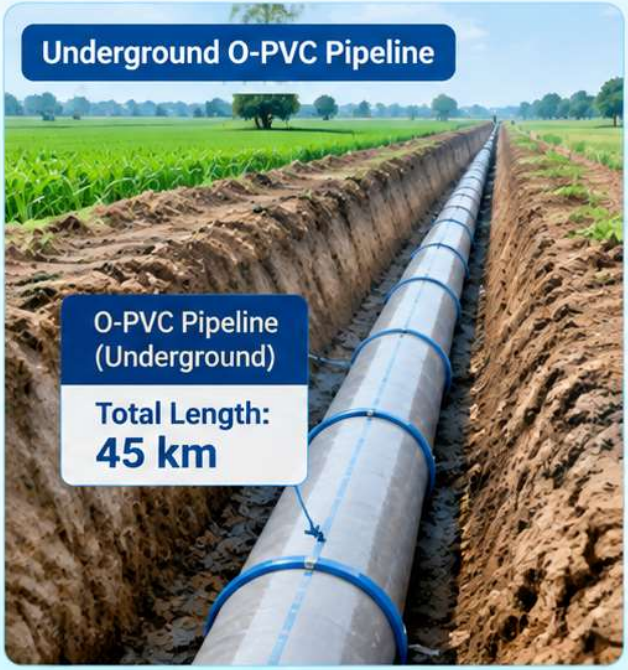
7 ASHA's Main Feature

Underground Pipeline Network

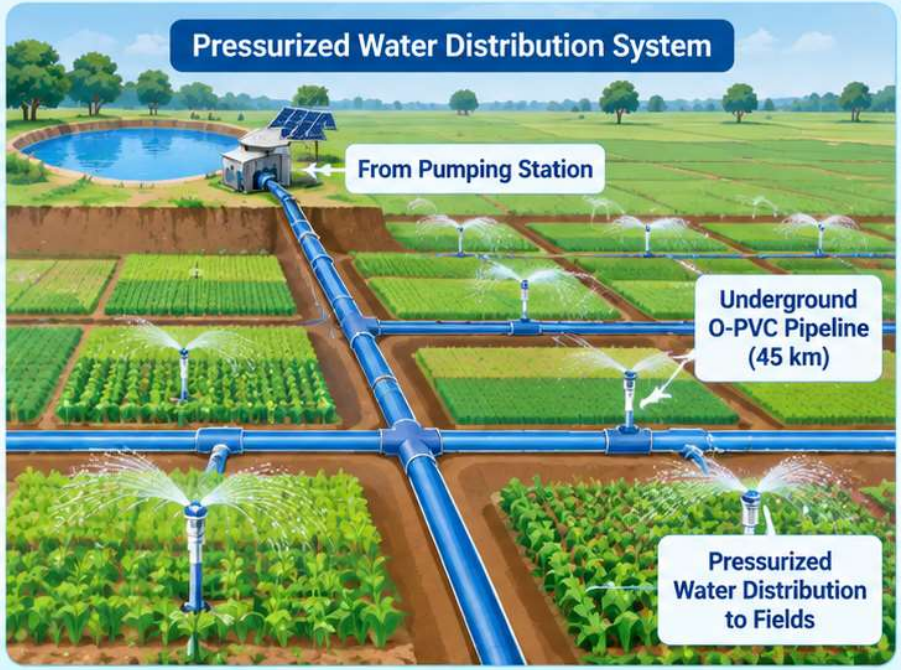
Pressurized water distribution for efficient and reliable irrigation

ASHA
Smart Water Management

Underground O-PVC Pipeline



Pressurized Water Distribution System



Key Highlights

- **45 km** O-PVC underground pipeline network
- **Pressurized** water distribution system
- **Efficient irrigation** water delivered directly to fields under pressure
- **Reliable & durable** O-PVC pipeline for long-term performance

Key Benefits

- **Uniform Water Supply** to all fields
- **Higher Water Use Efficiency** reduces wastage
- **Lower Operation & Maintenance** long life and durable
- **Supports Sustainable Agriculture** better crop productivity

8 ASHA's Main Feature

24 × 7 Pumping System

Reliable water supply through solar and grid power

ASHA
Smart Water Management



Key Highlights

6 Pumps
At a time, 6 pumps can be operated.

Solar Operation in Daytime
Solar pump can be operated with the help of solar energy.

Grid Operation in Low Sunlight / Night
Grid electricity can be used for pump operation.

24 × 7 Pumping
Ensures continuous functioning of pump operation.

Key Benefits

Reliable Water Supply
Continuous irrigation support

Efficient Use of Renewable Energy
Solar in daytime, grid at night

Operational Flexibility
Multiple pumps operated as per demand

Sustainable Agriculture
Assured irrigation for better crop productivity

9 ASHA's Main Feature

Zero Maintenance Cost with Carbon-Credits

Clean energy today, a greener and self-sustaining tomorrow

ASHA
Smart Water Management

From Clean Energy to Carbon Credits

Reducing Emissions | Generating Green Value



Key Highlights

1,200 tonnes/year
Carbon emission reduction through use of solar energy and efficient equipment.

Carbon credit trading
Can be traded in the open market to generate additional revenue.

Total revenue
₹ 12 lakhs per year
From surplus electricity transfer to grid and carbon credit trading.

Zero maintenance cost
Through revenue generation, project maintenance cost becomes zero, i.e. government need not bear the maintenance cost.

Key Benefits

Environnmental Benefit
Reduces greenhouse gas emissions

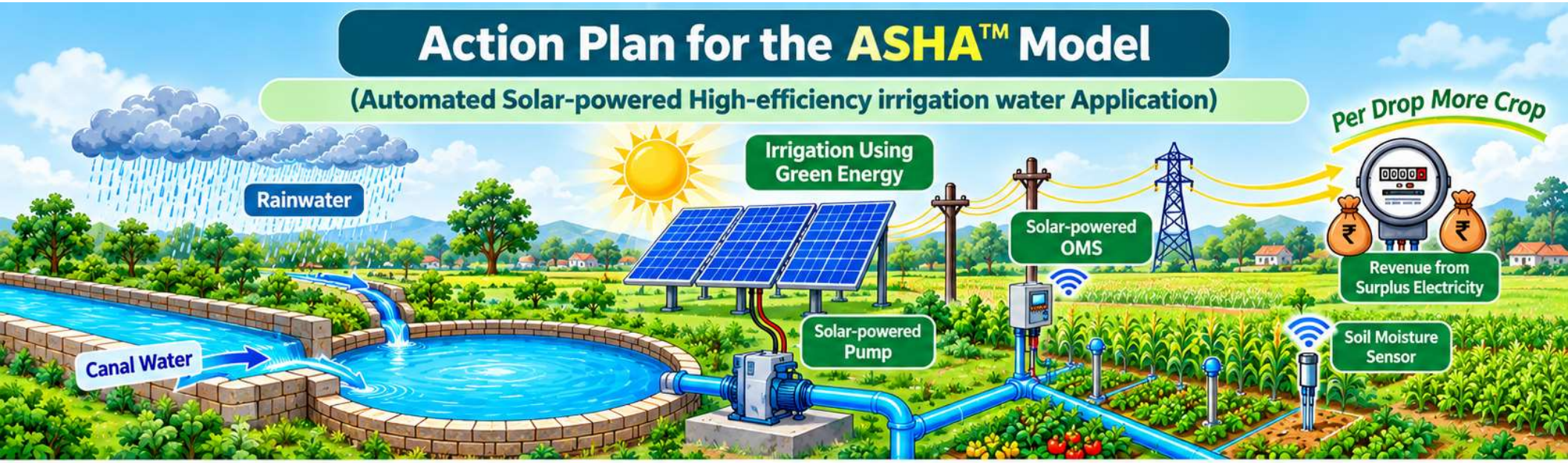
Financial Sustainability
Generates additional revenue

Zero Maintenance Burden
Self-sustaining system

Supports Climate Action
Contributes to a cleaner and greener future

Action Plan for the ASHA™ Model

(Automated Solar-powered High-efficiency irrigation water Application)



Secondary water storage for water security, utilizing two sources

1. Rain Water
2. Conventional canal system



Solar-powered Pumps with Automated OMS

Irrigation based on real-time data of soil moisture.



Irrigation facility even during rainfall deficiency

Assured irrigation for every crop, even in the absence of monsoon.



More income for farmers

Higher productivity along with income from sale of power and carbon credit.



Climate resilience, saving of valuable oil like Diesel



A key step towards climate resilience in Patna district

Cultivable Area: **740 acres**

0.25 MCM Water Storage Capacity

400 kW Solar Power Plant

45 km Length of Pipeline Network

Benefits to Farmers



Assured irrigation throughout the year

Better crop yield through adequate water supply



Higher income and better livelihood opportunities



Increase in agricultural production



Reduction in electricity and diesel costs

Cash Crops + Traditional Crops

Diversified Cropping for Prosperous Farmers

ASHA Model enables farmers to grow both traditional crops and cash crops

Traditional Crops

Paddy, wheat, maize and pulses – for food security, self-consumption and meeting household needs.





Cash Crops (High Value)

Tomato, chili, brinjal (eggplant), cucumber, fruits and other vegetables – higher market value and better income opportunities.





Reliable Water Availability

Conserved water through ASHA supports multi-season and diversified cropping.

Improved Agricultural Productivity

Better yields, quality produce and climate resilience.

Stronger Farmer Livelihoods

Expanded crop choices, reduced risk and more stable income.





From Farm to Market

More Crops. Stronger Farmers. A Resilient Bihar.



De-siltation of Ahar-Pyne



During De-siltation Work



Progress of De-siltation

Pipeline Laying



Trenching work for pipeline



O-PVC pipeline laid in trench

Installation of Solar Pannel





Thank You