

Strengthening Cooperative Dairying to Meet Future Challenges  
NDDDB, Anand, May 16<sup>th</sup>, 2017

# *Harnessing Solar Power for Climate Resilient Agriculture*

Solar Pump Irrigators' Cooperative Enterprise [SPICE]  
ધૂંડી સૌર ઉર્જા ઉત્પાદક સહકારી મંડળી



RESEARCH  
PROGRAM ON  
Water, Land and  
Ecosystems



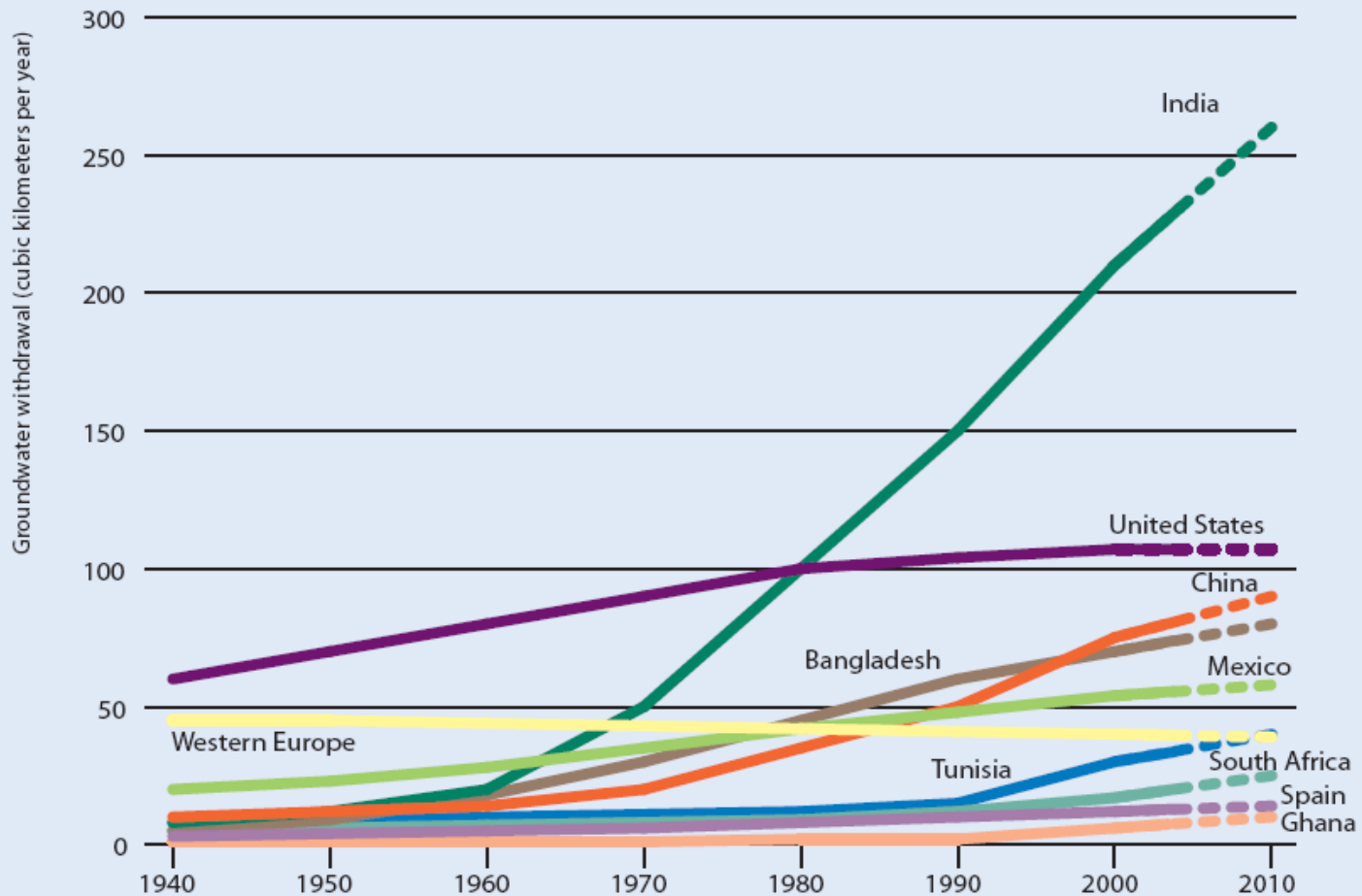
RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



# Solar Pumps: 'Green' opportunity or GW threat?



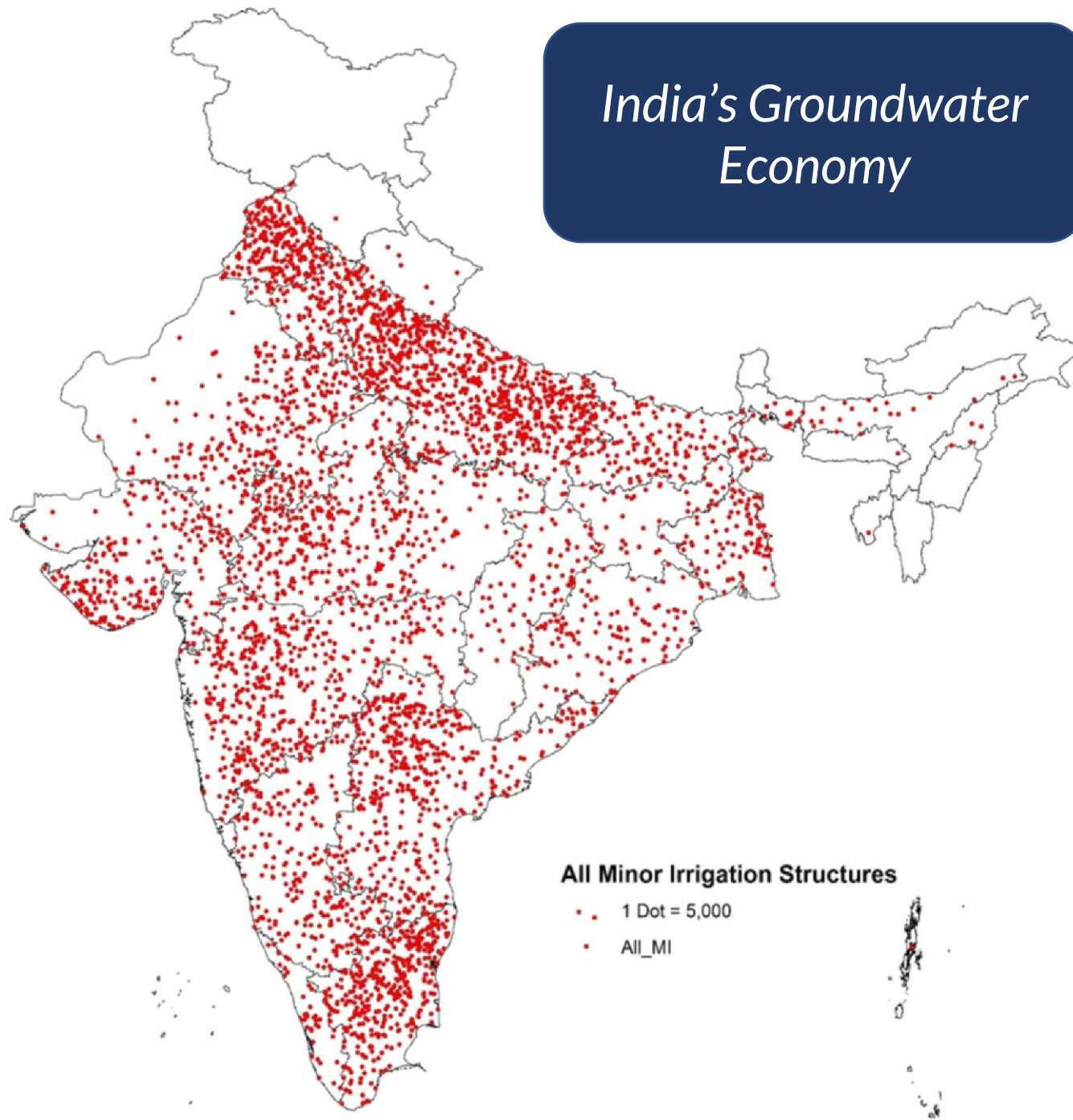
*Independent India inherited world's largest canal infrastructure...  
Over years, it has emerged as the world's largest GW user...*



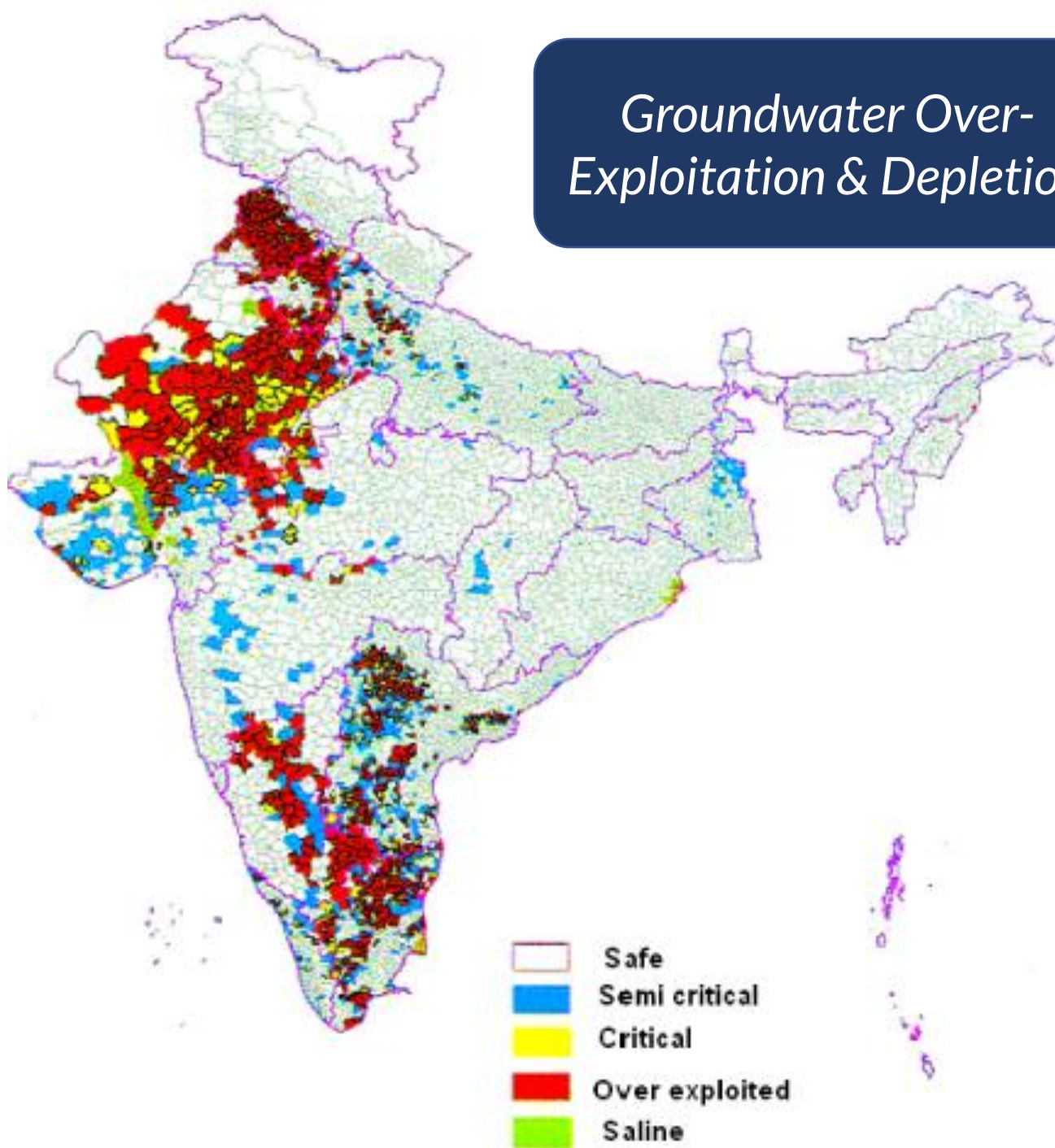
Source: Shah 2005.

Credit: Comprehensive Assessment of Water Management in Agriculture  
Publisher: Earthscan [www.earthscan.co.uk](http://www.earthscan.co.uk)

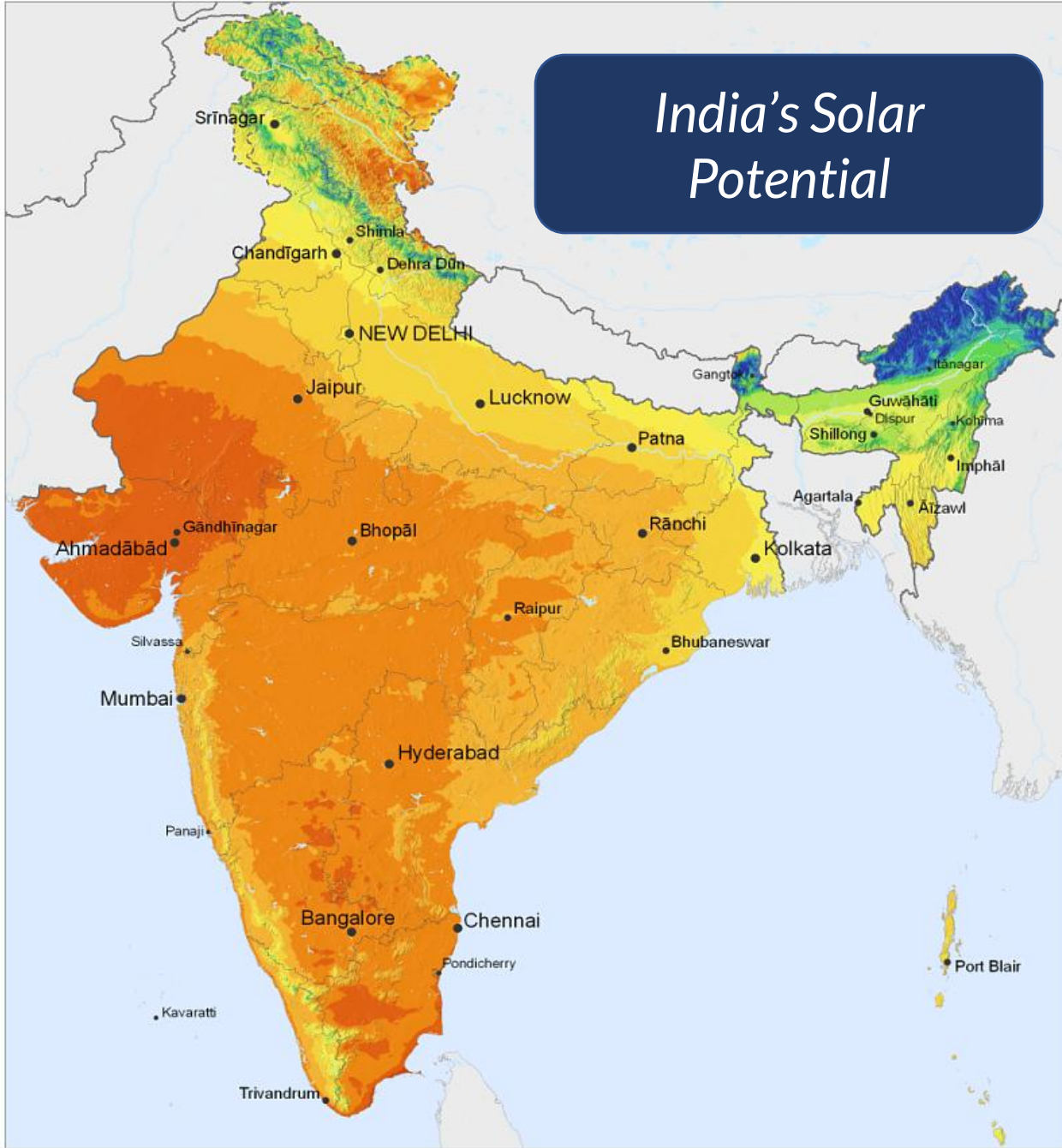
# India's Groundwater Economy



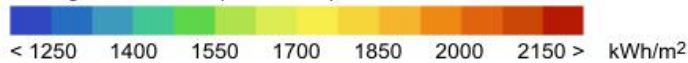
## Groundwater Over-Exploitation & Depletion



# India's Solar Potential



Average annual sum (2005-2010)



0 100 200 km

300 km

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# Solar Pump Promotion

75% capital subsidy  
[yet, few takers!]

87% capital subsidy  
[later cut to 70%]

90% capital subsidy  
[15 MWp capacity]

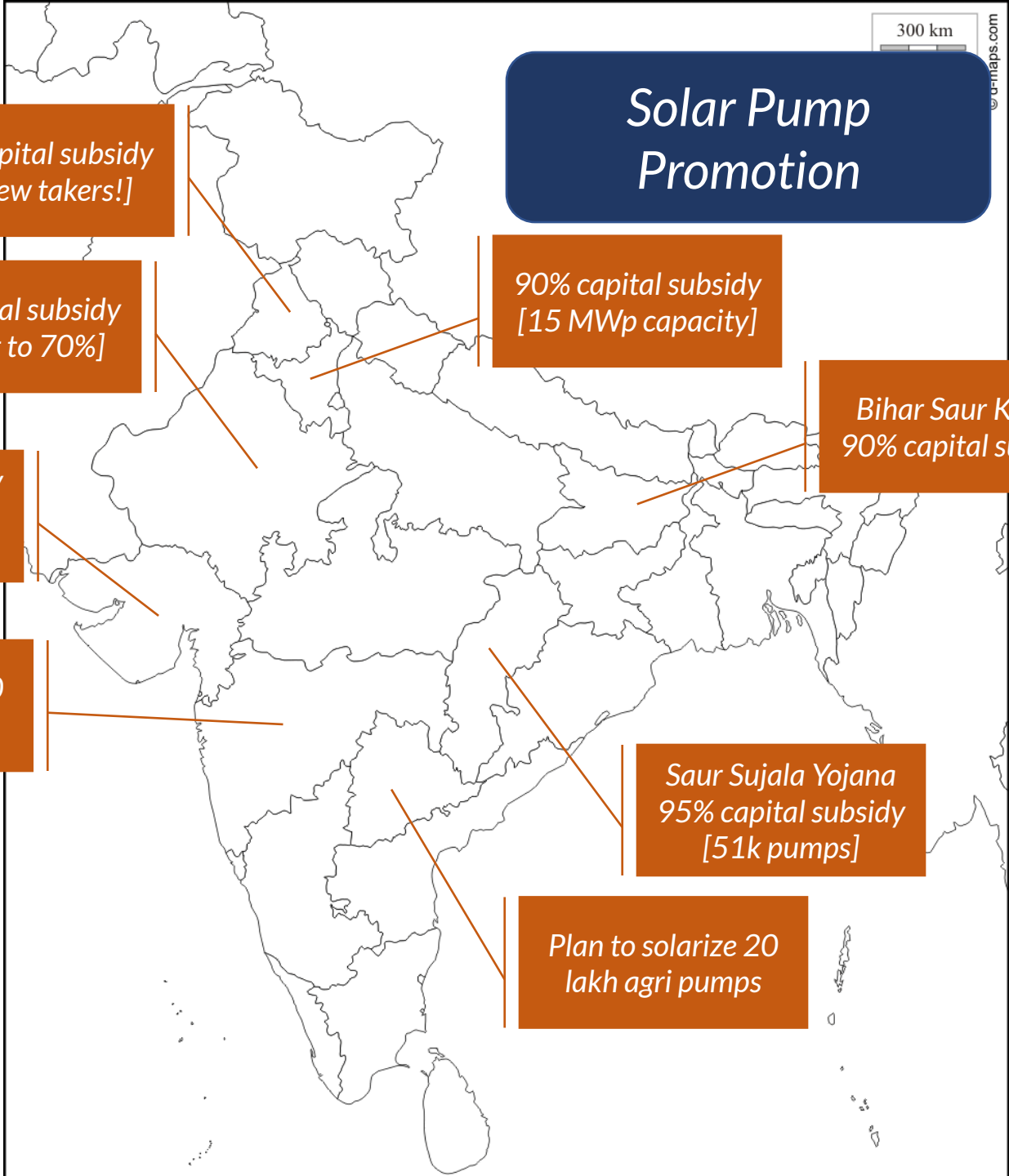
Bihar Saur Kranti  
90% capital subsidy

95% capital subsidy  
for farmers waiting  
for electric conn.

Plan to solarize 50  
lakh agri pumps

Saur Sujala Yojana  
95% capital subsidy  
[51k pumps]

Plan to solarize 20  
lakh agri pumps



# Invidious Energy-Irrigation Nexus

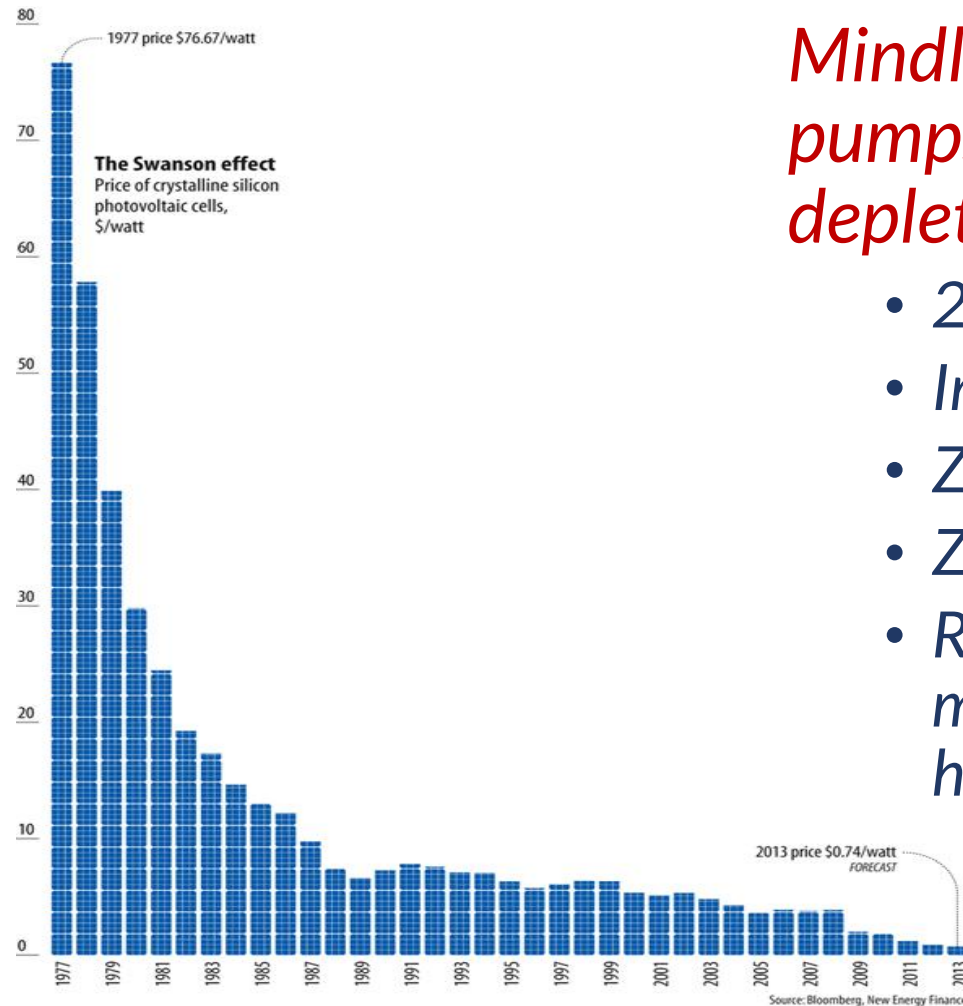
- *Free power and groundwater depletion*
  - *Zero marginal cost => inefficient use*
- *Farmers vehemently oppose metering / tariffs*
- *Bankrupt utilities / gradual de-electrification*
- *Farmers treated as liability*
  - *4-6 hours farm power per day*
  - *Poor quality, disruptions, unreliable*
  - *Night-time supply, auto-switches => more wastage*
  - *High T&D and commercial losses*
  - *Feeder-level anarchy*
  - *Domestic users and rural Industries also suffer*



# Solar Pumps: Opportunity or Threat...?

- IWMI's 'intelligent power rationing' argument
  - Matching farm power supply to water demand
  - Gujarat's acclaimed 'Jyotigram Yojana'
    - Feeder separation
    - 24\*7 power supply to villages
    - Rationed but high quality supply to farmers
    - Strictly enforced, pre-announced supply schedule
    - Contracting water markets; higher prices
    - New connections to SC/ST/marginal farmers
  - Efforts to replicate JGY in other states
- **Solar pumps can undo all of this in no time...!!**

# Solar Pumps: Opportunity or Threat...?



*Mindless promotion of off-grid solar pumps will accelerate groundwater depletion like never before...*

- 2200-2500 hrs of day-time power
- Impossible to ration supply
- Zero marginal cost
- Zero opportunity cost
- Rapidly declining PV prices will mean soon farmers will not even have to rely on capital subsidies...

# Solar Power as Remunerable Crop (SPaRC)

## Current Solar Pump Strategy

SIPs are promoted by capital cost subsidy of 80-90%

SIP owners have no power purchase guarantee or FiT

Solar power complements grid power

Farmer remains net buyer of grid power

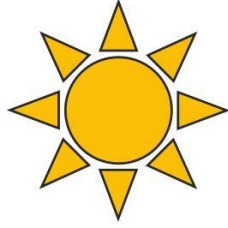
## SPaRC Strategy

Capital cost subsidy on SIP's should be around Rs 40,000/kW

SIP owners should be grid connected, have power purchase guarantee at Rs 6-8/kWh

Surrender of grid connection or (real or virtual) net metering; so SIP replaces grid connection

Farmer becomes net seller of power to the grid



**IWMI-TATA**  
Water Policy Program

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વિશ્વની પ્રથમ સૌર ઊર્જા પંપ સિંચાઈકાર સહકારી મંડળી

**Dhundi Saur Urja Utpadak Sahakari Mandali**  
*World's First Solar Pump Irrigators Cooperative*



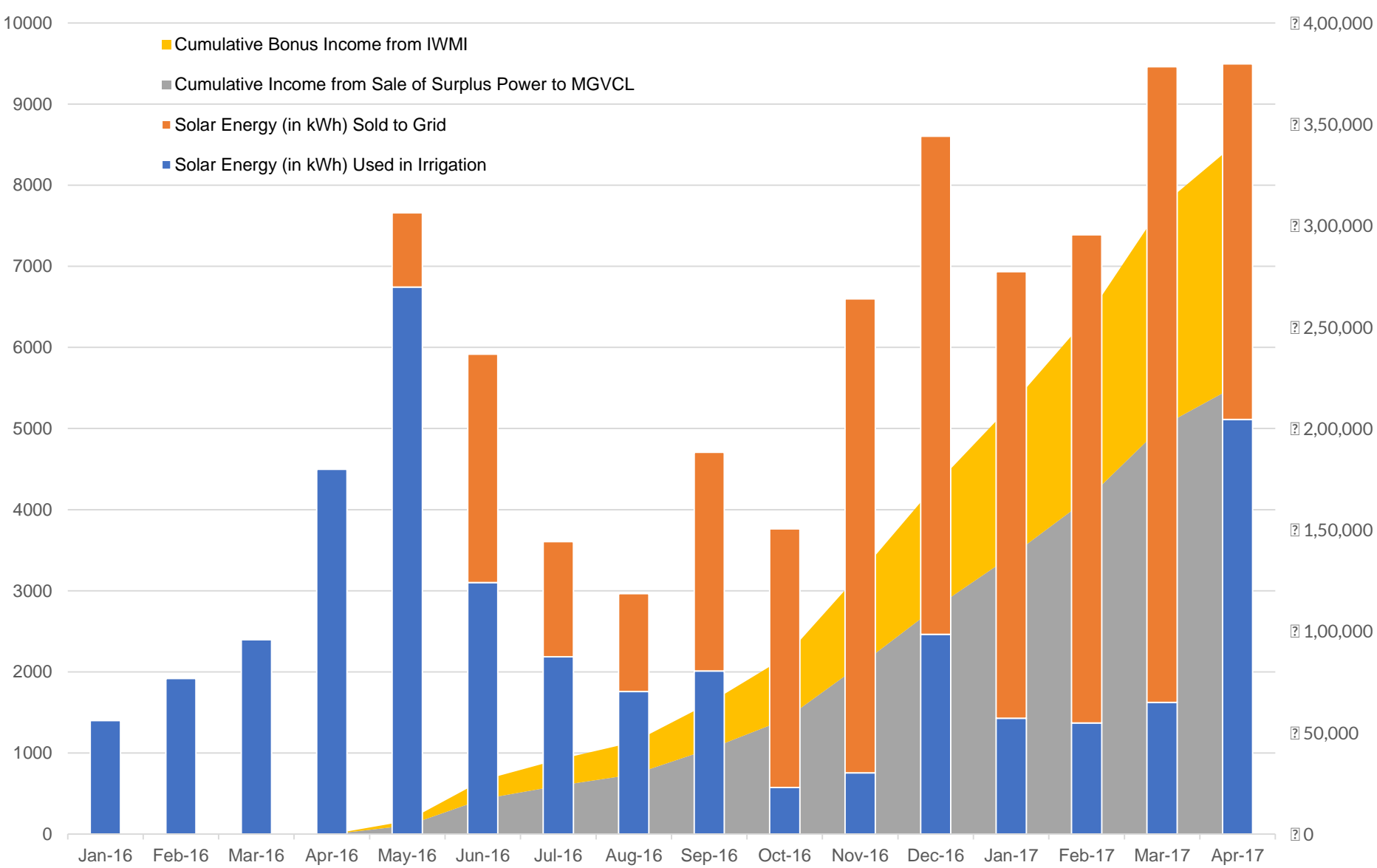
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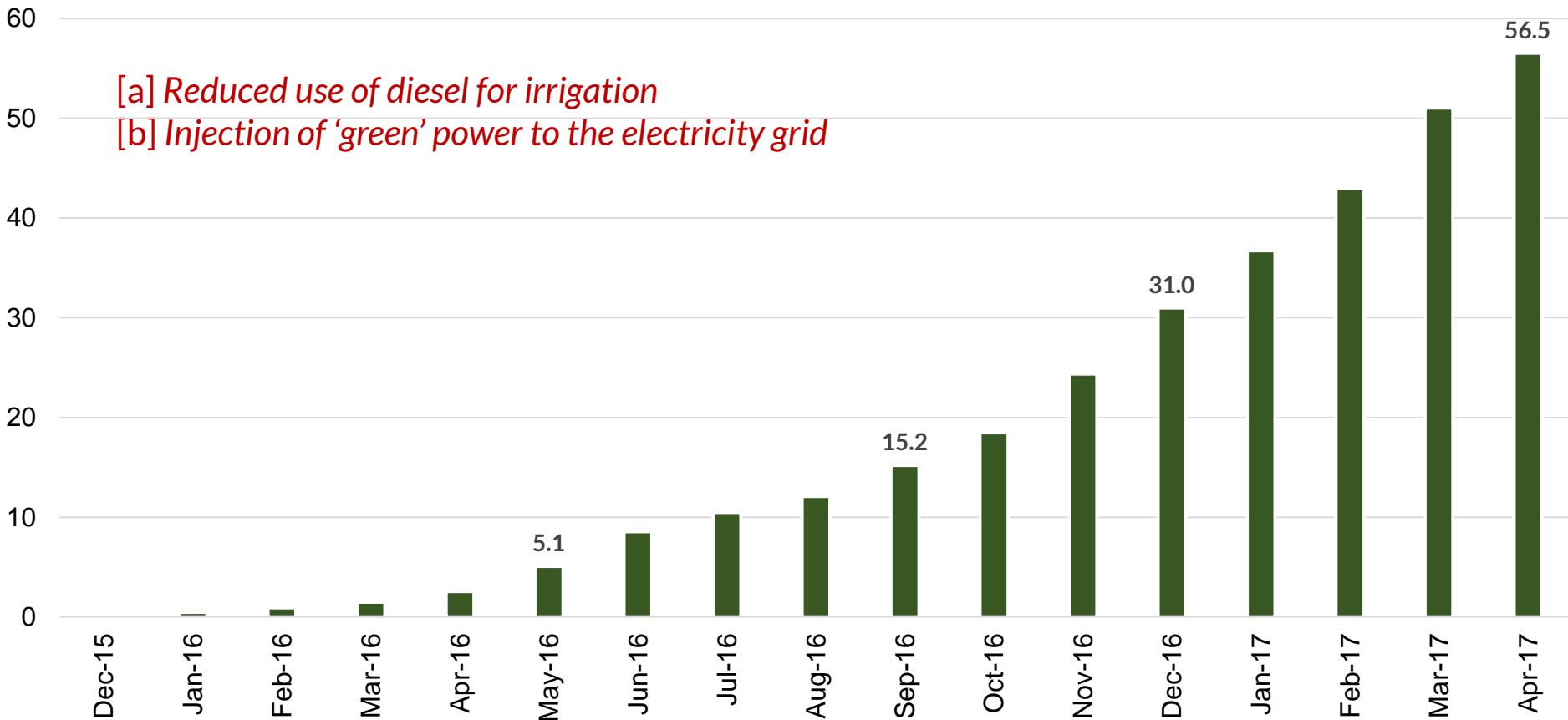


Complex Issues	SPICE	Dhundi Experiment
<p><b>Deadweight of electricity subsidies:</b> US\$ 30 billion/year</p>	<p>Replacing every GWh through SPICE way reduces subsidy burden by US\$ 85000/year.</p>	<p>Local power utility MGVCL saved US\$ 10,000 upfront and future subsidy of US \$ 58,500.</p>
<p><b>Poor quality and nightly power supply to agriculture</b></p>	<p>Solar energy is more reliable than grid power</p>	<p>Not just farmers but the neighbours of the solar farmers are very satisfied since they get reliable day time irrigation.</p>
<p><b>Perverse incentives driving groundwater depletion in western India</b></p>	<p>Power buy back – powerful incentive to economise pumping</p>	<p>~48,000 units sold to grid, avoided groundwater draft of nearly 200k m<sup>3</sup></p>
<p><b>Carbon footprint of groundwater irrigation</b></p>	<p>No direct carbon footprint</p>	<p>Avoided 56.5 tonne of CO<sub>2</sub> emissions by replacing diesel and adding green energy to the grid</p>
<p><b>Stagnant Income from farming</b></p>	<p>Farmers earn additional climate proof income from selling electricity</p>	<p>Dhundi Coop. has earned more than US\$ 5,000 in the last 12 months of operation by selling to the grid</p>



# Impact of Dhundi Cooperative...

Cumulative GHG Reduction (Tons CO<sub>2</sub>)



**1.5 bn unit**  
of green power

**₹ 375 Cr**  
of additional income

**1.23 mn tonnes**  
of CO<sub>2</sub> reduction

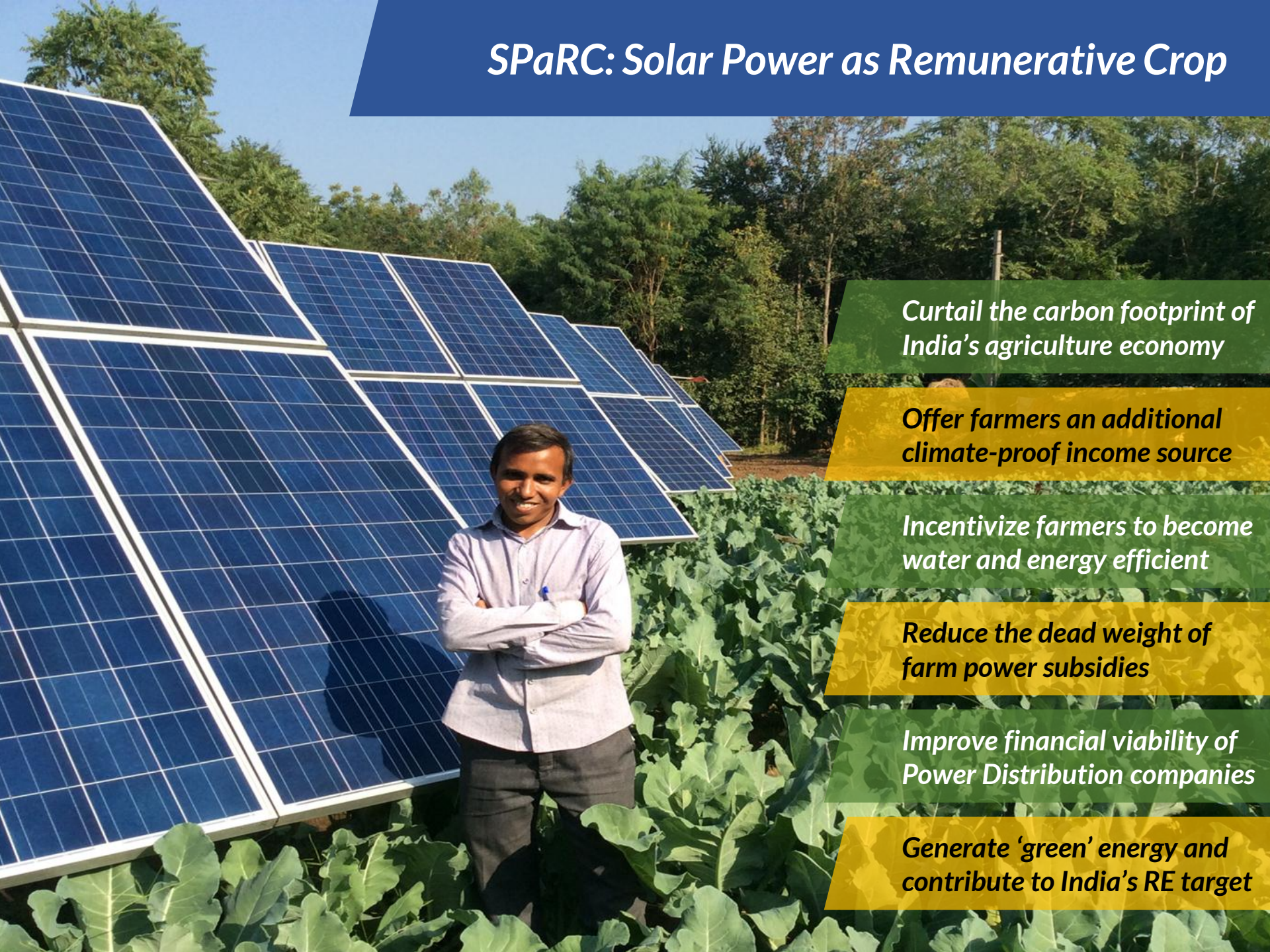
Solarising  
**1GW**  
through SPICE

**1.7 BCM**  
draft avoidance

**₹ 443 Cr**  
saving in subsidy



# *SPaRC: Solar Power as Remunerative Crop*



*Curtail the carbon footprint of India's agriculture economy*

*Offer farmers an additional climate-proof income source*

*Incentivize farmers to become water and energy efficient*

*Reduce the dead weight of farm power subsidies*

*Improve financial viability of Power Distribution companies*

*Generate 'green' energy and contribute to India's RE target*



# Thank You...

## Shilp Verma

IWMI-Tata Water Policy Program

<http://iwmi-tata.blogspot.in>



