



IMPACT OF TWO SCHEMES ON WATER, ENERGY AND FOOD NEXUS: EXAMPLES FROM INDIA

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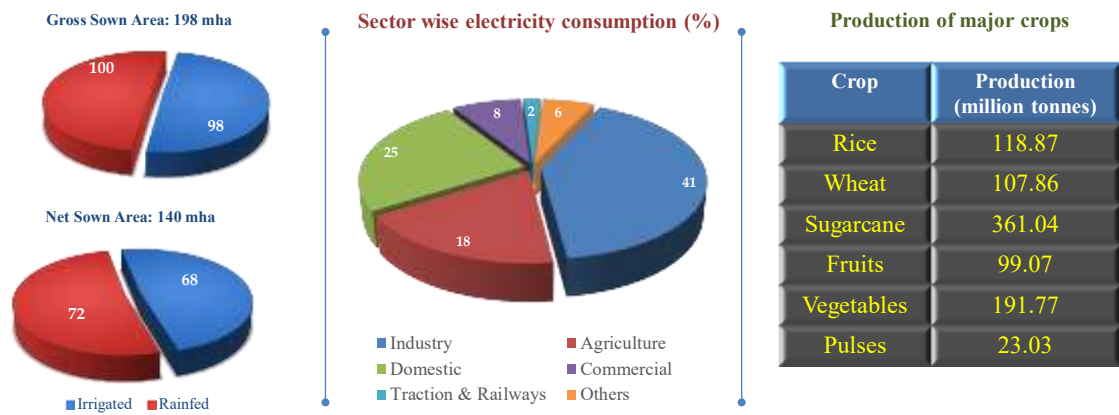
IMPACT OF TWO SCHEMES ON WATER, ENERGY AND FOOD NEXUS: EXAMPLES FROM INDIA

How the Prime Minister’s Irrigation Scheme (PMKSY), and the Prime Minister’s Scheme for Energy Security & Upliftment of Farmers (PM-KUSUM) helped India to increase its agriculture production, and to reduce electricity consumption.





Indian Scenario: Irrigation-Electricity-Agri Produce

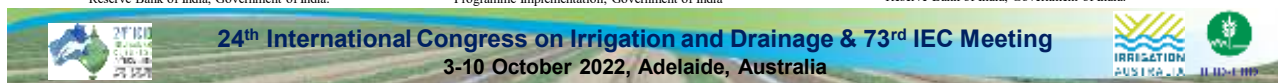


Source: Handbook of Statistics on Indian States 2020-21, Reserve Bank of India, Government of India.

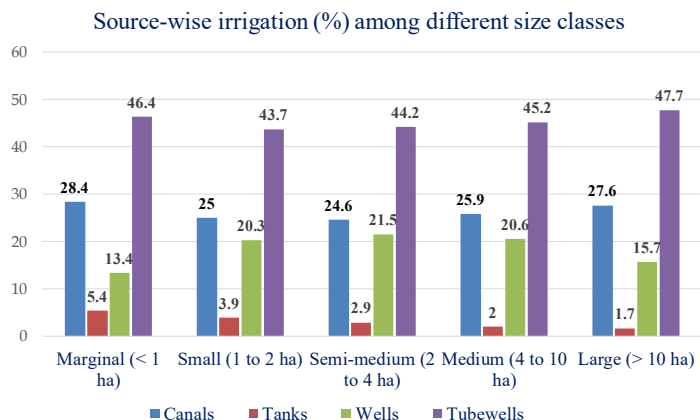
Source: Energy Statistics India-2021, Ministry of Statistics and Programme Implementation; Government of India

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Contribution of various sources in irrigation in India

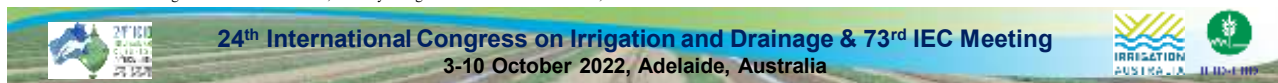


The contribution of groundwater based sources (Tube-wells and wells) is from 59.8% to 65.7%, across various land sizes.

In each land class, 6% to 7% of irrigation is met from other sources

Source: Agriculture Statistics – 2021; Ministry of Agriculture and Farmers Welfare; Government of India

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Reliance on groundwater in India



Groundwater extraction: 245 billion cum.

- 61.6% of annual groundwater recharge



In 16% of the geographical area, extraction is more than the annual recharge.



Wells & tube wells based area increased tremendously

- From 29% in 1950-51 to 63% as of now.

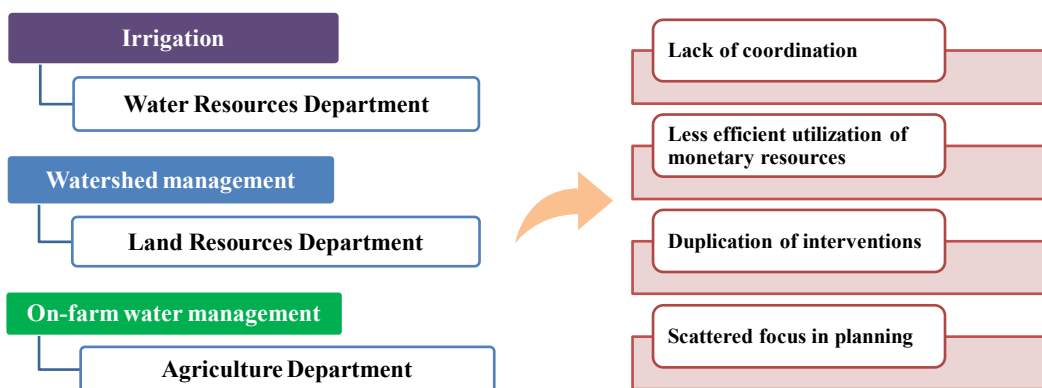


Subsidized tariffs and incentives promoted deep tube well

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Single Resource: Multiple Agencies



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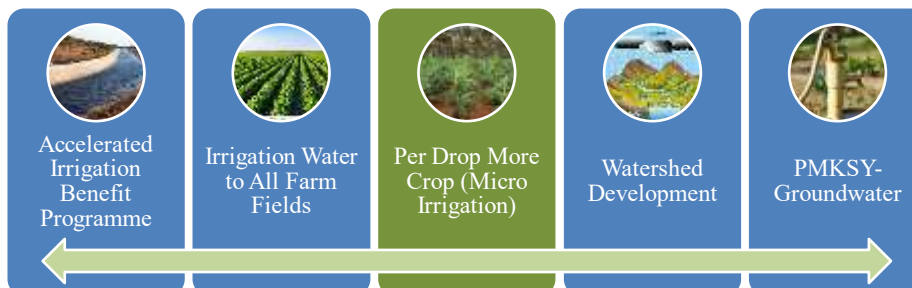


PMKSY: Prime Minister's Irrigation Scheme

(Pradhan Mantri Krishi Sinchayee Yojana)



An umbrella scheme amalgamating all relevant components, launched in 2015



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PM-KUSUM: Prime Minister's Scheme for Energy Security & Upliftment of Farmers

Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan



- ❑ Launched in 2019
- ❑ Aimed at ensuring energy security for farmers in India
- ❑ To increase the share of installed capacity of electric power from non-fossil-fuel sources
- ❑ Additional income to farmers by selling the solar power to power distribution companies (DISCOMs)

Three components

- A** Setting up of 10,000 MW of Decentralized Grid Connected Renewable Energy Power Plants on barren land
- B** Installation of 17.50 Lakh stand-alone solar agriculture pumps
- C** Solarization of 10 Lakh Grid Connected Agriculture Pumps.

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Impacts of interventions

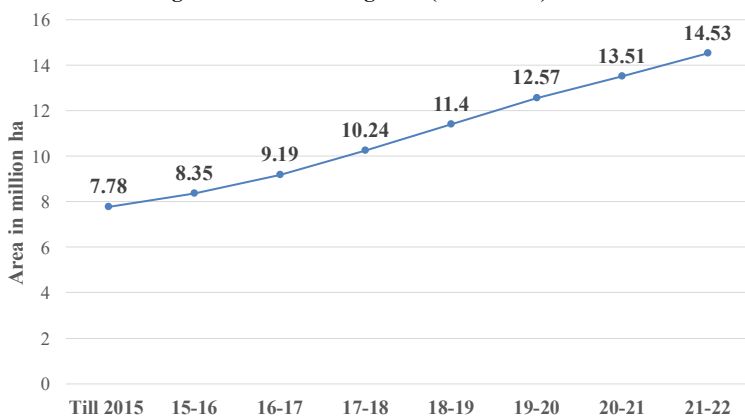
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Growth of micro irrigation, post PMKSY



Area brought under micro irrigation (cumulative) in million ha



6.75 million ha area brought under micro irrigation in the seven years since 2015.



Source: Ministry of Agriculture and Farmers Welfare; Government of India

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Progress of PM-KUSUM

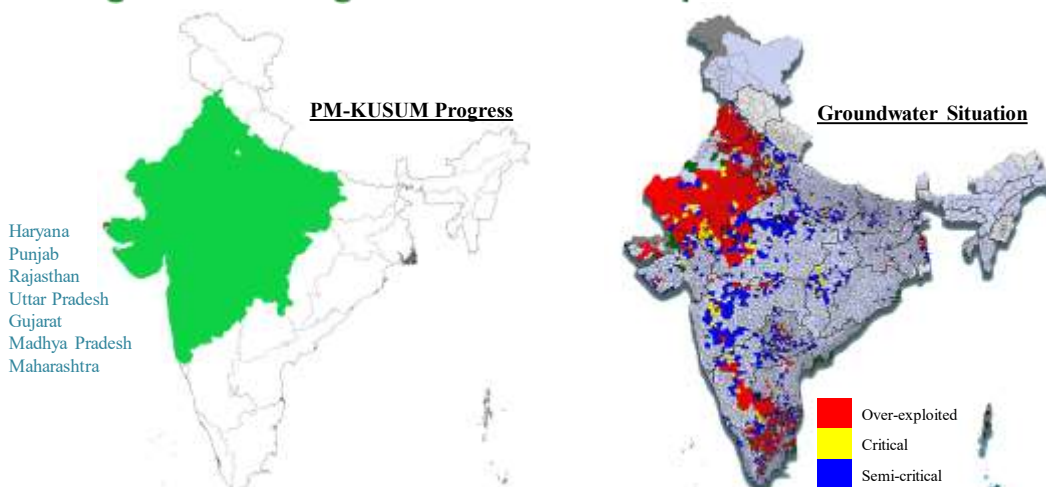
Component	Final Target	Total sanctioned so far
A Decentralized Grid Connected Plants	10000 MW	4886 MW
B Stand-alone Solar Agriculture Pumps	1.75 million pumps	0.81 million pumps
C Grid Connected Agriculture Pumps	1.0 million pumps	0.15 million pumps

Source: PM-KUSUM Dashboard, Ministry of New and Renewable Energy, Government of India; <https://pmkusum.mnre.gov.in>

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Regions leading in PM-KUSUM implementation



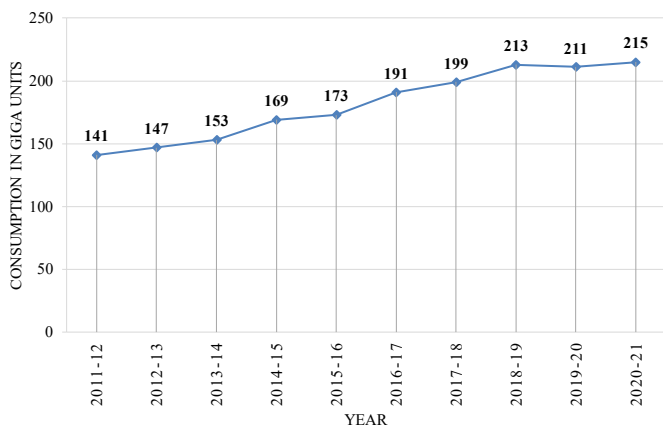
Source: PM-KUSUM Dashboard
<https://pmkusum.mnre.gov.in>

Source: Central Groundwater Board,
Government of India.

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Electricity consumption by agriculture sector



Trend has started flattening, post 2018-19



Source: Energy Statistics India-2021, Ministry of Statistics and Programme Implementation; Government of India

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Plausible reasons → Flattening electricity usage



Benefit of additional micro irrigation area of 6.75 million ha

At most: 16.9 BCM water and 23.5 Giga Units (23475 GWh) electricity.

At least: 10.1 BCM water and 6 Giga Units (6000 GWh)

Assumptions:

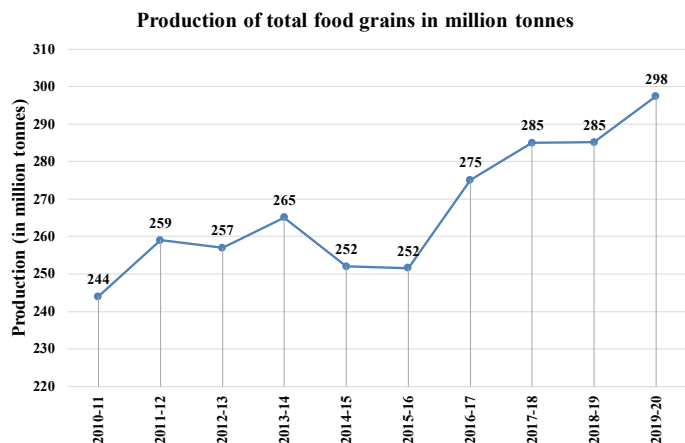
- * 30% to 50% saving in water
- ** Head varies from 25 m to 160 m
- *** Discharge of a 25 stage 5 HP pump in 4 inch dia bore well considered. (2.7 to 6.3 cum/hr)

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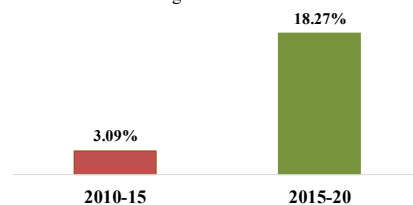


Rise in production of total food grains



An increase of 46 million tonnes in 5 years (2015-16 to 2019-20)

Half-decadal growth in production of food grains in %

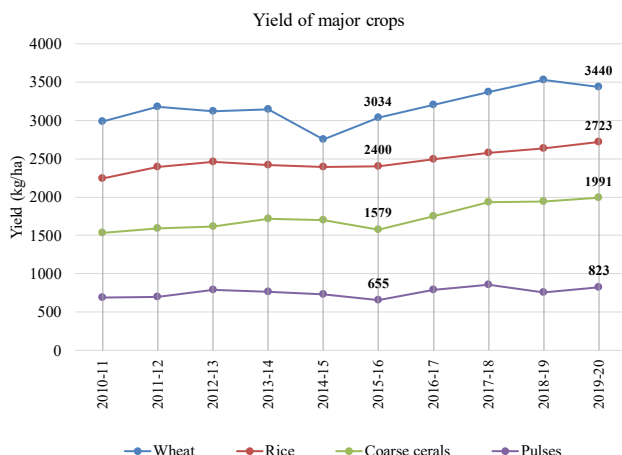


Source: Handbook of Statistics on Indian States 2020-21, Reserve Bank of India, Government of India.

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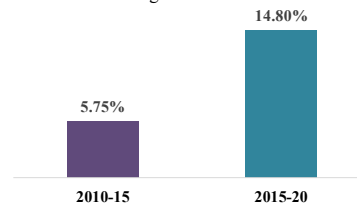
24th International Congress on Irrigation and Drainage & 73rd IEC Meeting
3-10 October 2022, Adelaide, Australia

Impact on yield of major crops



Average yield of total food grains increased by more than 300 kg/ha in the five years past 2015-16

Half-decadal growth of yield of food grains in %



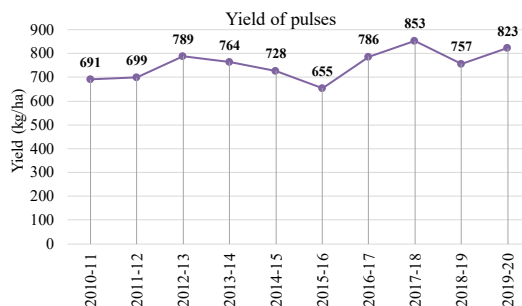
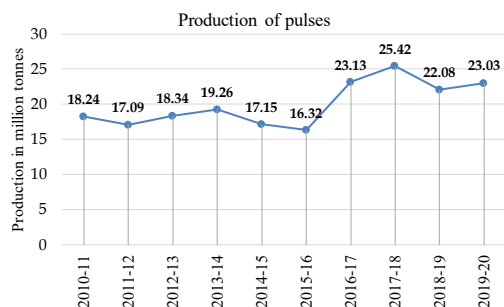
Source: Handbook of Statistics on Indian States 2020-21, Reserve Bank of India, Government of India.

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Role of irrigation coverage



Area under pulses

Total: 20.59 mha

Irrigated: 4.38 mha

Un-irrigated: 16.21 mha

Irrigation Coverage: 21%

Yield and production of pulses have been following more or less similar trends before and after the introduction of PMKSY.

This reinforces the argument that PMKSY influenced the increase in yield and production of the crops which are significantly covered by canal irrigation.

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Conclusions



- 💡 The PMKSY scheme could bring visible improvement in the water-energy-food nexus by increasing yield and production of crops under canal irrigation.
- 💡 The Per Drop More Crop (PDMC) component of the PMKSY helped to save a considerable volume of water, and a significant quantity of electricity.
- 💡 The PM-KUSUM scheme, which is in its initial years of implementation, has been positively contributing to the gain of nexus in high ground water extracting regions.
- 💡 The combined effect of PMKSY and PM-KUSUM contributed to the flattening of the electricity consumption trend in 2019-20 and 2020-21, which was on a rising trajectory.

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Thank You

Photo shot in a small river in a State in the west coast of southern India named "Kerala", which means "the Land of Coconut Trees."



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