

# An Indian Perspective on W-E-F Nexus for Sustainability

**S.K. Ambast**

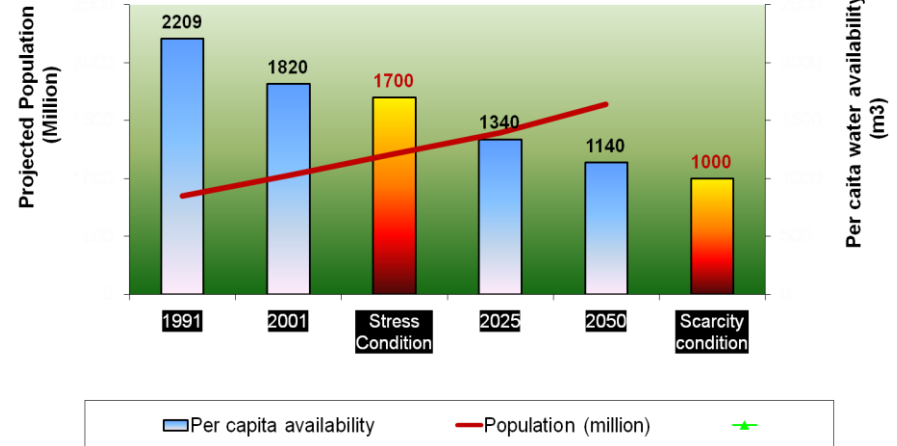
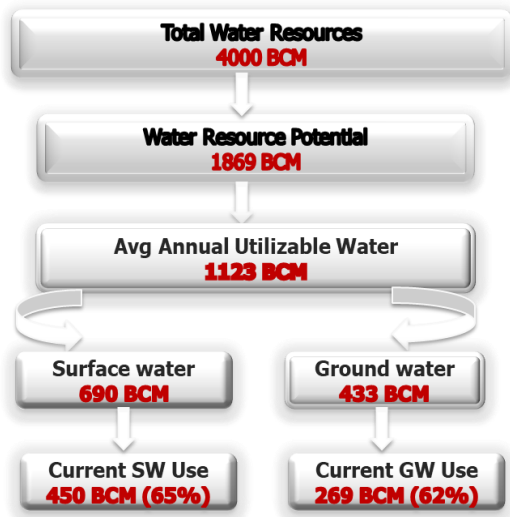
(Ex-Director, ICAR-IIWM; PS & JD Edn Act, ICAR-NIBSM)  
(skambast65@gmail.com)



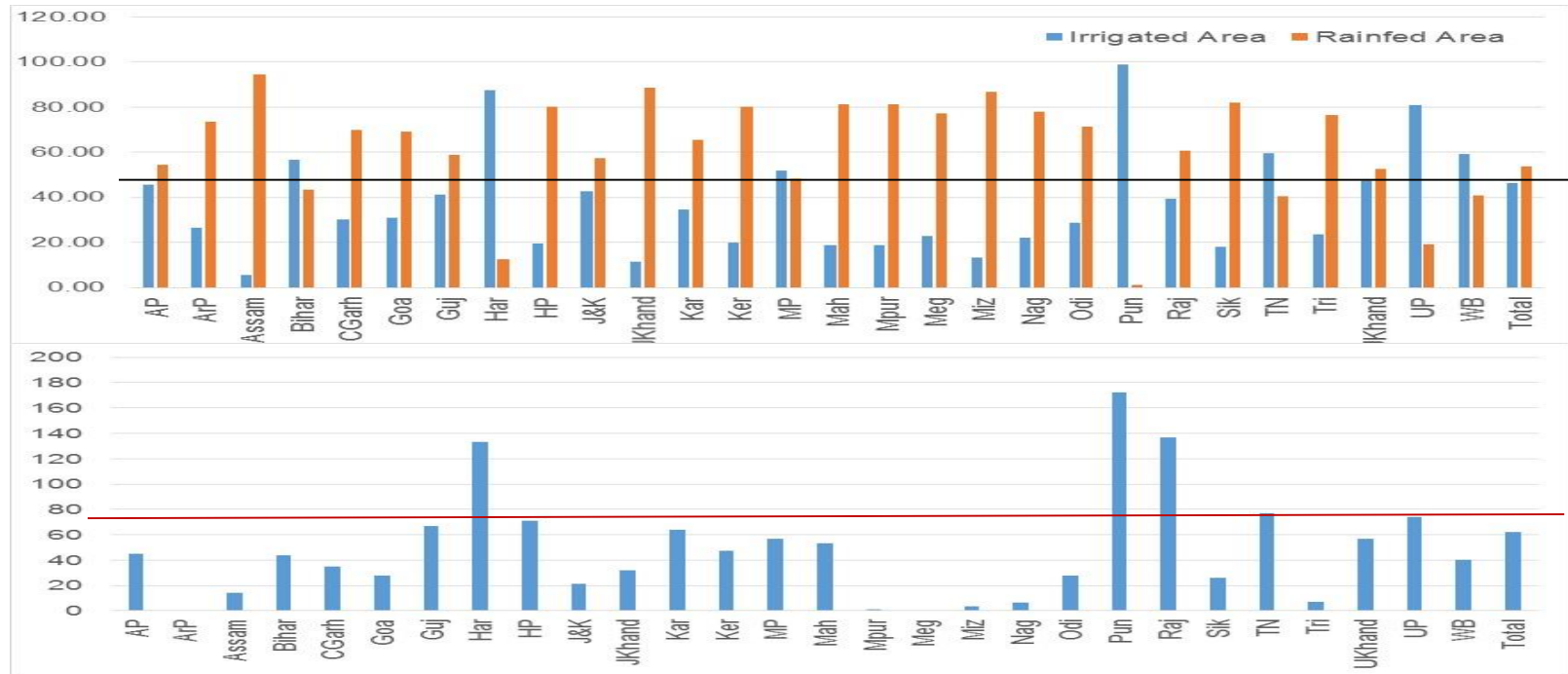
**Indian Council of Agricultural Research  
DARE, MoA&FW (GoI), India**



# Indian Scenario on Water

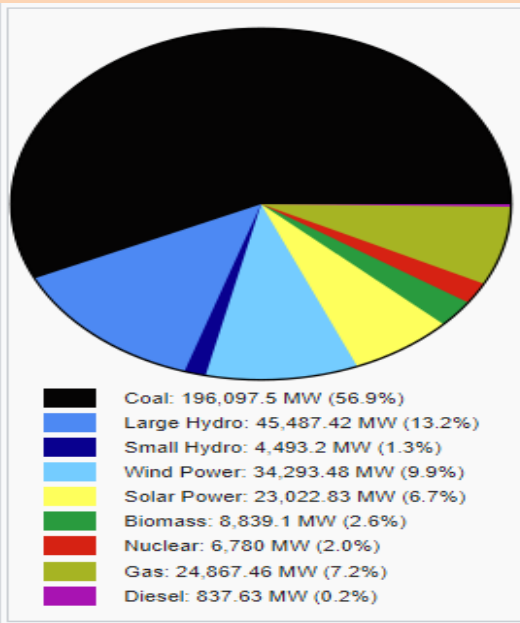


Surface Water



Use of 65% surface water and 62% of groundwater; Stressed condition;

# Indian Scenario on Energy



Total 344 GW

(Thermal-223; Nuclear-6.7; Hydro-45.3; RE incl. Solar-69)

RE potential of 900 GW

(W - 105; SHy – 20, BE – 25 & SE - 750)

In addition, solar energy potential - 1 GW / 2400 ha);

GoI - RE 175 GW by 2022

(SE - 100, WE - 60, S Hy - 10 & BE - 5)

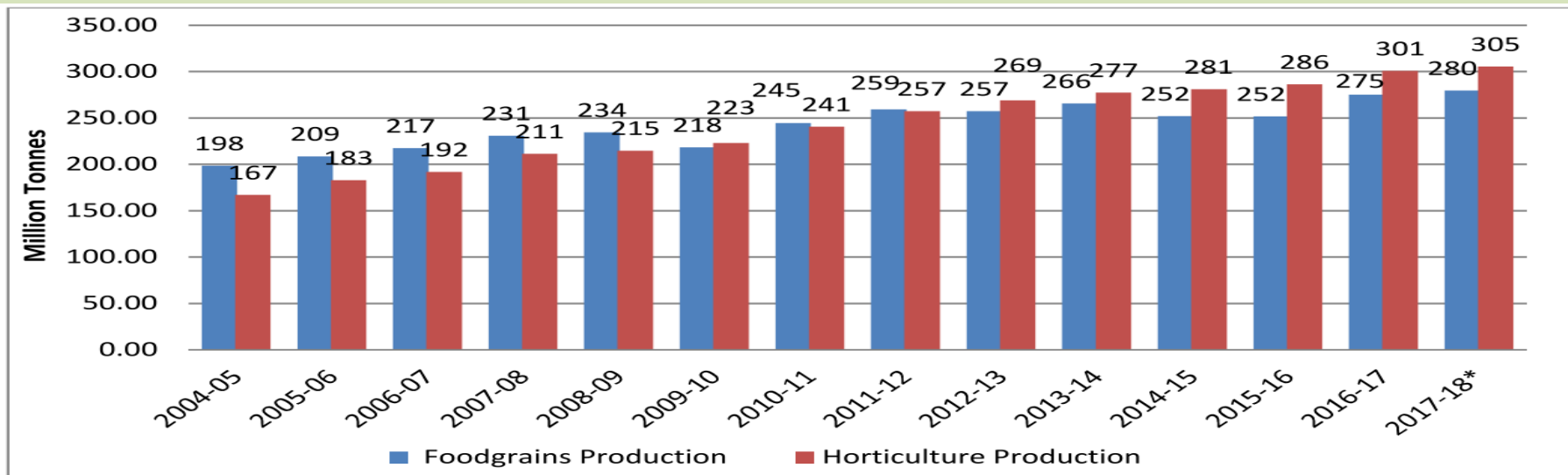
Installed Capacity (2020)	
Coal	205954.5
Gas	24991.51
Diesel	509.71
Nuclear	6780
Hydro	45699.22
Small HP	4712.17
Wind	37940.95
Bio	10085.49
Solar	35303.3
Total	371976.8
(Source: NPP)	



Attained 63% energy self sufficiency (2017)

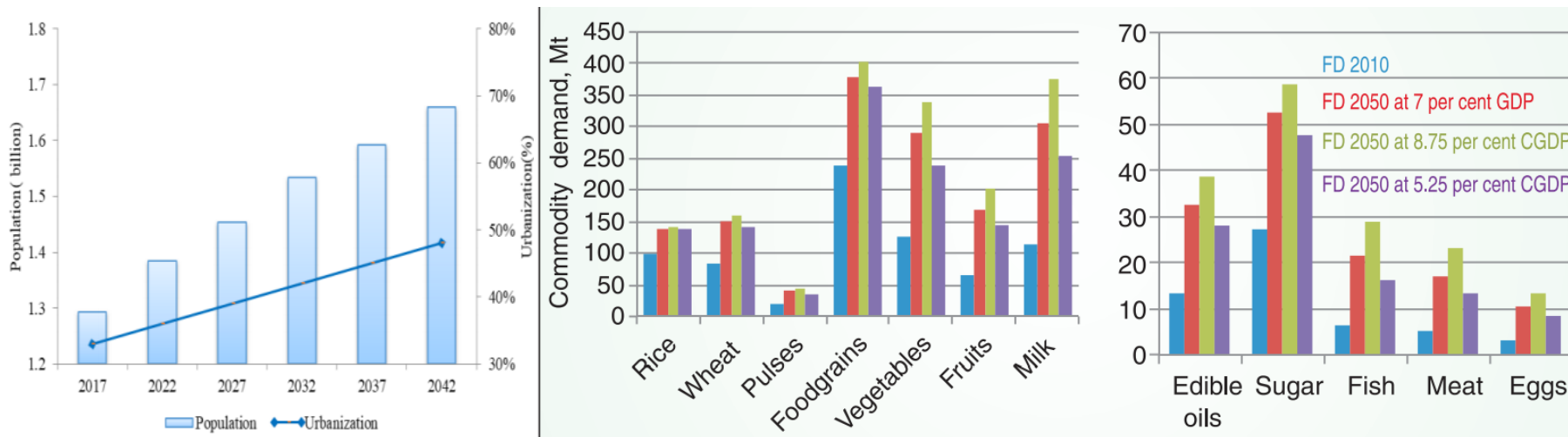
Targeted 175 GW renewable energy including 100 GW solar energy by 2022

# Indian Scenario on Food Security



\* Based on Third Advance Est. for Foodgrains and First Advance Estimates for Horticulture

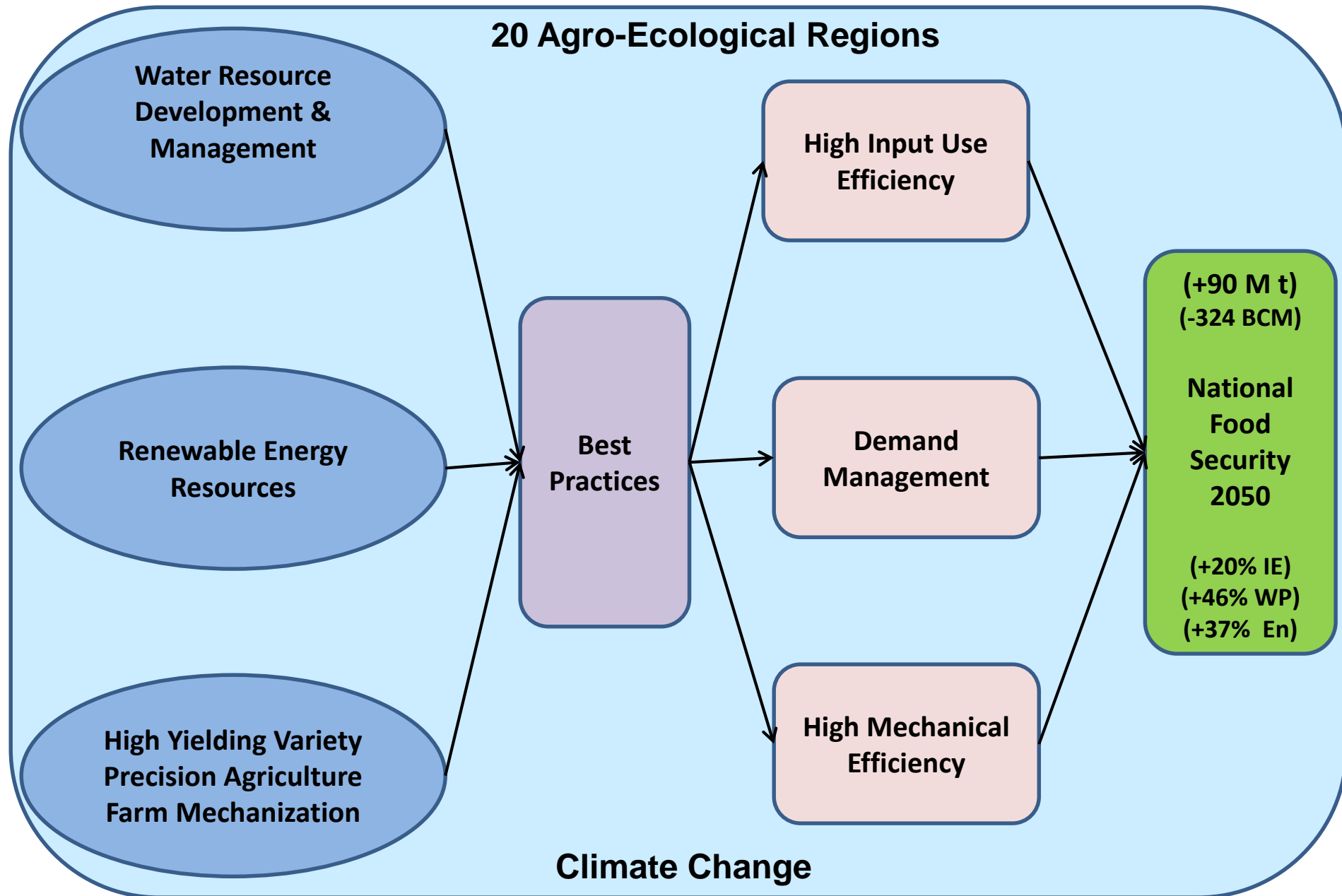
Source: Directorate of Economics and Statistics, DAC&FW



(Source: ICAR, 2015)

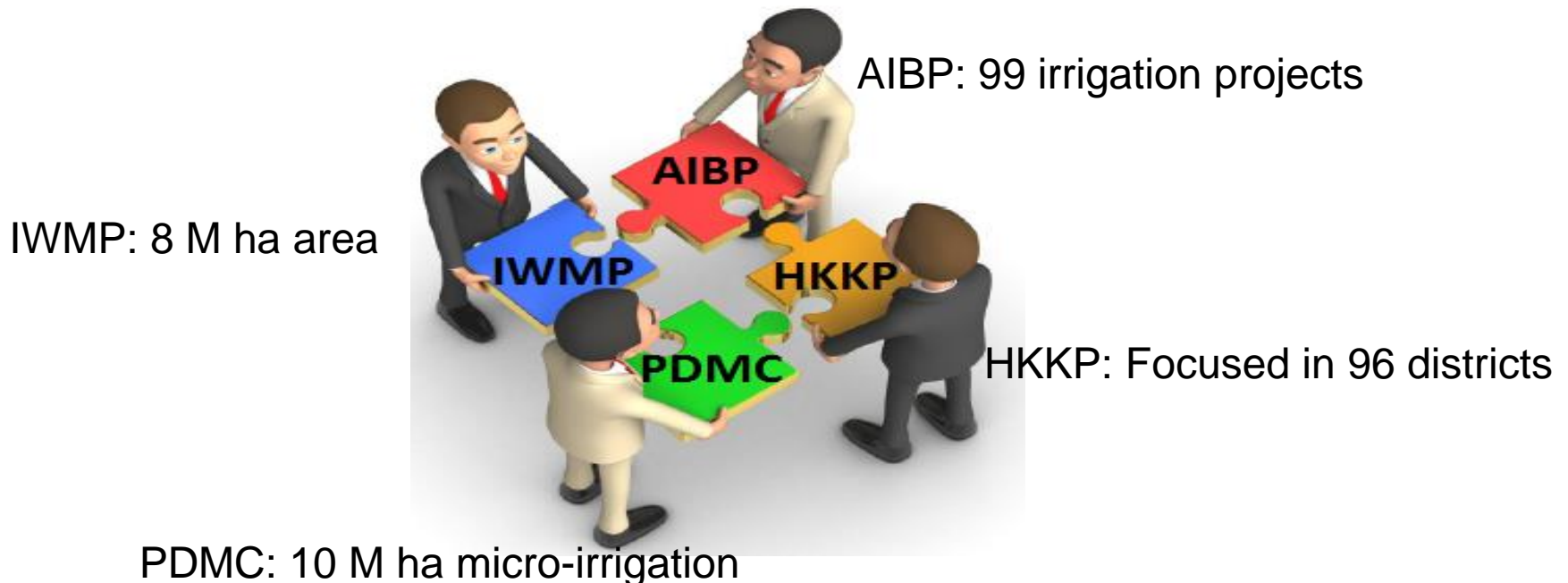
Increase in food grain (41%) and horticultural crop production (82 %)

# Water, Energy & Food Security: Challenges By 2050



# Agricultural Water for Sustainability

- 33% of rainfed area receives rainfall < 750 mm
- 35-40% irrigation efficiency in canal systems
- 62% GW development provides scope for expansion whereas overexploited area require immediate attention
- 62 & 30 BCM domestic & industrial WW by 2050, 31% is treated

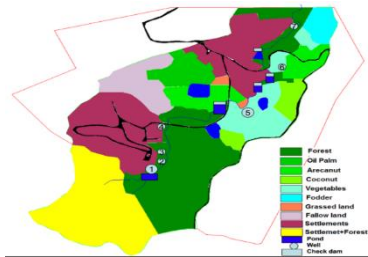


Policy Intervention: Prime Ministers Krishi Sinchai Yojna (PMKSY)

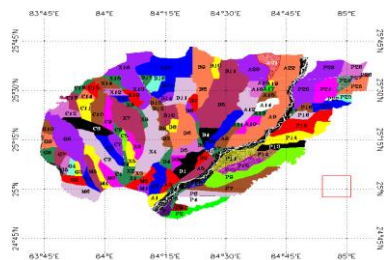


# BMP on Agricultural Water for Sustainability

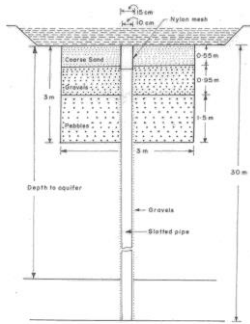
## Rain Water use



## Canal water use



## Ground Water use

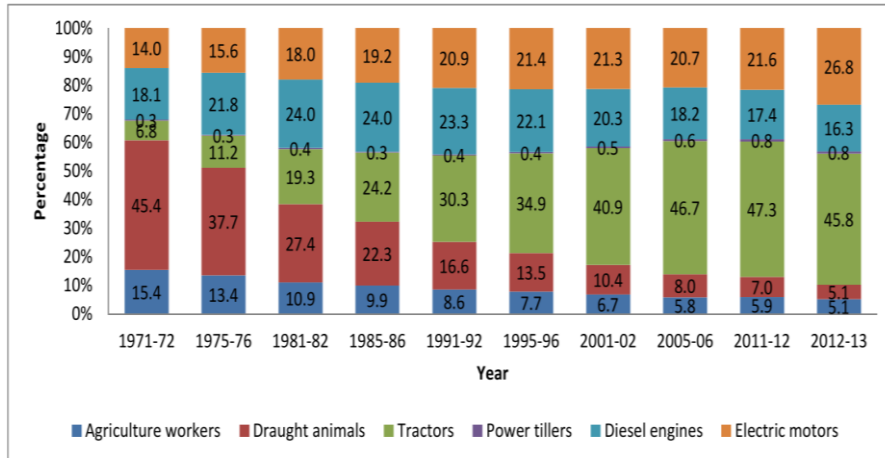


## Waste water use





# BMP (Agriculture, Water vs Energy)



Trends of agri mech in India (Source: CIAE, 2014)



**With 2,245 MW of Commissioned Solar Projects, World's Largest Solar Park is Now at Bhadla**

Ramthal Irrigation Project (24000 ha) Karnataka



Solar power based groundwater irrigation



Growing mechanization & precision irrigation lead to high energy demand



# BMP (Food Security)

Developed & released nearly 3,300 HYV/ hybrids of field crops

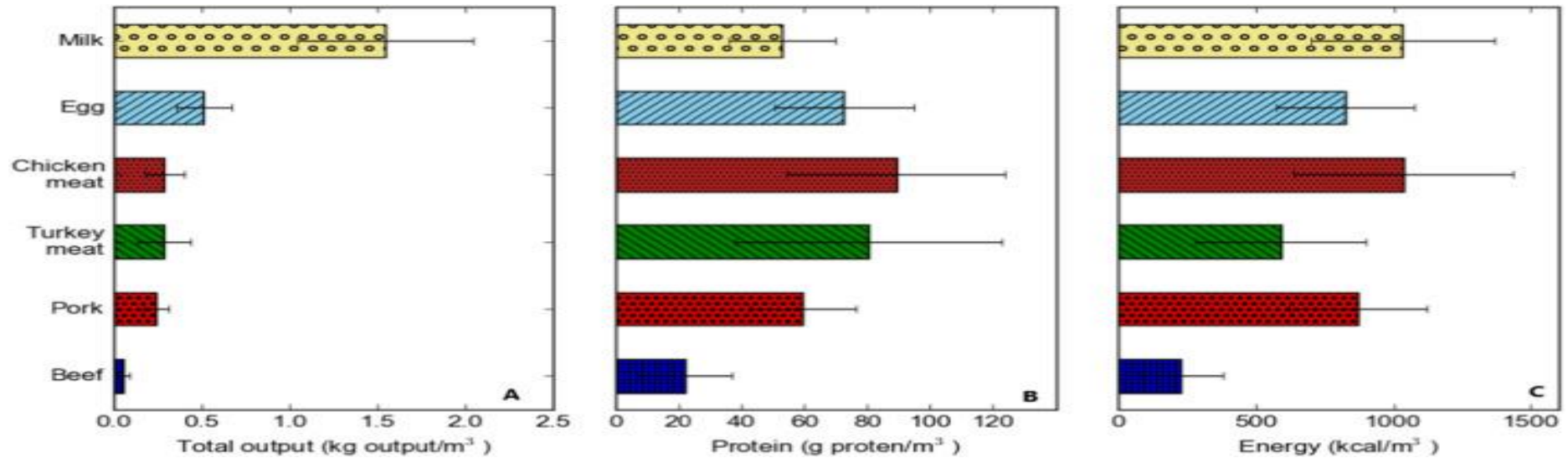


300 technologies of precision machinery for carrying out timely and efficient agricultural operations were commercialized/ licensed

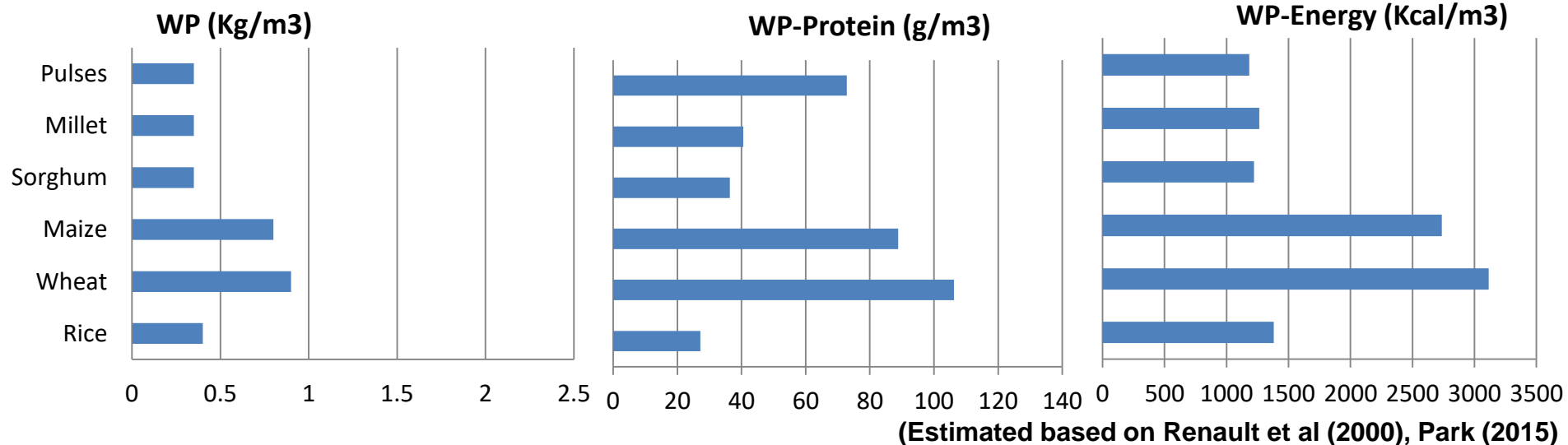
Sensor-based drip irrigation at 80%  $ET_c$  at 60 min interval 3 times daily could save 20% water compared with manually operated system in banana



# Demand Management by Change in Dietary Pattern



(Source: Mekonnen et al, 2019)



Increased cereals & pulses; reduced meat consumption

# Summary

- Water, energy & foodgrain demand is governed by population, socio-economic & urbanization/industrialization
- Increased food demand to 17 Mt by 2025 & 90 Mt by 2050
- Irrigation second most energy intensive input after tillage, requires more energy for precision irrigation
- Declining groundwater and wastewater treatment will add high energy requirement whereas increased efficiency and demand management will save it considerably
- BMP at policy and local levels will meet W-E-F challenges and associated issues of sustainability



**Thank You.**

---