India's Water-Energy-Food-Climate Nexus

Can strategic emerge out of the chaotic?

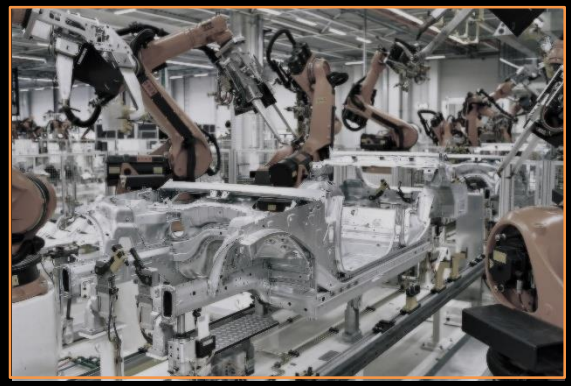
Dr Arunabha Ghosh
CEO
Council on Energy, Environment and Water

Innovation Strategies for Sustainable Development through WEF Nexus
UNESCAP APCTT, TISTR, MOST
Bangkok, 28 June 2017

CEEW: among the world's 20 best climate think-tanks

Energy Access

Renewables



Low-Carbon Pathways

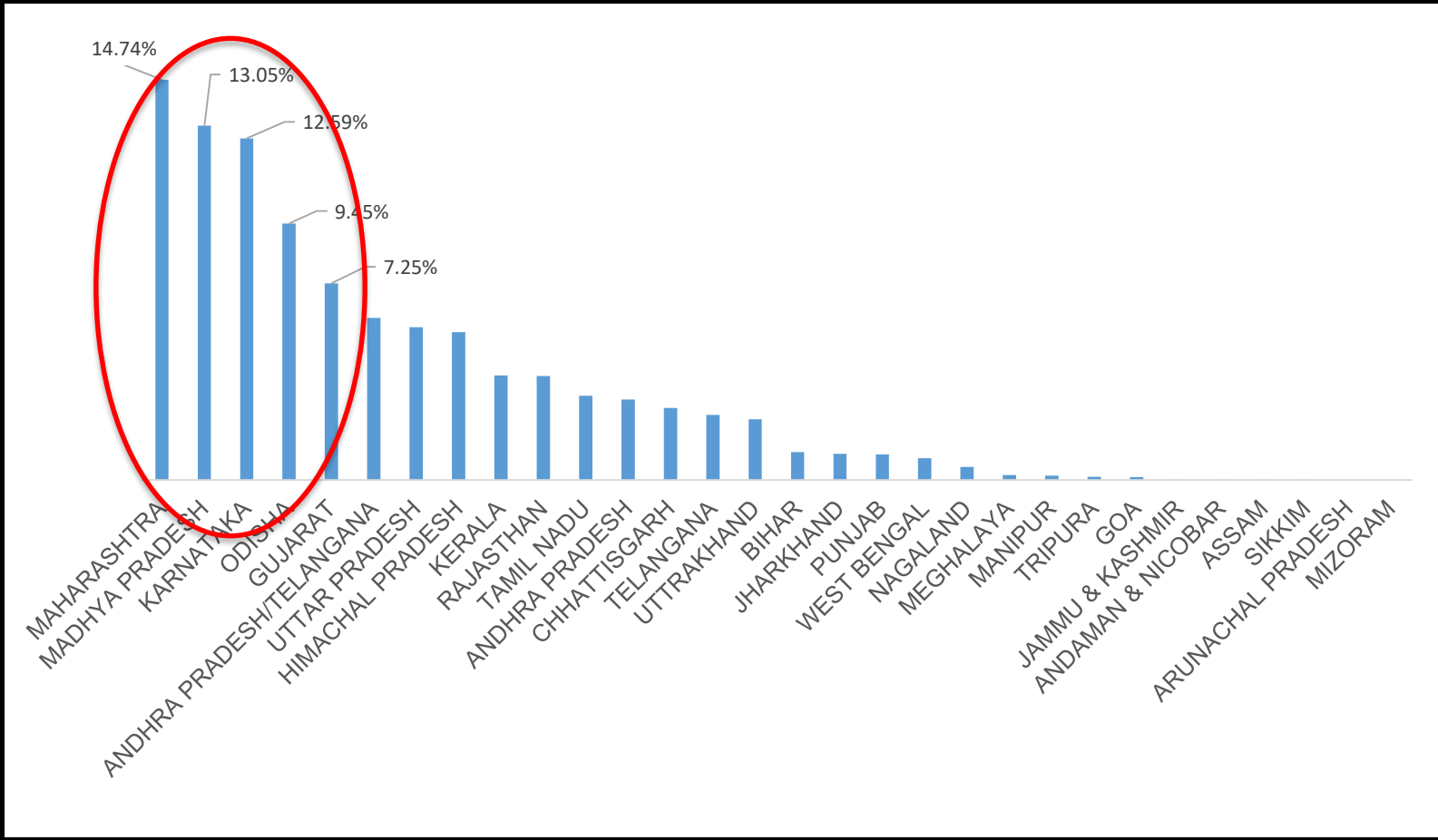
Greenhouse Gases and
Monitoring, Reporting, Verification

Risks and Adaptation

Technology, Trade & Finance

Innovations in institutions

Only five states with nearly 60% of reservoir storage capacity

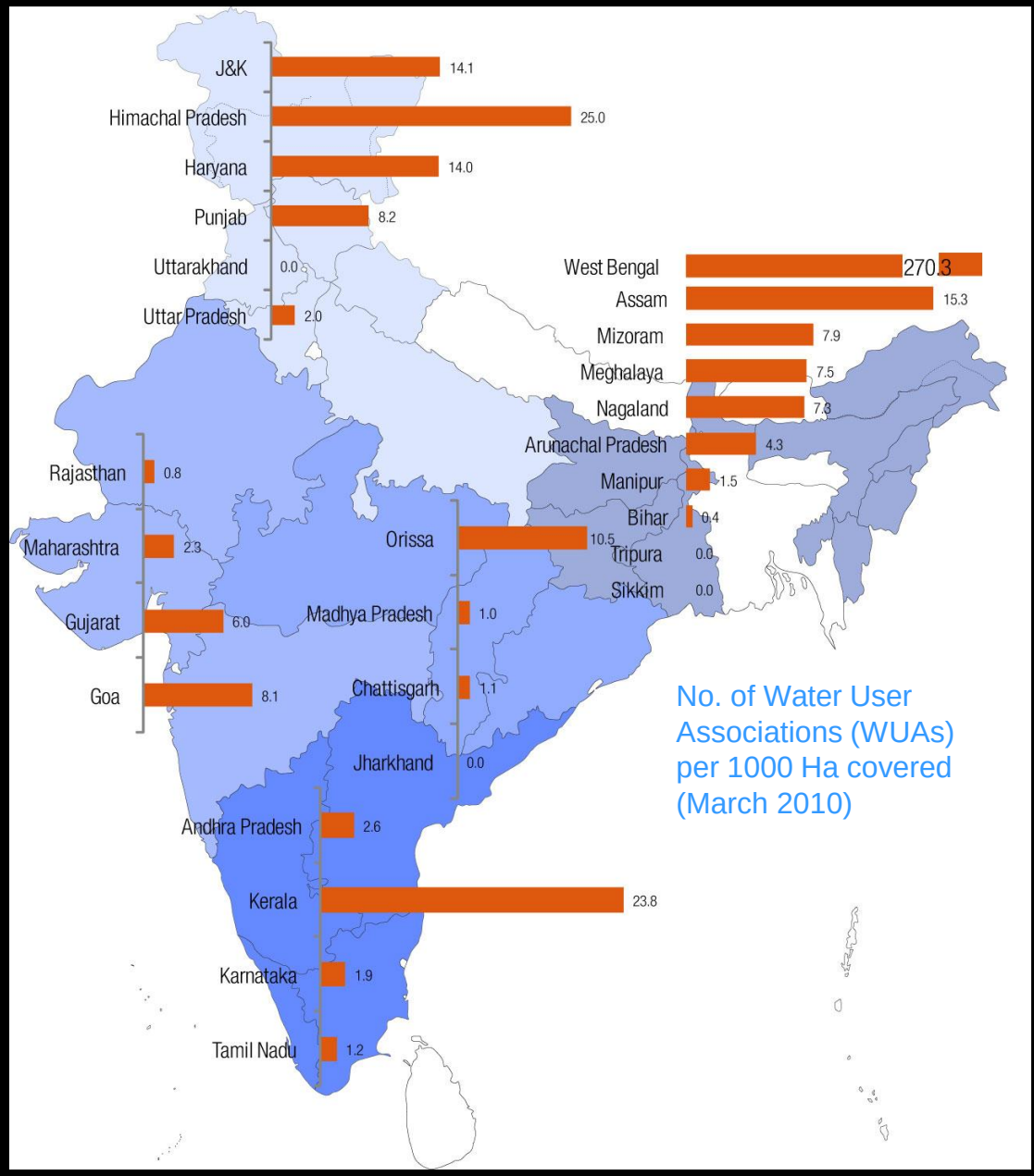


SOURCE: Adapted from CWC (2015)

Empowering water user associations in India

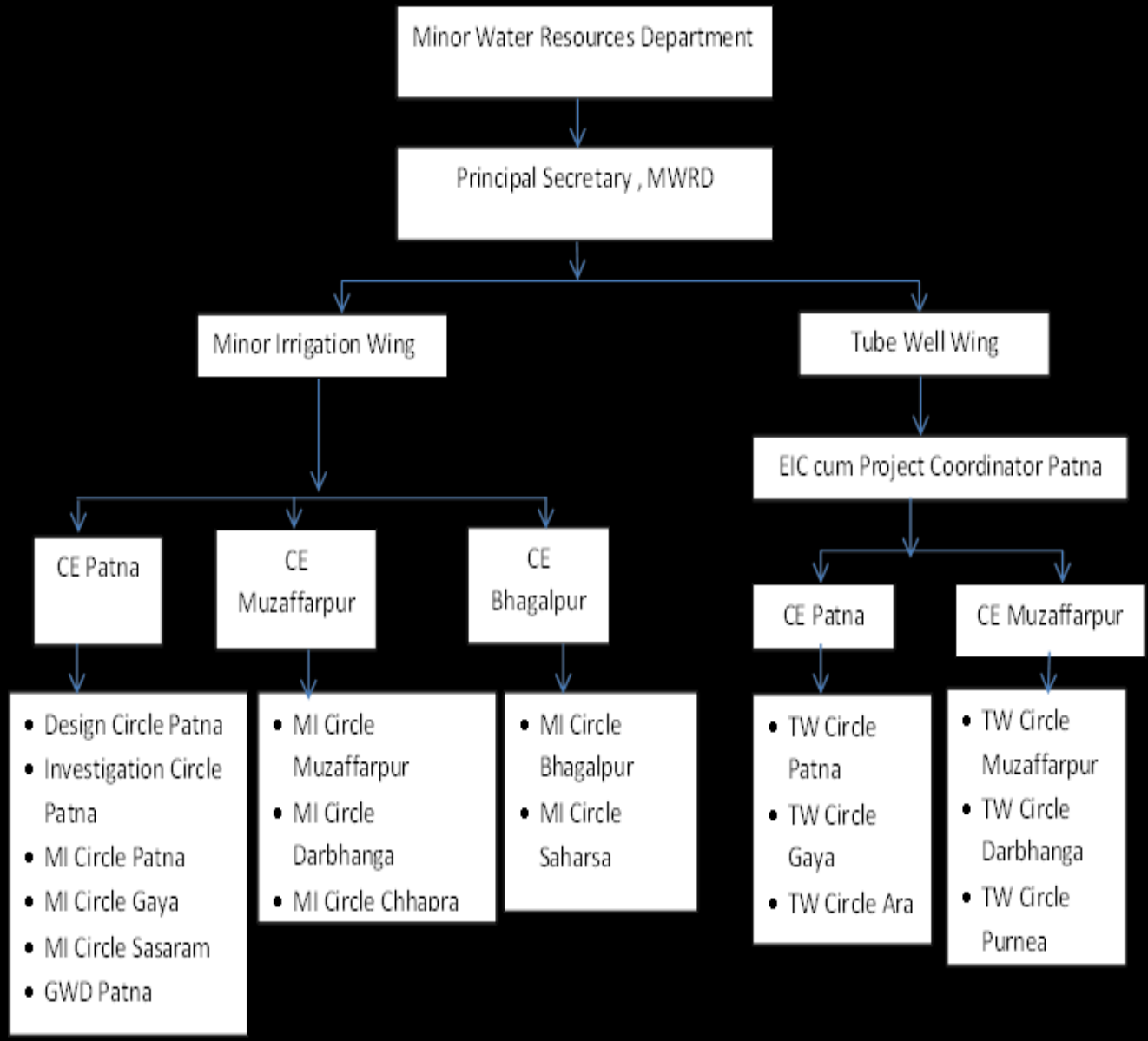
Functions

- Implementing O&M
- Crop planning, crop water budgeting & raising irrigation water demand
- Implementing water distribution
- Support in estimating and collecting water charges



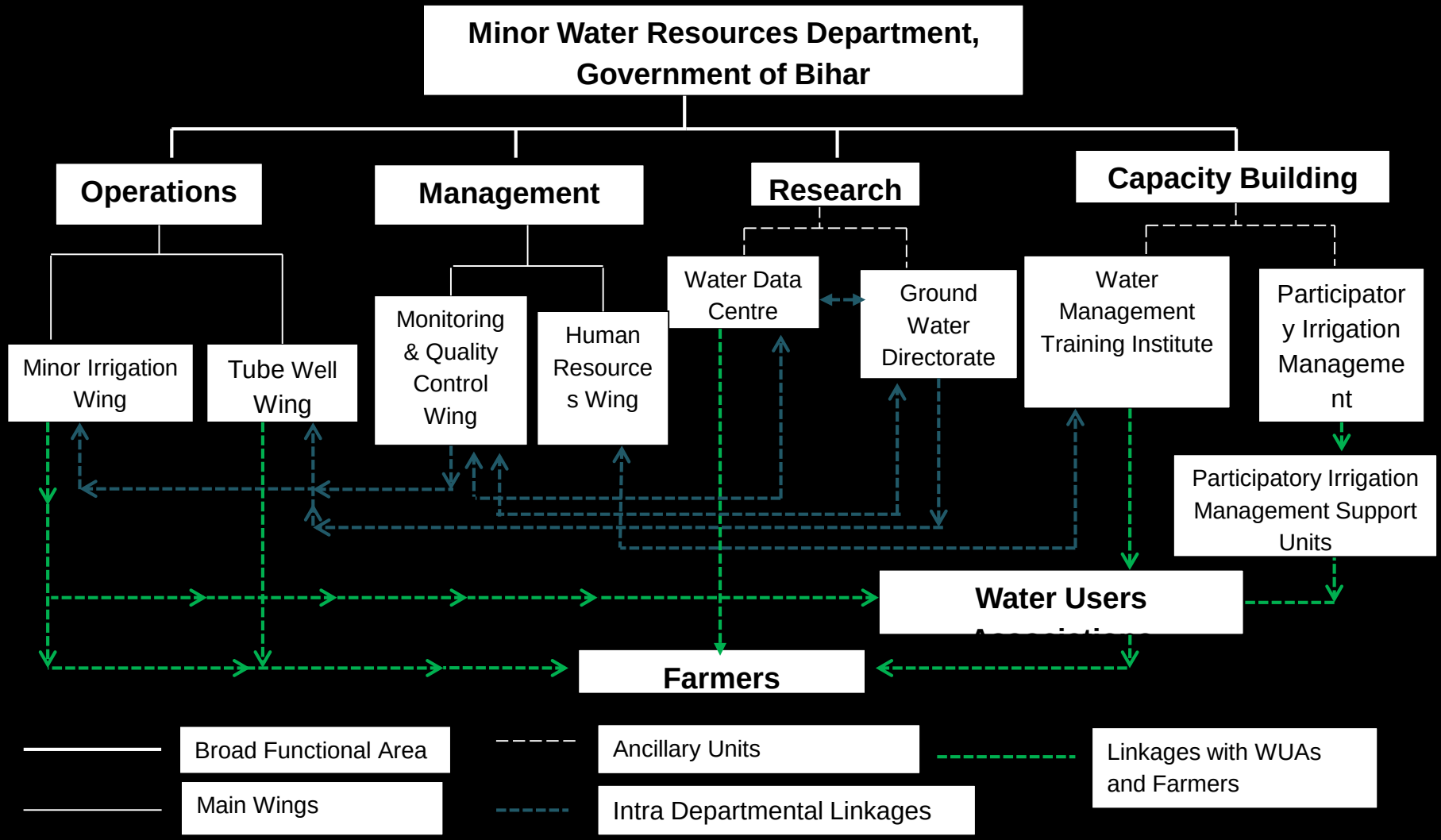
SOURCE: Ghosh et al / CEEW (2011)

Bihar: how institutions looked



SOURCE:Sugam and Ghosh (2012)

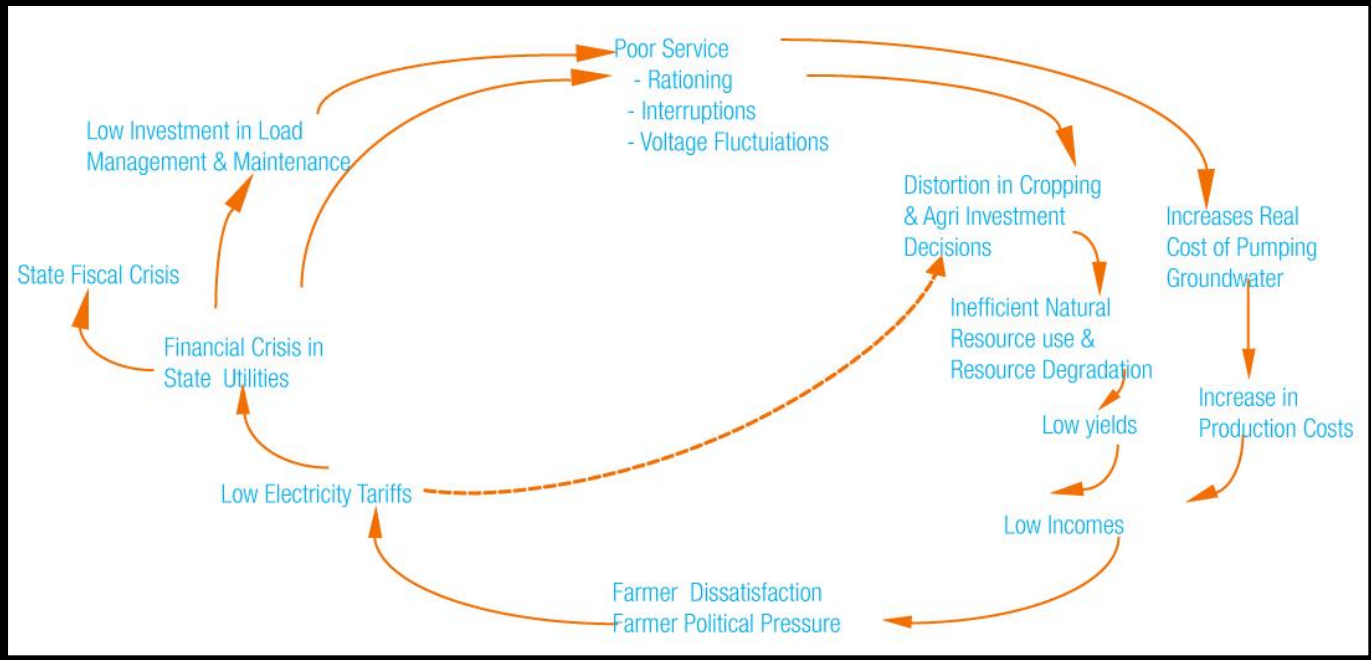
Bihar: focusing on service delivery



SOURCE:Sugam and Ghosh (2012)

Innovations in irrigation

Energy for irrigation: vicious cycle persists



SOURCE: Ghosh et al / CEEW (2011)

Comprehensive approach: agriculture demand side management

Groundwater

- Basin wide Assessment
- Participatory Hydrological Monitoting
- Environmental Viability Assessment
- Application efficiency Drip/ Sprinkler

Energy

- HVDS,Feeder Separation & other activities
- Energy Efficient Pumps
- Participation in Agri Power Management

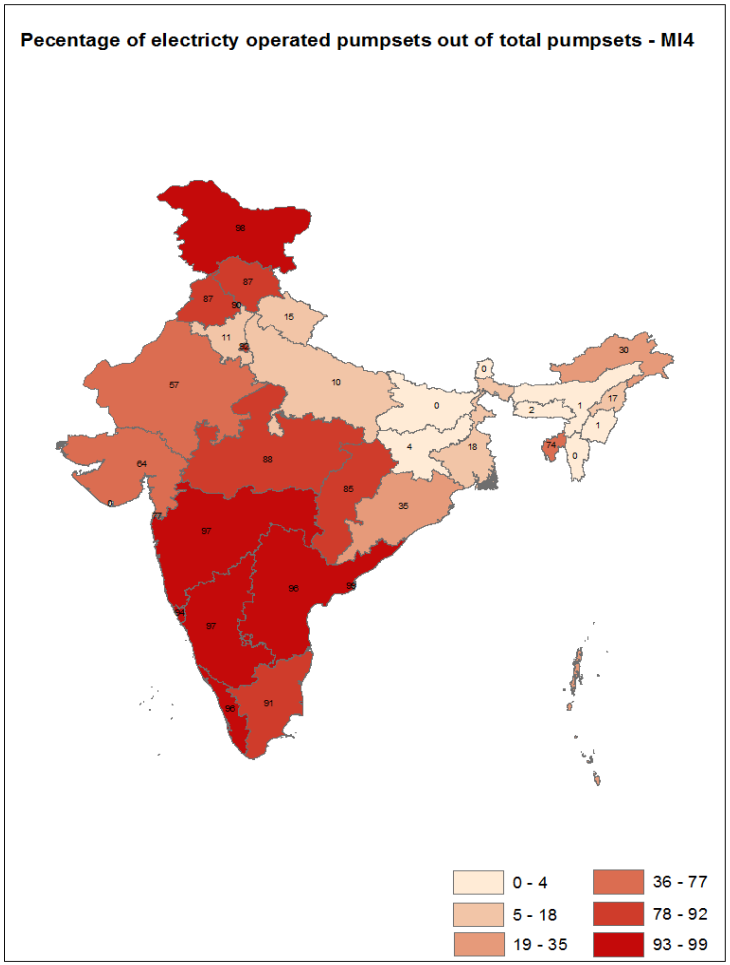
Agriculture

- Crop Water Budgeting
- Technology – Extension Services - FFS
- Expansion of Financial services

SOURCE: Ghosh et al / CEEW (2011)

Electricity vs diesel pumpsets

Percentage of electricity operated pumpsets out of total pumpsets



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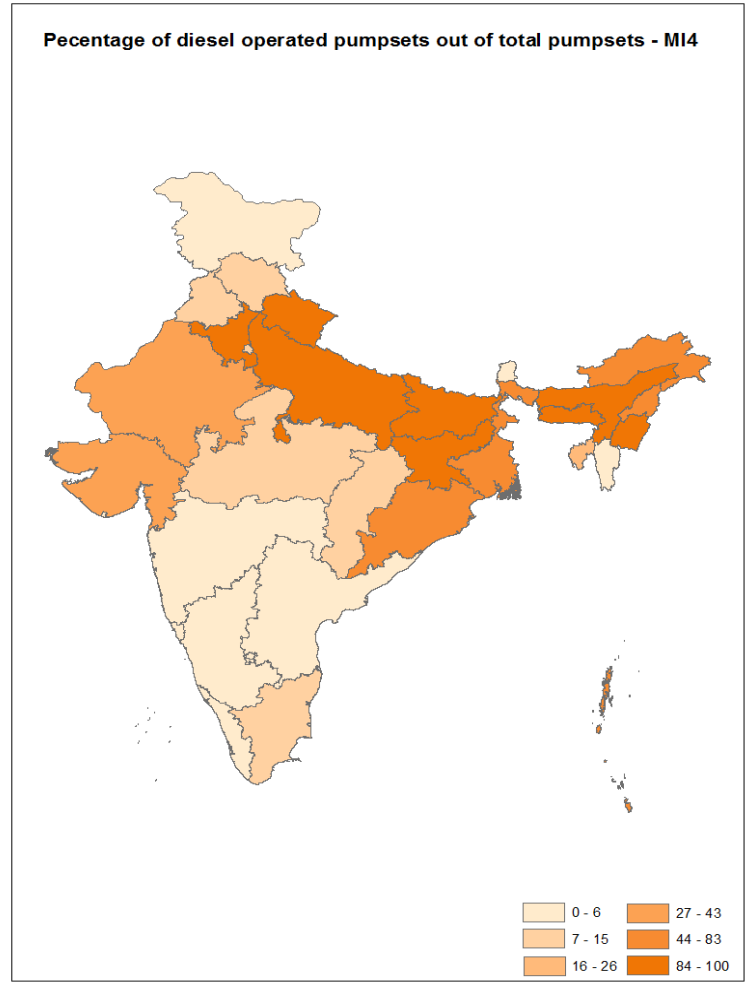
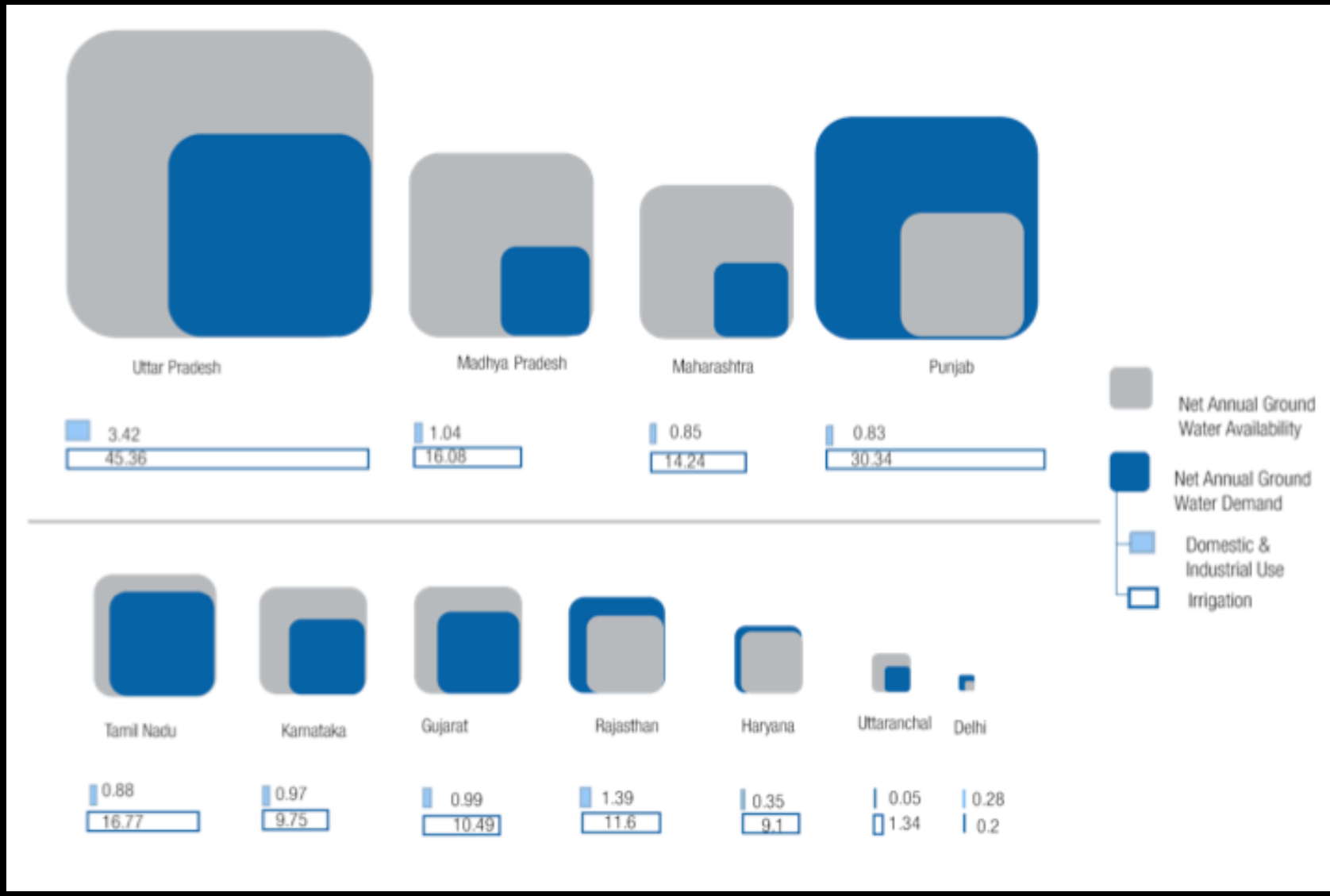


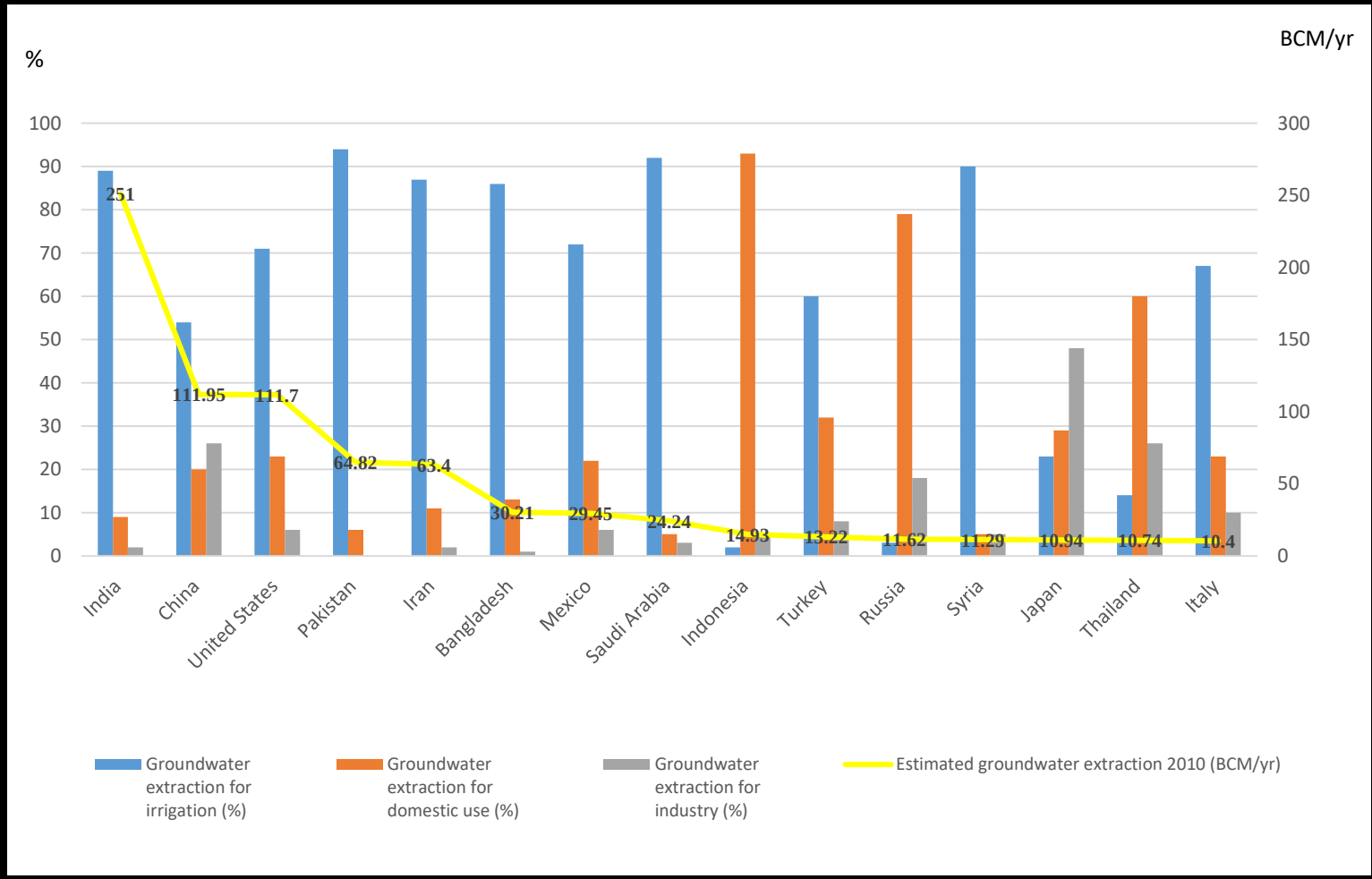
SOURCE: CEEW / Minor Irrigation Census

Groundwater stress in several states



SOURCE: Ghosh et al/ CEEW (2011)

India leads in groundwater extraction



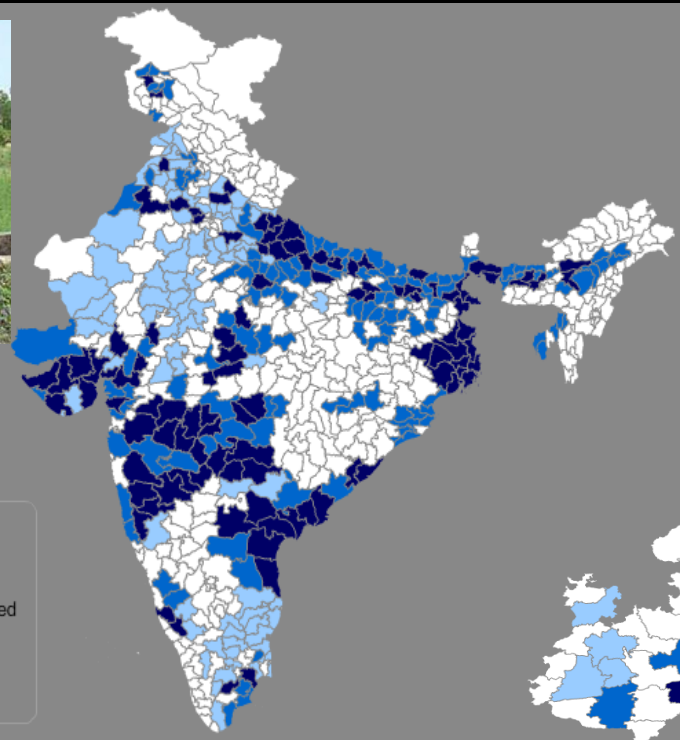
SOURCE: CEEW; Adapted from National Ground Water Association data (2016)

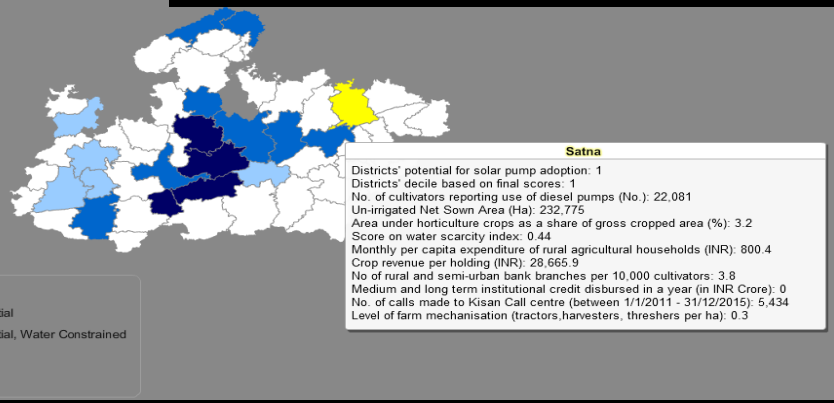
Can we deploy solar pumps at scale, within budget and sustainably?

Approach

Identifying criteria → Collecting data & Delphi process → Estimating weights & scores → Categorising districts

PHOTO CREDIT: Claro Ventures



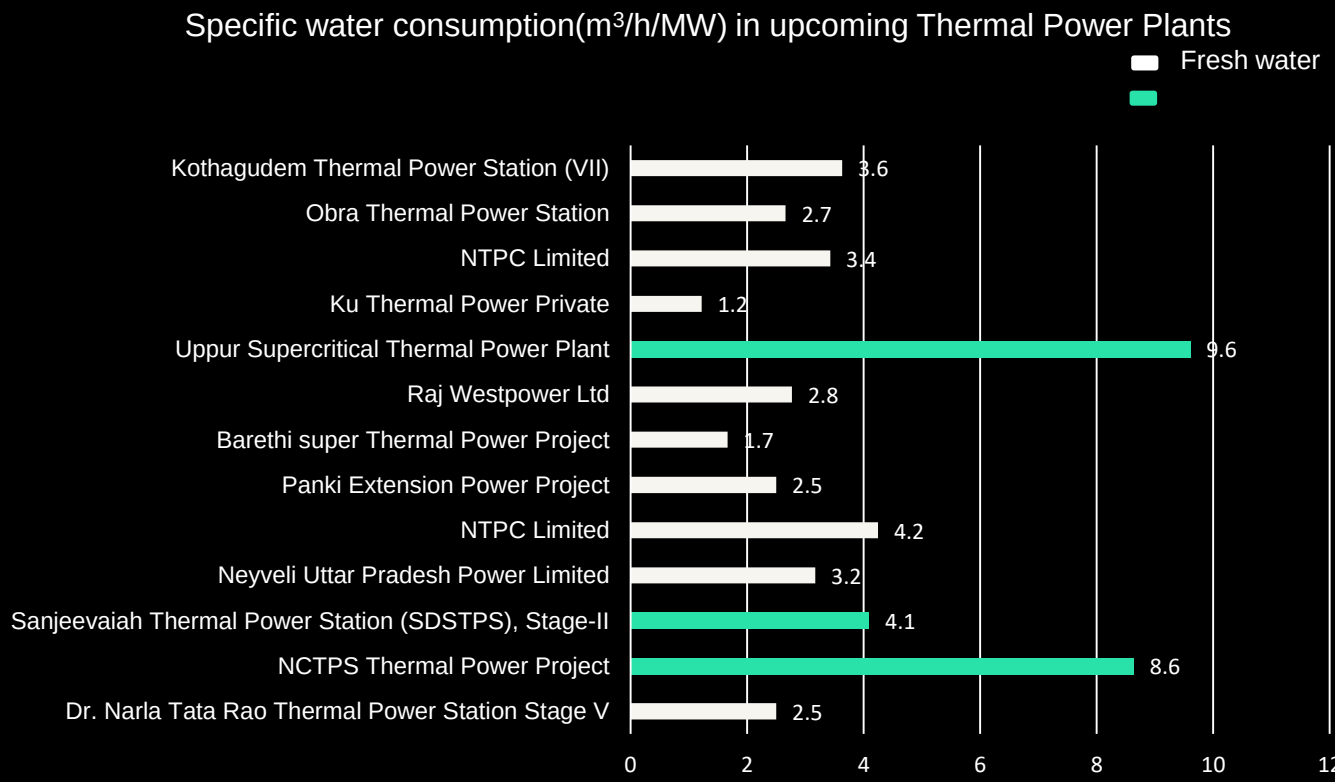


SOURCE: CEEW; Agrawal and Jain (2016); Jain (2017)

Innovations in energy provision

Energy choices will impact water demand

- Current specific water consumption **4-5 m^3/h/MW**
- New guidelines limit water use to **2.5 m^3/h/MW** in new plants and **3.5 m^3/h/MW** in existing plants



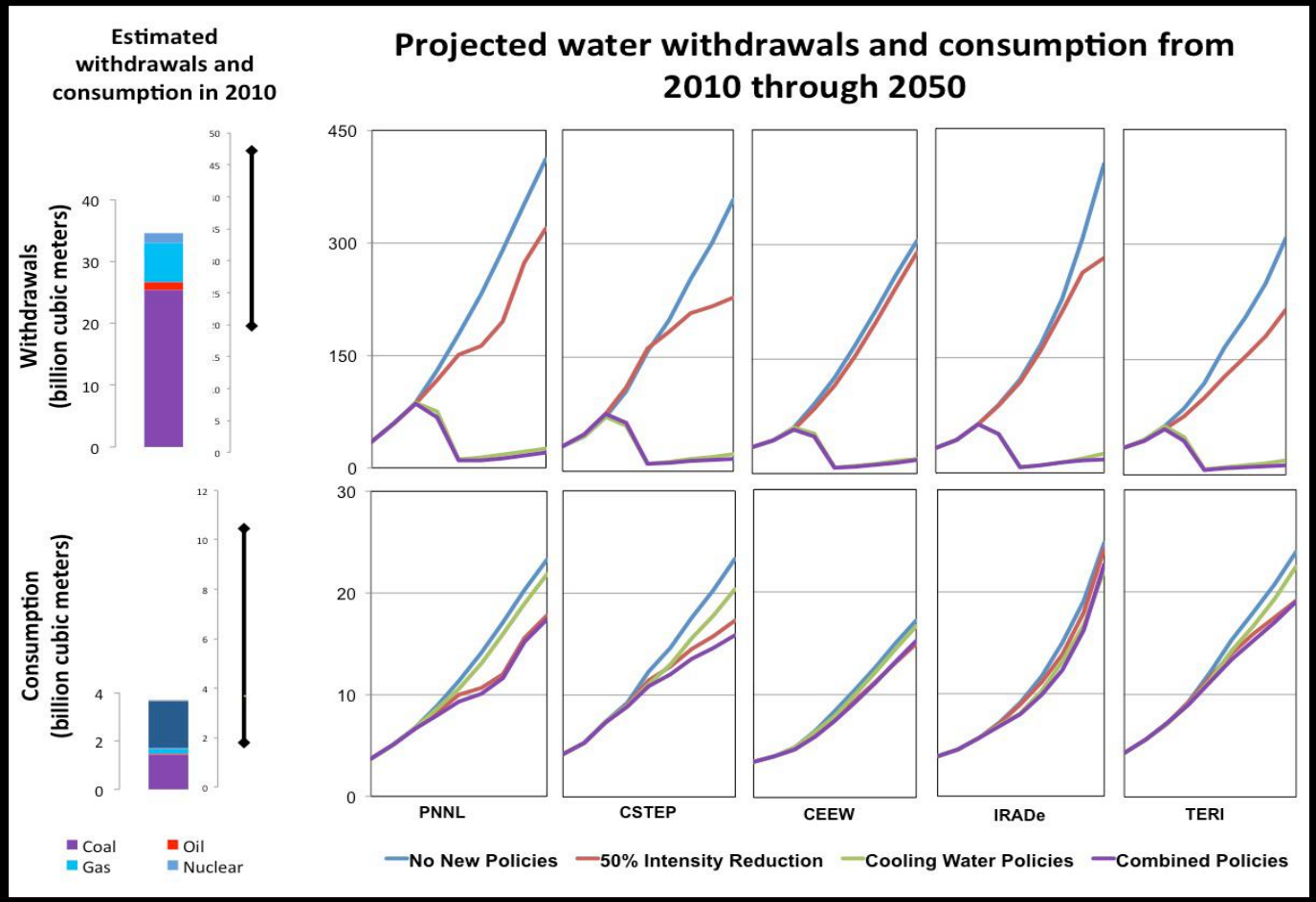
SOURCE: MOEFCC (2015); EIA reports MOEFCC

Sustainable Growth Working Group Scenarios: Insights from US-India Inter-Model Comparison Exercise

Scenario	Description
Reference	▸ Business-as-usual ▸ No further policy control on the power sector in terms of emissions reduction and water consumption limits
Policy50	▸ 50% decrease in carbon intensity of power production by 2050, compared to the 2010 level ▸ Start in 2018, the beginning of India's 13th Five-Year Plan
LWC	▸ Low water consumption ▸ Recently proposed rules on limiting water consumption from coal-fired thermal power plants ▸ Phase out once-through cooling system and achieve the lowest water consumption limits by 2030

SOURCE: CEEW / NITI Aayog (2016)

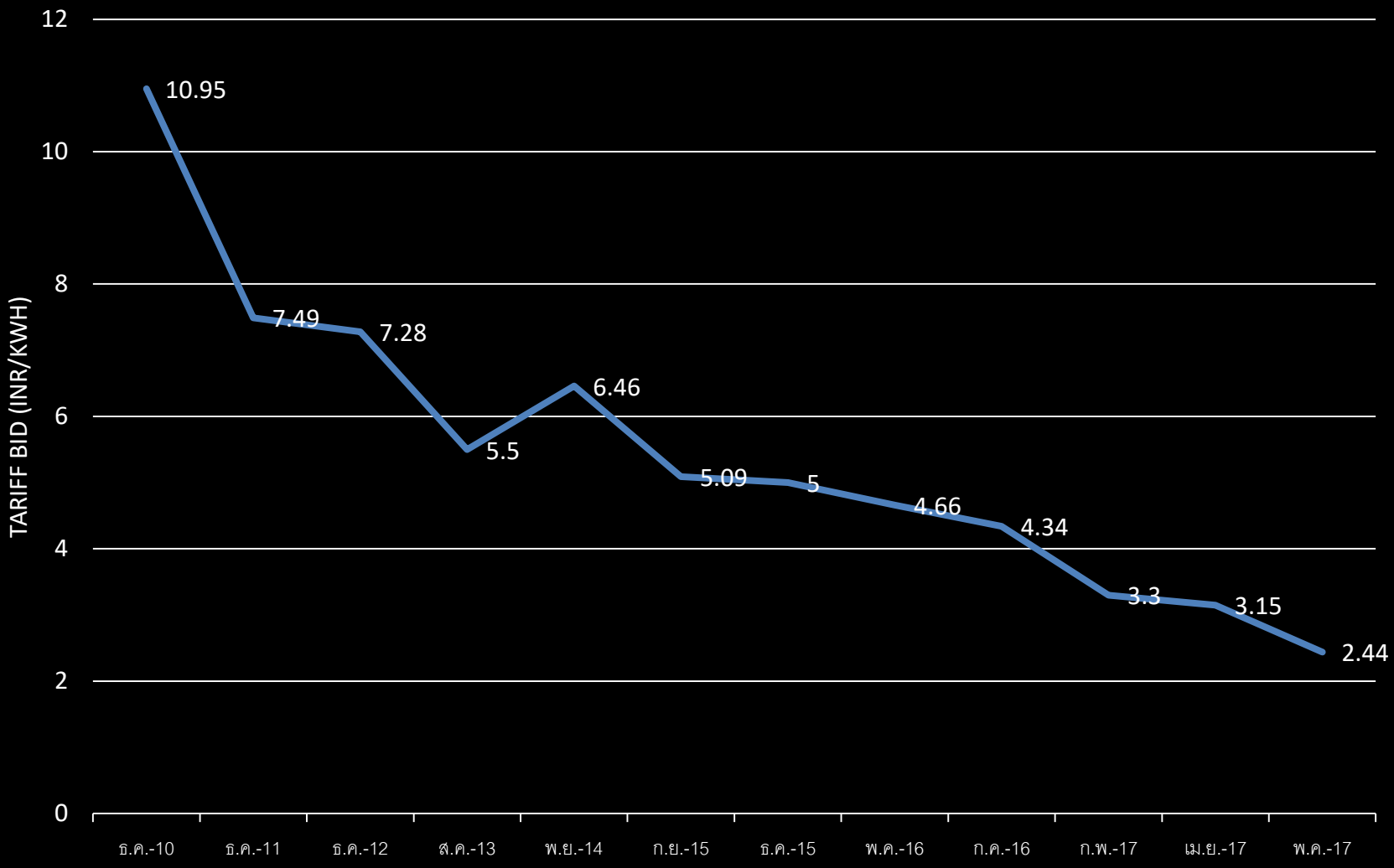
Can we make our power plants emit GHGs less and use less water?



- Lower emission intensity also lowers pressure on water resources: 9-fold increase in water withdrawal and 5-fold increase in water consumption by 2050 under BAU
- 50% of implementation of water-saving technologies reduces water consumption by 7%–28% and water withdrawals 40%–67%
- Full implementation reduces water consumption by 12%–36% and water withdrawals by as much as 97%

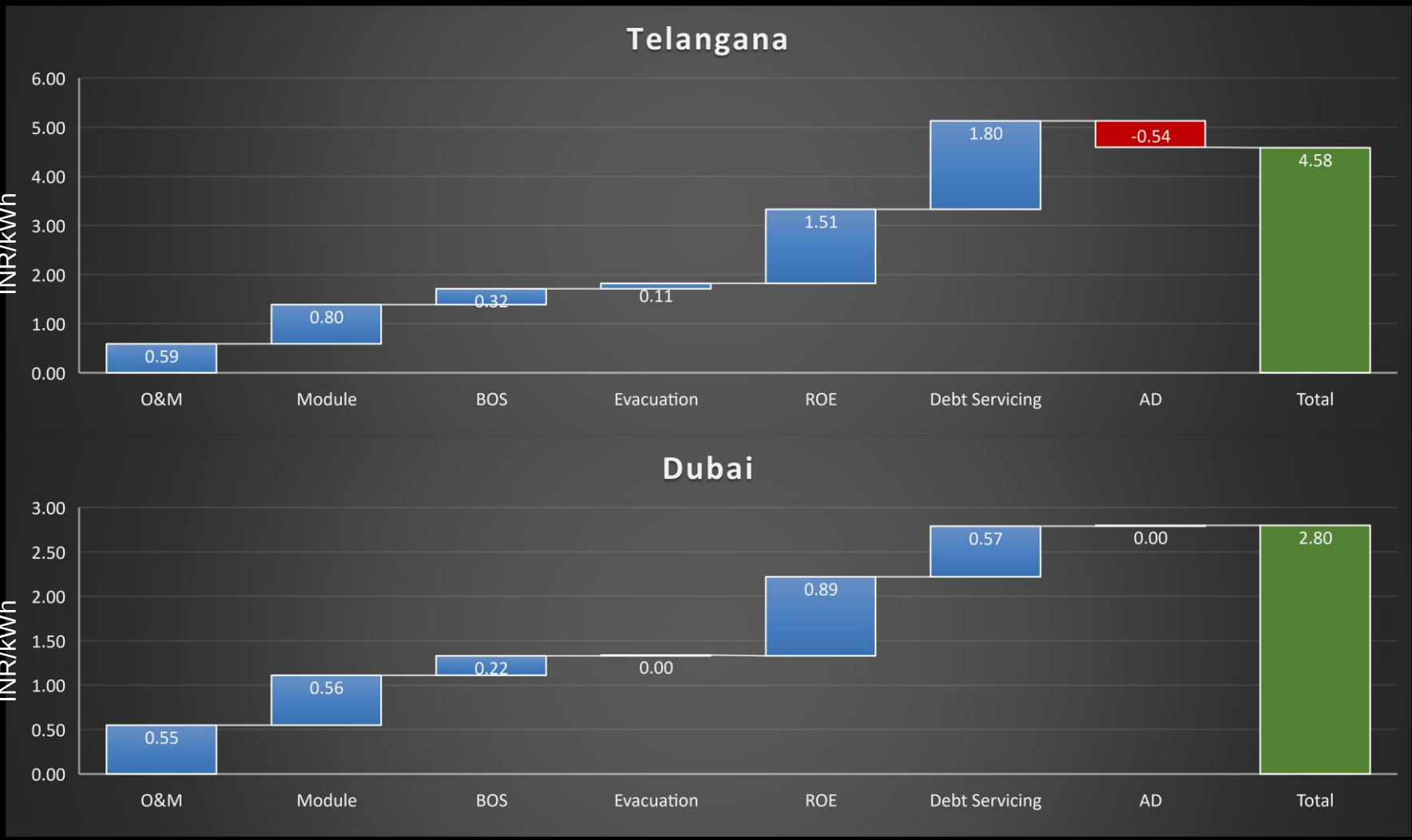
SOURCE: CEEW / NITI Aayog (2016)

Solar tariffs have fallen rapidly



SOURCE: CEEW; MNRE

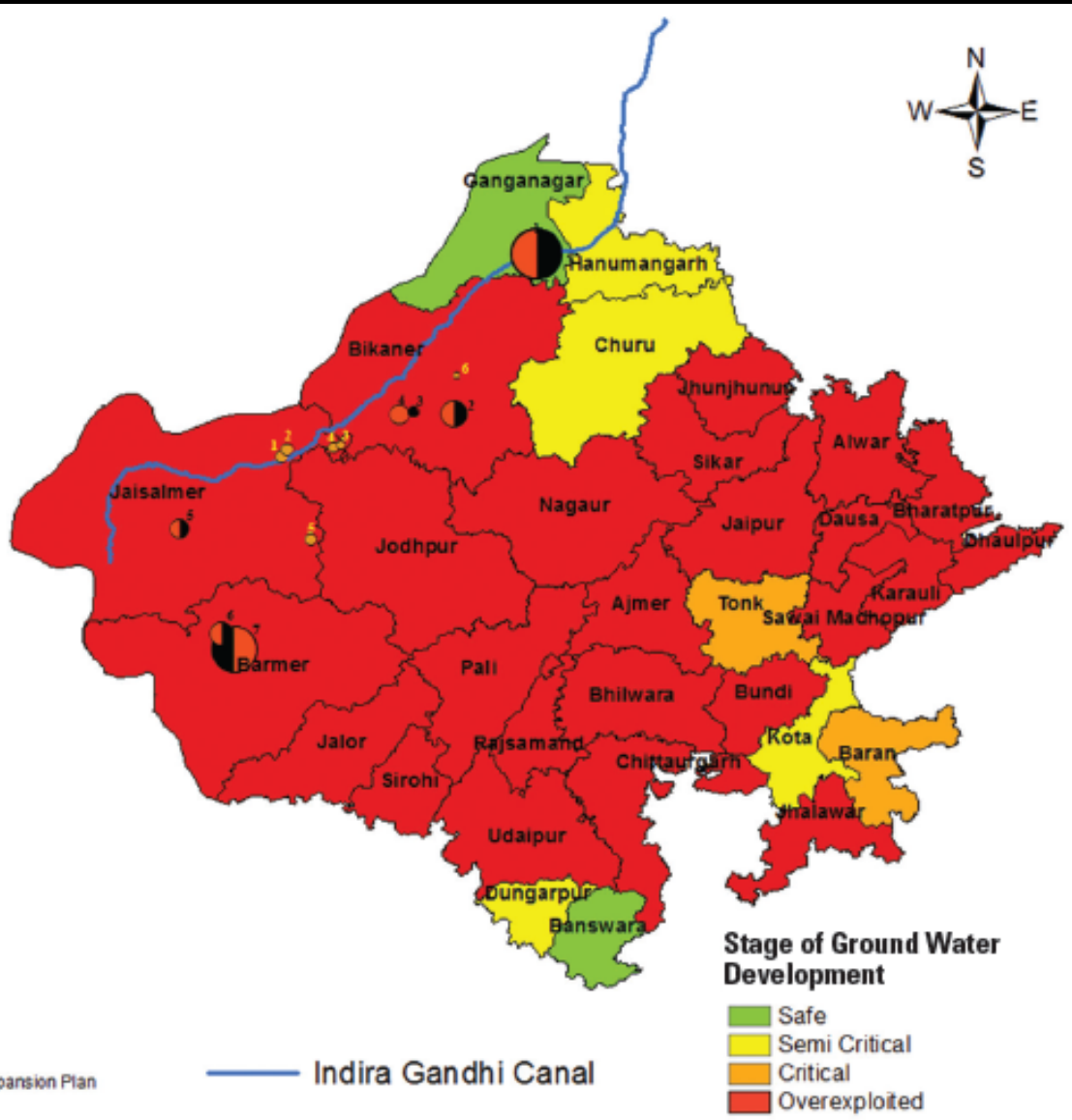
The cost of capital is the principal barrier to scaling renewables



SOURCE: CEEW analysis; CEEW estimates have been used for the different cost components

Even clean energy needs water

	Plant	Present MW	Proposed MW	Cusec
1	Suratgarth Super Thermal Power Plant	1500	1320	100
2	Barsingsar Thermal Power Plant	250	250	45
3	KSK Energy Ventures	135	Nil	13.5
4	Bithnok Thermal Power Plant	Nil	250	25
5	Ramgarh Gas Thermal Power Plant	113.5	160	25
6	Giral Lignite Thermal Power Plant	250	250	24
7	JSW Lignite Power Plant	1080	Nil	80
	SOLAR THERMAL POWER PLANTS			
1	Dikwakar Solar Projects Pvt Ltd	Nil	100	2.9
2	KVK Energy Ventures Pvt Ltd	Nil	100	2.9
3	Godawari Green Energy Ltd	Nil	50	1.6
4	Corporate Ispat Alloys Ltd	Nil	50	2.02
5	Rajasthan Sun Technique Energy Pvt Ltd	Nil	100	2.5
6	ACME Solar Thermal Power Plant	10	Nil	0.8



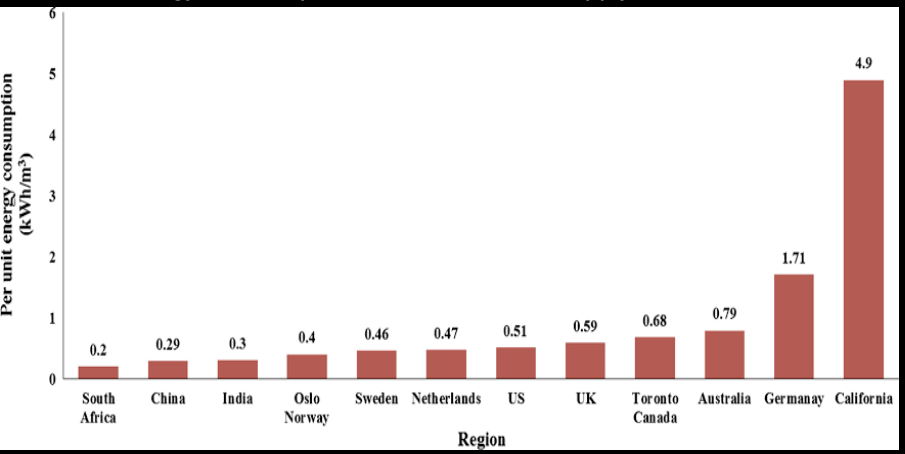
SOURCE: Ghosh et al/ CEEW and NRDC (2012)

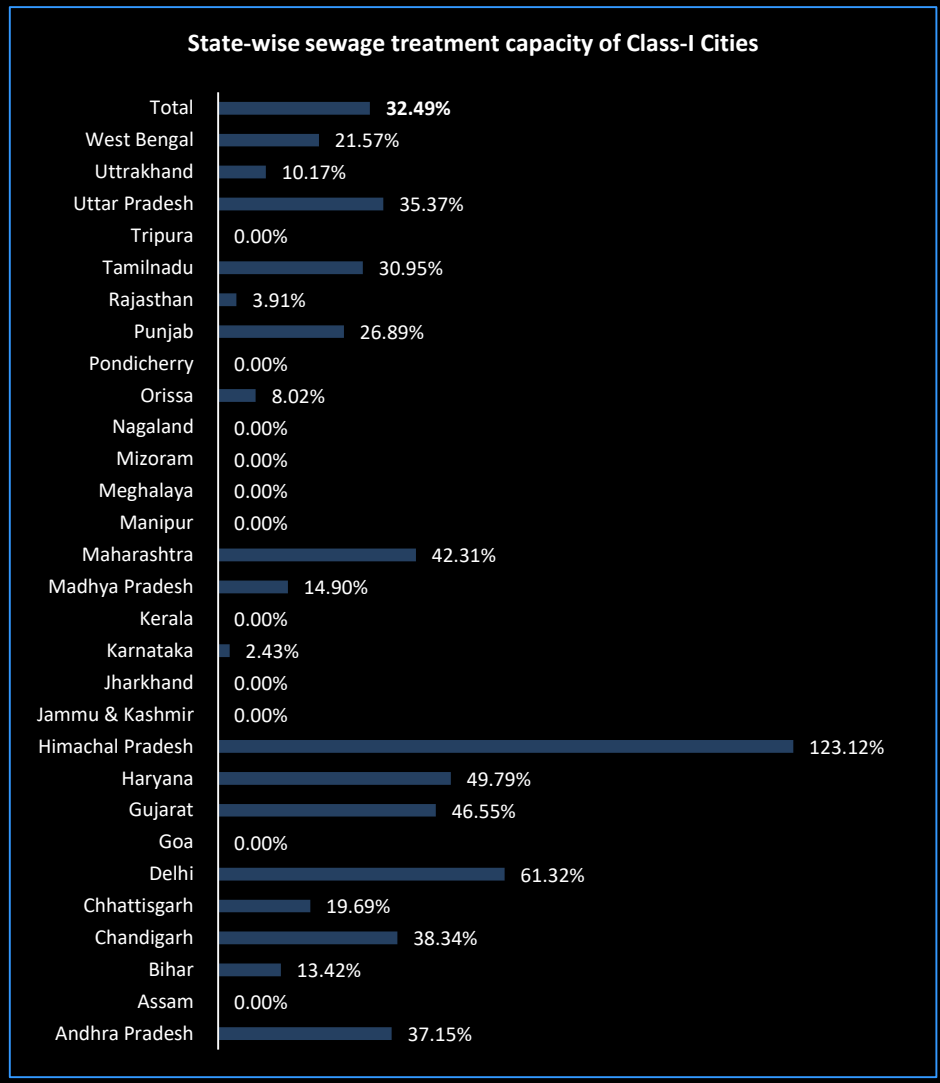
Innovations in urban service provision

Energy demand for urban water…is likely to increase

- Water and wastewater infrastructures were found to contribute 3%-16% of community-wide electricity use and GHG emissions for 16 cities in India
- End-use energy intensity for drinking water provision was more than double that for wastewater treatment (reverse of cities in developed countries)

Per unit energy consumption for urban water supply





SOURCE: Miller, Ramaswami and Ranjan (2013); World Bank (2008); CPCB (2014); Wakeel et al (2016)

Government initiatives: Promising but need a lot of external support

Swachh Bharat[1]

- Eliminate open defecation and manual scavenging and promote scientific SWM
- Create an enabling environment for private sector participation in Capex and Opex
- Allocated Rs. 1700 crore[2]

National Mission for Clean Ganga[3]

- Abatement of pollution and rejuvenation of Ganga
- Maintain minimum ecological flows in the river Ganga
- Sanctioned Rs. 20,000 crore

Amrut (Atal Mission for Rejuvenation & Transformation) – 500 Cities[4]

- Ensure that every household has access to tap water and a sewerage connection
- Funds allocated Rs. 50,000 crore

Smart cities – 100 cities[5]

- More liveable and inclusive cities, besides driving economic growth
- Sanctioned Rs. 48,000 crore

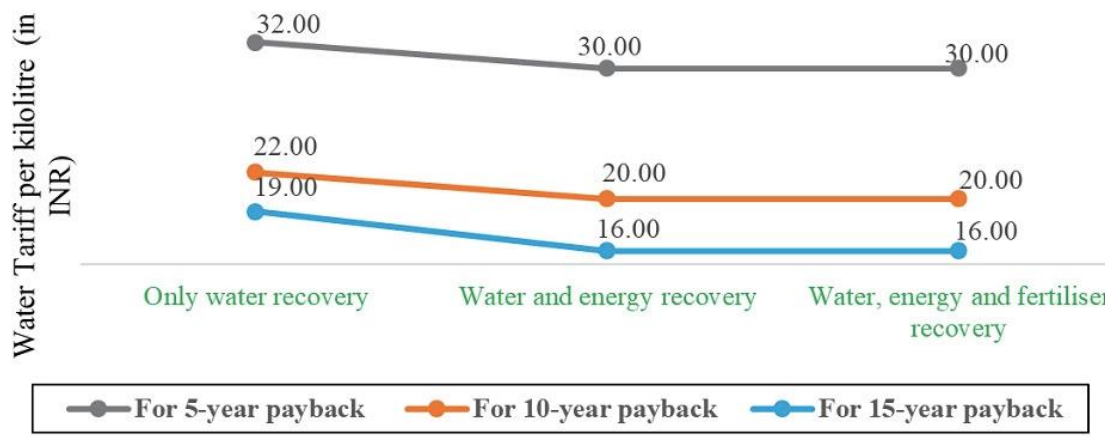
PM has stressed need for Foreign Direct Investment for all these missions

SOURCE: [1] *MouD, GoI;* [2]*Modi govt allocates Rs 1700 crores for Swachh Bharat Abhiyan*, Firstpost, Available at: *http://www.firstpost.com/business/modi-govt-allocates-rs-1700-crores-swachh-bharat-abhiyan-2077149.html;* [3] Ganga cleaning mission gets Rs 20,000 crore boost, The Times of India, Available at http://timesofindia.indiatimes.com/india/Ganga-cleaning-mission-gets-Rs-20000-crore-boost/articleshow/47262364.cms, [4]http://amrut.gov.in/writereaddata/The%20Mission.pdf,; [5]http://smartcities.gov.in/writereaddata/Financing%20of%20Smart%20Cities.pdf

Turning wastewater into an economic resource

- Water from operational STPs could service 53 GW of TPP capacity
- If all STPs were functioning, 64 GW of capacity could be supported
- If all sewage were treated, 194 GW of capacity could be supported

Water tariff for different payback periods and modes of revenue generation



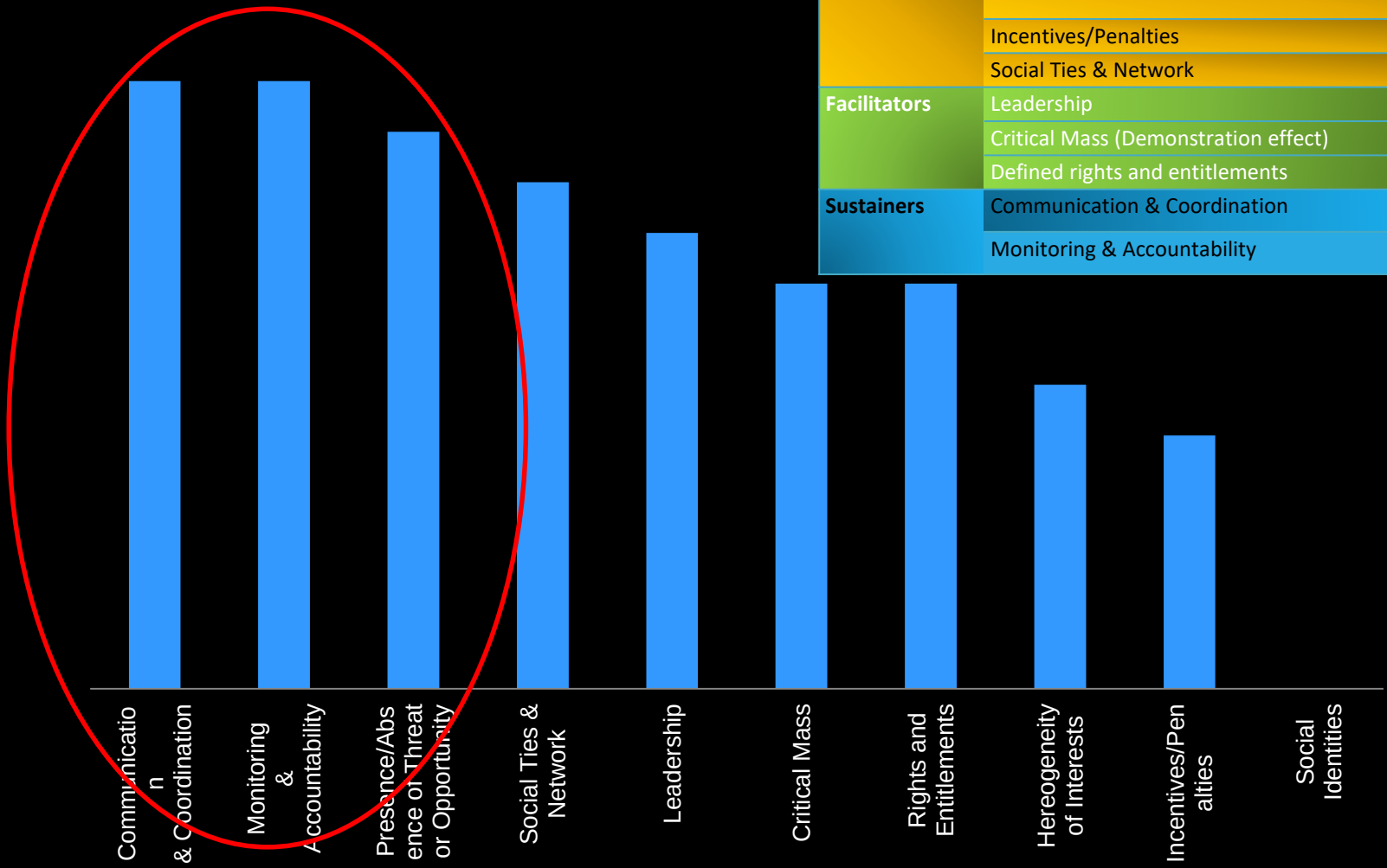
Source: CEEW

SOURCE: CEEW/ Sugam, Jain and Neog (2017)

Innovations in collective action

What will drive collective action?

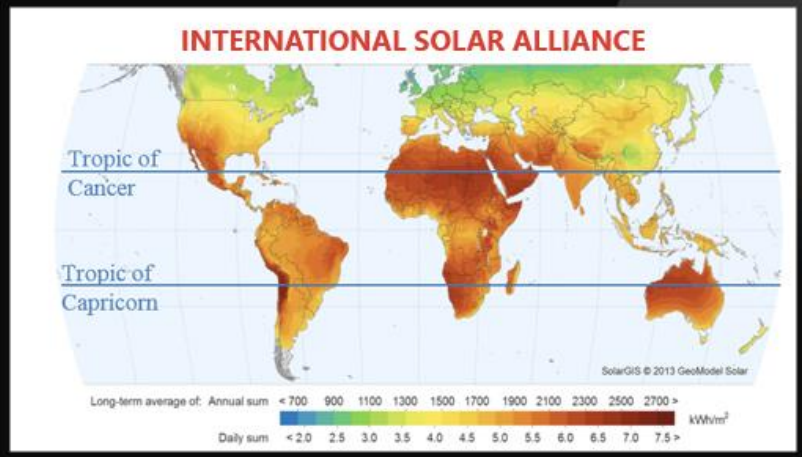
Triggers	Presence/Absence of Threat or Opportunity
	Incentives/Penalties
	Social Ties & Network
Facilitators	Leadership
	Critical Mass (Demonstration effect)
	Defined rights and entitlements
Sustainers	Communication & Coordination
	Monitoring & Accountability



SOURCE: Mittra, Sugam and Ghosh (2014)

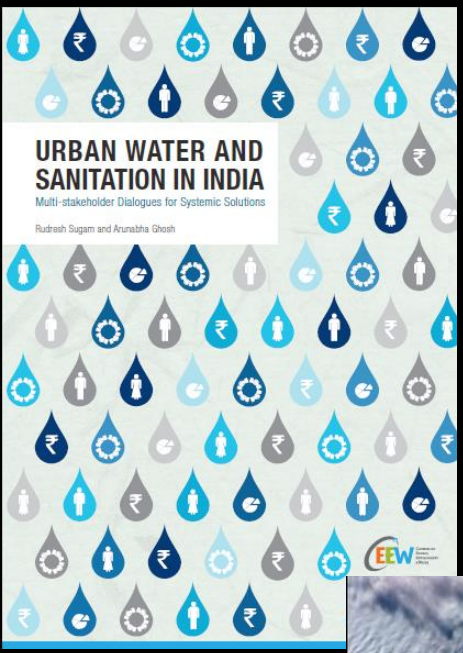
Innovations in WEFC partnerships

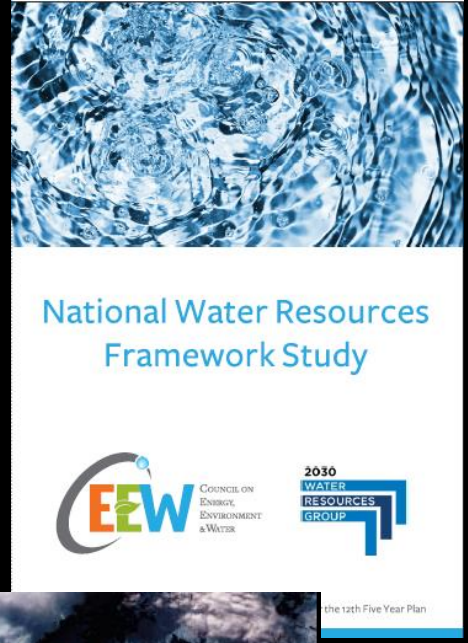
International Solar Alliance: a new kind of energy partnership

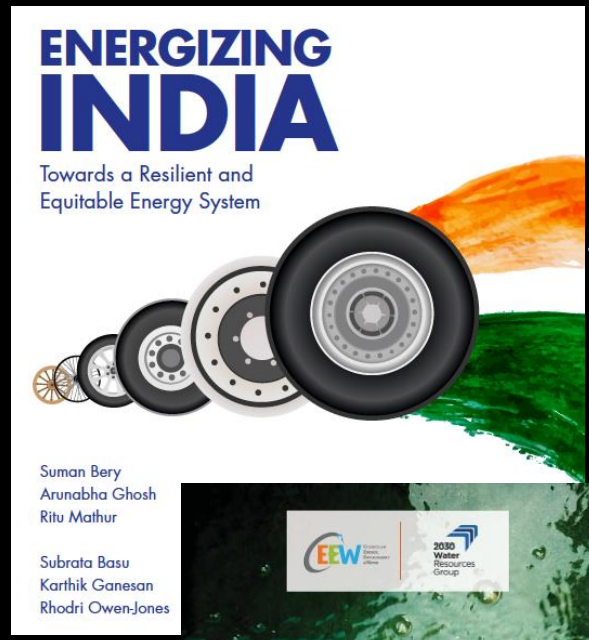


Recognizing that sustainable development, universal energy access, and energy security are critical to the shared prosperity and future of our planet, and acknowledging that clean and renewable energy needs to be made affordable for all, we do hereby declare our intention to support India's proposal to launch an international solar alliance as a common platform for cooperation among solar resource rich countries lying fully or practically between the Tropics of Cancer and Capricorn.

SOURCE: PTI; www.intsolaralliance.org

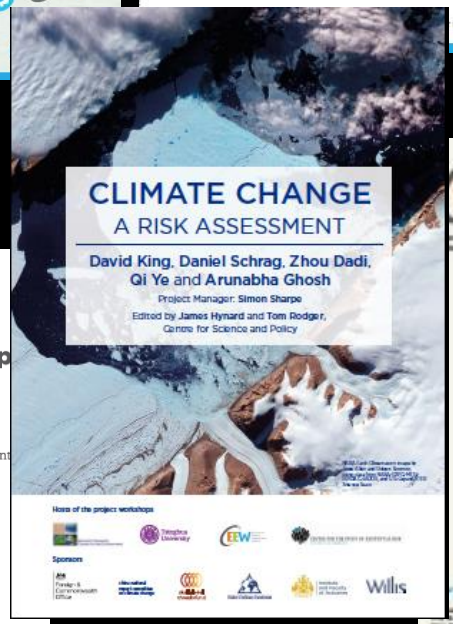


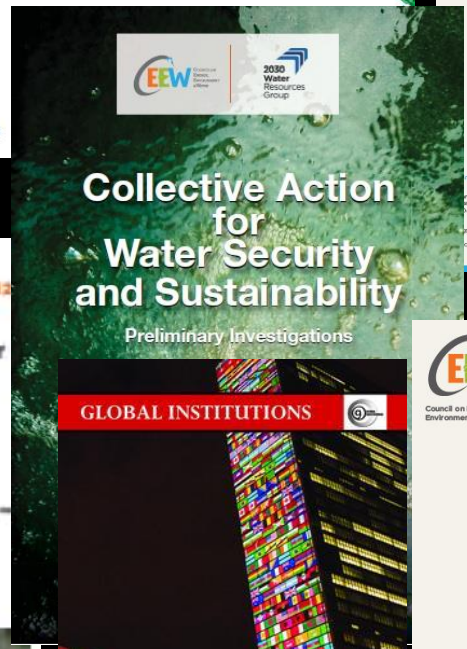


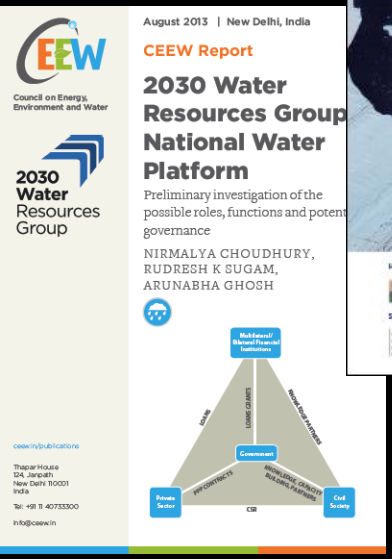


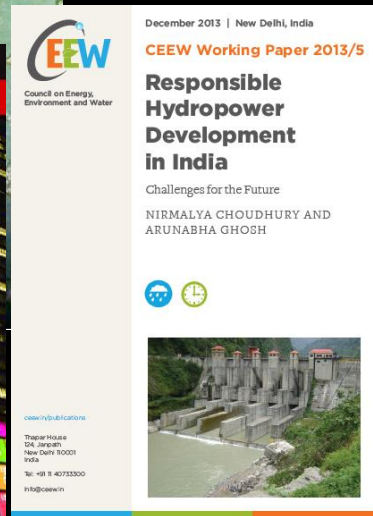
http://ceew.in/water

http://ceew.in/resources









THANK YOU

http://ceew.in/