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Climate Strategies

Climate Co-Benefit Policies in India: Domestic Drivers and North-South Cooperation (Case Study on Indian Power Sector)

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Climate Change, Domestic Policy and International Cooperation

- CO_2 emissions on account of energy use are expected to reach 5.5 billion tonnes by 2031-32 under a scenario for high coal use (GOI, 2006a).
- Increasing demand for fossil fuels for the electricity and the transport sector would significantly contribute towards this.
- Due to the competing development objectives and resource constraints, costly policy options with significant environmental dividends are not realised to their full potential.
- Large scale adoption of clean technology needs policy push beyond CDM and there is scope for international cooperation.

Potential for Climate Co-benefit Policies in the Indian Power Sector

Climate Co-benefit Policy	Implementation Horizon	Climate Benefit Potential	Existing Policy Push	Status of Adoption	Scope for International Co-operation
Clean and efficient coal-based generation technology	Long-term	Very Large	Low	Very Low	High
High share of renewable energy	Medium-term	Medium	High	Medium	High
Rehabilitation and refurbishments of old plants	Medium-term	Large	High	Medium	High
Improving efficiency of agricultural pump sets	Short to Medium-term	Large	Low	Very Low	High
Up-gradation of distribution network	Medium-term	Large	Low	Very Low	High

Policy options for GHG mitigation in the Indian power sector

- Clean and efficient coal-based generation technology
- Generation
- Up-gradation of distribution network
- Network
- Improving efficiency of agricultural pump sets
- Utilization

Significance of Coal Based Power Generation

Description	
Coal Based Power Generation Capacity (As on 31 July 2008)	77199 MW (53.03%)[#]
Coal Consumption by Power Sector (2007-08)	330 million tonnes
Emissions from Power Sector (2006-07)	460 million tonnes (92.8%)[$]

Evaluation of Selected Policy for North-South Cooperation

Criteria	Efficient Generation Technology	Efficient Agricultural Pumps	Upgrading of Distribution. Network
Presence of large scale inefficiencies	Y	Y	Y
Ease of Policy Formulation	Y	Y	Y
Ease of Programme Design	Y	N	N
Large Identifiable Sources of Emission	Y	N	Y (indirectly)
Ease of Verification of Emission Reduction	Y	Y?	Y
Ease to Channelising Support from North	Y	Y?	Y
Political Acceptability	Y	Y?	Y
Ease of Implementation	Y	?	Y
Transparency in Implementation and Monitoring	Y	?	Y
Will it help reduce energy subsidy in future?	N	Y (large)	Y
Level of government priority for domestic financing	Low	Low and limited	Low and limited
Domestic Fiscal Policy Support Available	Y (SC – PC)	N	N

Coal Consumption and the Indian Power Sector

- Coal requirement for generation is expected to reach 1475 million tonnes by the year 2031-32 and is expected to fuel about 78% of the electricity generation in the country.
- By the year 2020, replacement of old and smaller plants, and adoption of efficient technology for new capacity (scenario EFF) could lead to 9% reduction in GHG emissions compared to a base case (Kroeze et al., 2004).
- In 2003, average energy efficiency of coal-fired power plants in India was 30% as compared to 42% for Japan (Graus et al., 2007).

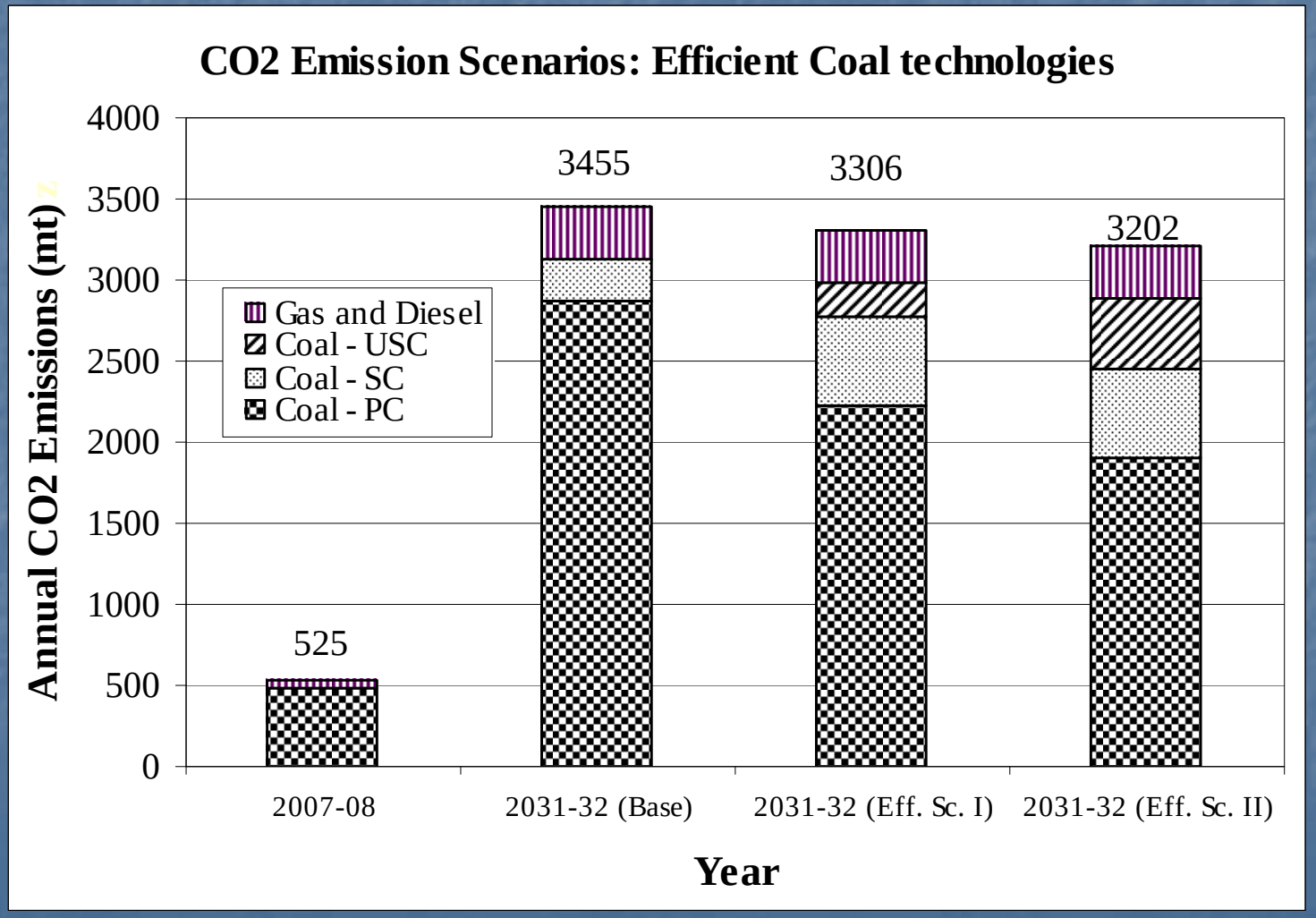
Adoption of Efficient and Clean Coal Technologies

- **Policy Description**
- Adoption of efficient and clean coal technology for new capacity addition in the Indian power sector.
- Alternate scenarios being considered are (i) 20% share of supercritical technology and (ii) Additionally 10% share of ultra supercritical technology.
- Additionally, this could also include development of a carbon capture and storage (CCS) ready Integrated Gasification Combined Cycle (IGCC) plant of commercial size.

Capital Cost and CO2 Emission Factor Comparison for Coal Based Technologies

S. No.	Technology	Capital Cost ('000 USD per MW)	Thermal Efficiency &	CO_2 Emission Factor (tCO_2 / GWh)@	CO_2 Emission Factor (tCO_2 / GWh)#
1	Subcritical Pulverised Coal (PC)	1549#		1073.75	809
2	Supercritical Pulverised Coal (SC-PC)	1575#; 1408&		941	764
3	Ultra Supercritical Pulverised Coal (USC-PC)		44%		743&
4	Integrated Gasification Combined Cycle (IGCC)	1733-1977#; Shell - 1613& GE - 1439&	Shell - 43.1% GE – 38%		640 – 663# Shell - 763& GE - 833&

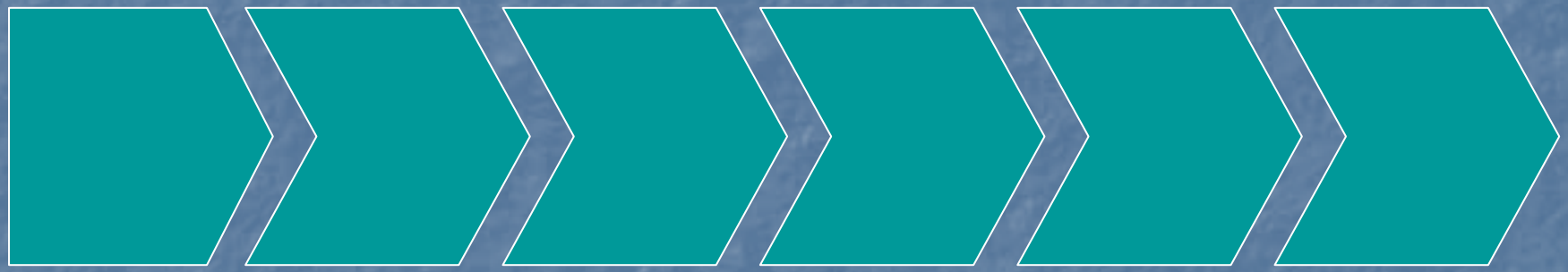
CO_2 Emissions Scenarios with adoption of Efficient Coal Technologies



Policy Developments for Clean Coal

- Supercritical technology for projects under the Ultra Mega Power Projects (UMPP).
- A fiscal push has been provided by the government by granting full exemption from central excise duty for goods procured for setting up ultra mega power projects based on supercritical technology .

Strategy for Policy Implementation



Stakeholder Responsibility: Adoption of Clean Coal Technology

S. No.	Responsibility	Stakeholders	Description
1	Policy Formulation	* Ministry of Power * State Govts. (state-specific projects)	Adoption of Supercritical, Ultra Supercritical and IGCC technology for identified projects above 500 MW and with appropriate time-line.
2	Policy Description	* Ministry of Power, * State Govts. * CERC & SERCs * Central Electricity Authority * Generation Companies * Equipment Manufacturers	• All new additions to capacity to utilize supercritical technology if plant size is 500 MW or above. • Identification of plants for use of ultra supercritical and IGCC technology. • Setting responsibilities for programme design, implementation and monitoring.

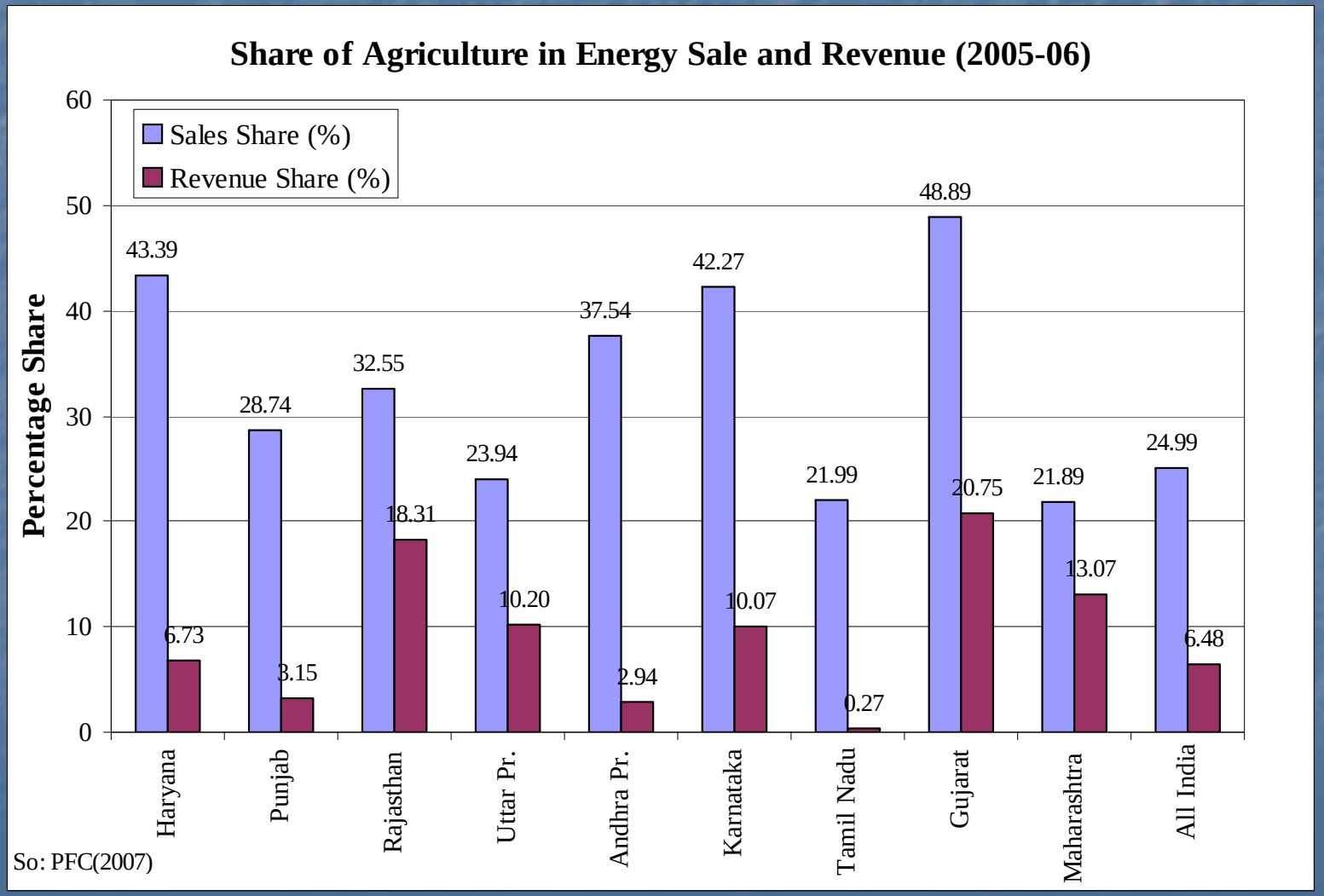
Stakeholder Responsibility: Adoption of Clean Coal Technology (contd.)

3	Programme Design	* Ministry of Power * Central Electricity Authority * State Govts. * Generating Companies * Equipment Manufacturers	• Identification of projects for completion during the 12th five-year plan onwards and specification of project size and time line for adoption of the SC, USC and CCS-ready IGCC technology. • Assessment of technological capability and manufacturing base in the country, and international scenario. • Need for technology tie-ups with technology developers • Status of domestic manufacturing base and international technology availability. • Assessment of need for fiscal measures and direct financial support.

Stakeholder Responsibility: Adoption of Clean Coal Technology (contd.)

4	Implemen-tation	* Project Developers * Equipment Manufacturers * Central Electricity Authority * International Cooperation	* Specification of SC, USC and IGCC technology in bid documents of the identified projects * Enhancement of domestic manufacturing capacity * Facilitation of technology cooperation
5	Monitoring	* Ministry of Power * Central Electricity Authority	* Domestic manufacturing capacity for SC and USC plants * Status of international technology collaboration * Outcome of IGCC demonstration plants
6	Financing	* International Cooperation * CDM financing	Incremental cost of SC, USC and IGCC (CCS) for demonstration plants

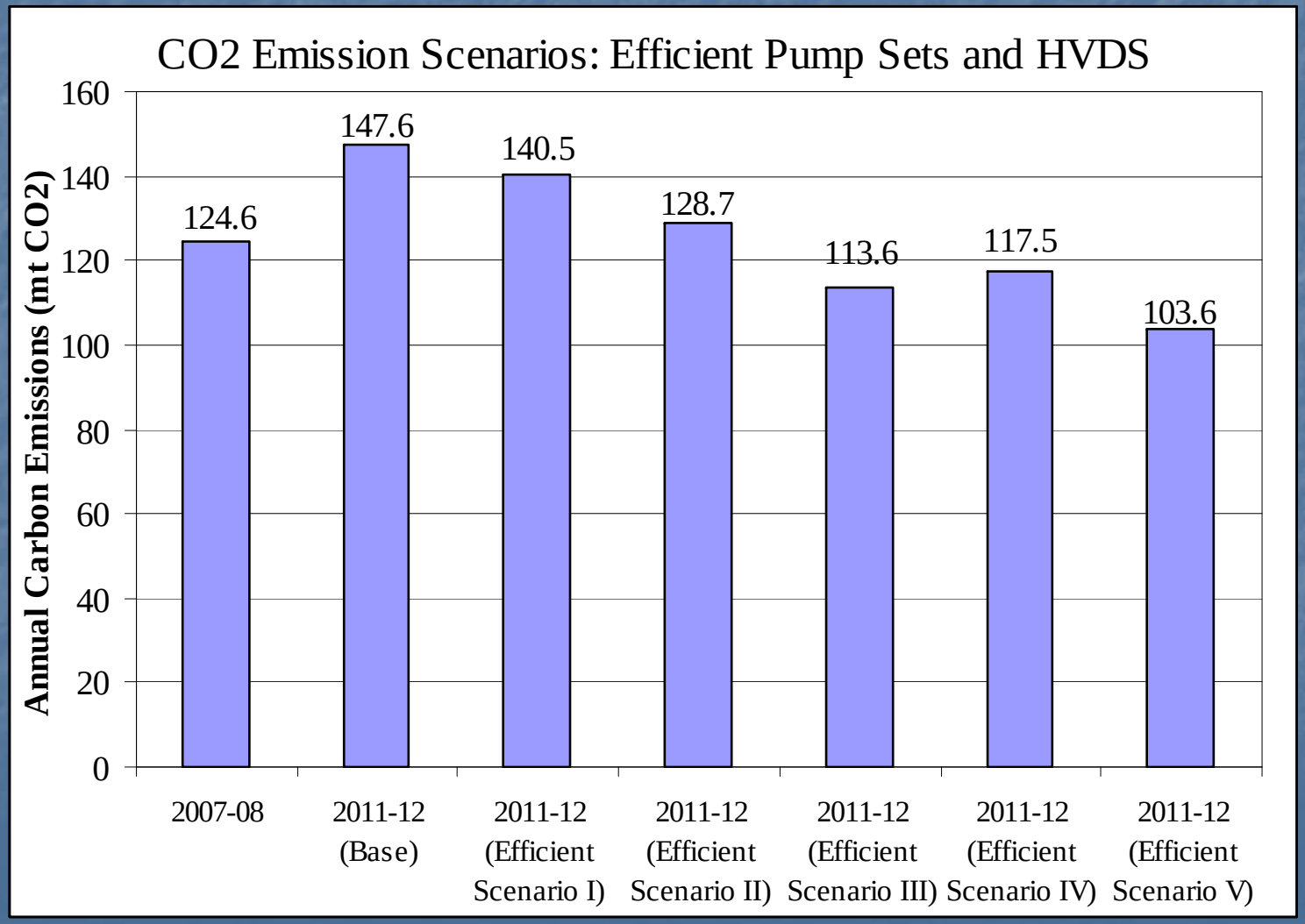
Significance of Agriculture Consumers in Power Sector



Improving Efficiency of Agricultural Pump Sets

- **Policy description:**
- The policy prescription is to implement a joint programme for replacement of inefficient agricultural pump sets (including motor/engine and pump assembly) along with mandatory electronic metering of such electricity connections.
- Such a program should be supplemented with feeder metering and system up-gradation of the low-tension (LT) network with High Voltage Distribution Systems (HVDS) .
- The distribution companies (discoms) should also undertake separation of rural feeders with partial support from APDRP.

CO2 Emissions Scenarios with adoption of Efficient Pump sets and HVDS



Distribution Network to High Voltage Distribution System (HVDS)

- **Policy Description:**
- The existing low-tension (LT) distribution system in India is largely supported through 100 kVA or 63 kVA distribution transformers, which feed various consumers through long LT lines rated at 400 Volts.
- With HVDS, a greater part of the LT network can be upgraded to 11 kV lines with numerous small capacity transformers to feed consumers.
- Any residual LT lines would be replaced with Aerial Bunched Conductors (ABC). Additionally, metering of DTs and their LT connectivity would add further impetus to efficiency improvements and transparency in the system.

- Stages for Implementing the Selected Policies

Responsibility	Clean Coal Technology	Upgraded Distribution Network	Efficient Agricultural Pump sets
Policy Formulation	Supercritical, Ultra Supercritical and IGCC technology for coal based electricity generation with milestones	Conversion of low voltage distribution network to HVDS (with DT metering system strengthening) Conversion of LT lines with ABC	Policy Direction to adopt efficient agricultural pumps in a phased manner.
Policy Description	All new addition to capacity to utilize supercritical technology if plant size is 500 MW or above. Additional UMPPs to use Ultra SC tech. IGCC demonstration plants (incl. CCS).	Setting specific standard for ABC and HVDS system. Timeline for implementation in identified areas/states	Setting specific technical standards for motors, pumps, fittings, conversion efficiency, rating, safety features.
Programme Design	Identification of plants for the 12th five year plan onwards. Upcoming plants of central and state generating companies for which choice of technology is yet to be frozen (11th five year plan). Status of Domestic manufacturing base and international technology availability.	Phased program for conversion of LT network to HVDS system. Setting responsibilities for identification, coordination with MoP and SERCs for implementation.	Selection of specific areas for pilot Programme. Phasing of motor replacement program across various states, creation of databank for implementation, monitoring and follow up with in states. Rating of efficiency of agricultural supply and utilization by an independent domestic agency.

Responsibility	Clean Coal Technology	Upgraded Distribution Network	Efficient Agricultural Pump sets
Implementation	Adoption by Project Developers. Enhancement of domestic manufacturing capacity International commercial technical collaboration	Contract Design, award, Progress reporting verification and testing.	Phased rollout plan of the Programme for replacement of inefficient agricultural pump sets. Contract Design, contract award, progress reporting verification and testing.
Monitoring	Status of technology collaboration and domestic manufacturing capacity Outcome of demonstration plants	Quality Progress Report on rollout implementation. Estimation of benefits accused in terms of reduction in network losses and emission reduction.	Monthly progress report along with verification certificate from local rural bodies /NGOs / Consumer organizations Sample quality testing by an independent agency to be appointed by the SERC. Quality Progress Report on rollout implementation. Estimation of benefits accused in terms of reduction in network losses and emission reduction
Financing	Incremental cost of SC, USC and IGCC Cost of CCS for demonstration plants	Fiscal incentive for ABC & HVDS manufacturers System strengthening to be financed by Distribution Utilities Programmatic CDM APDRP funding for ABC & HVDS	Fiscal incentives to manufactures of top rated efficient motors and pump sets APDRP Funding for up gradation and separation by Min. of Finance of rural network. International funding for inefficient pump sets replacement Programme. Carbon credits under programmatic CDM.

Need for International Cooperation and Financing

S. No.	Policy	Consumers	Distr. Utility	State Govt.	Central Govt.	CDM Financing	Interna -tional Financing
1a	Efficient Agricultural Pump sets	NIL for existing pump sets. Incremental cost for new Connections.	---	---	Y - Partial (BEE)	Programm- atic CDM	Y
1b	Consumer Metering & IT	----	Y		Y – (APDRP)	N	N
1c	Strengthening of Rural distribution Network	---	Y	--	Y - Partial (APDRP)	Y - Partial	Y – Partial

Need for International Cooperation and Financing (contd.)

S. No.	Policy	Consumers	Distr. Utility	State Govt.	Central Govt.	CDM Financing	Interna-tional Financing
2a	Up gradation of Distribution Network with HVDS	N	Y	---	Y - Partial (APDRP)	Y - Partial	Y - Partial
2b	DT Metering & IT	N	Y	N	Y - Partial (APDRP)	N	Y - Partial
3	Efficient Generation Technology	N	N	N	N	Y?	Y
4	Awareness and Capacity Building	N	Partial	Y (Gen. Cos.) Partial	Y	N	Y

Domestic Policy Action

- India's National Action Plan on Climate Change (NAPCC)
- Super-critical Technology for Ultra Mega Power Projects (upto 40,000 MW)
  - Fiscal incentives (no excise duty)
- Use of Washed Coal for Projects > 1000 km from coal mines
- Renewable Portfolio Obligations
  - Renewable Energy Credits

India's National Action Plan on Climate Change (NAPCC)

- Eight national missions as adaptive / mitigation policy options:
- (i) to increase the share of solar energy in the total energy mix,
- (ii) to implement energy efficiency measures,
- (iii) to launch sustainable habitats,
- (iv) to ensure effective water resource management,
- (v) to safeguard Himalayan glaciers and mountain eco-system,
- (vi) to enhance eco-system services,
- (vii) to make agriculture more resilient to climate change, and
- (viii) to set up a Strategic Knowledge Mission for focused research in these areas.

ISDCP - II

	Phase I	Phase II
Identify	Yes	Specifics
Quantify	Partial	Specifics
Apply	Partial	Stakeholder Discussion
Monitor (metrics)	---	Yes

ISDCP - II

- Metrics for Policy Implementation
  - Input Based (measured now)
  - Outcome Based (measured later)
  - Outcome Based Policy Input (measured now)
- Financing and technology

Is technology a challenge in policy implementation?

- Availability
- Accessibility
- Financing

- ‘Existing’ Vs ‘Future’ Technology

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Thank you