



GOVERNMENT OF INDIA
MINISTRY OF POWER

सत्यमेव जयते



A Maharatna Company

NETRA

NETPC Energy Technology Research Alliance

WELCOMES

Participants of Webinar

On

Accelerating Clean Energy Innovation in India

14.09.2016

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Mission Innovation : Accelerating Clean Energy Innovation In India



Hon' ble Prime Minister of India



सत्यमेव जयते

Ministry of Power Government of India



Hon' ble Minister of State (I/C)
Power, Coal, New & Renewable Energy

- ❖ The Ministry of Power is primarily responsible for the development of electrical energy in the country
- ❖ The Ministry is concerned with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects, training and manpower development and the administration and enactment of legislation in regard to thermal, hydro power generation, transmission and distribution.



पावर गिड कारपोरेशन ऑफ इंडिया लिमिटेड
(बल्ल समार का उरुम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)



BUREAU OF ENERGY EFFICIENCY
Government of India, Ministry of Power





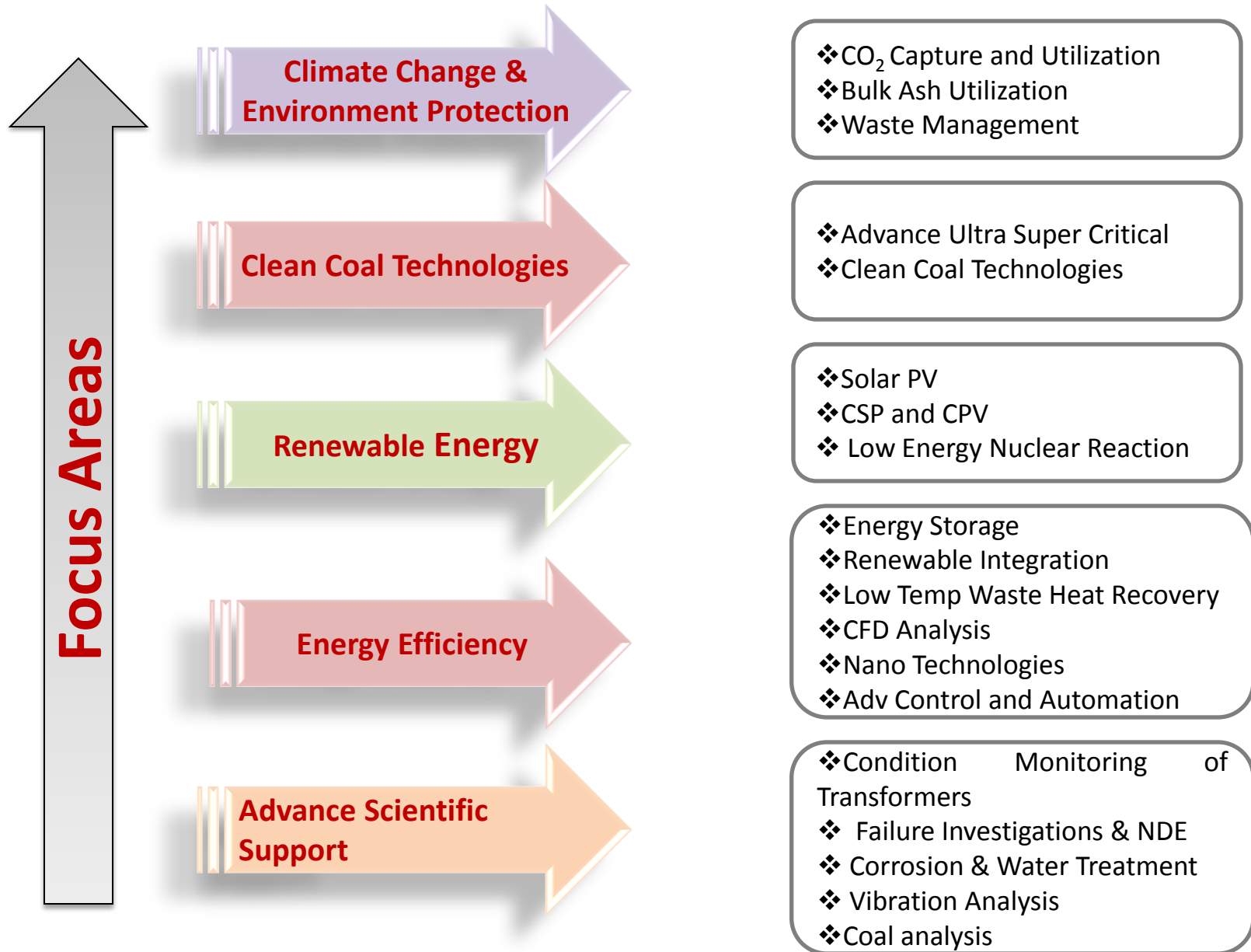
Mission Innovation – Accelerating the Clean Energy Revolution



Majority of Research on Clean Coal Technologies /Clean Energy is being done by NTPC-NETRA

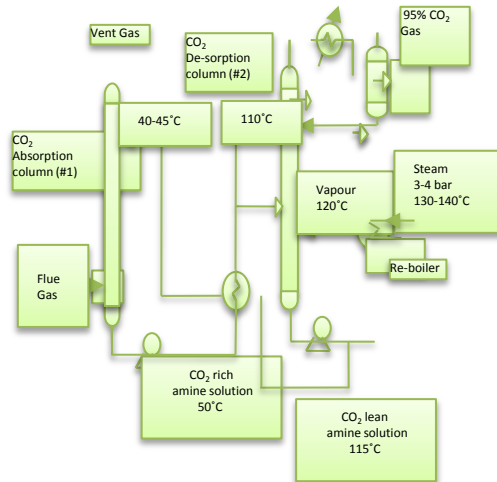


Mission Innovation – Accelerating the Clean Energy Revolution



Focus Areas - Climate Change & Environment Protection (CO₂ Capture & Utilization)

Development of Modified Amine for CO₂ capture



PSA based CO₂ separation Pilot scale



CO₂ Utilisation through Algae



Salient details:

- CO₂ absorbed in Mono Ethanol Amine (MEA) at 40-45°C (Col #1)
- CO₂ desorbed using steam at 120-125°C (Col #2) energy intensive : ~ 4.2 GJ/ ton CO₂
- 20 LPM test facility

Benefits:

- Energy efficient CO₂ separation

Salient Details:

- Adsorption materials & Lab scale PSA process developed
- Phase-I: DPR for set up of PSA based CO₂ capture pilot plant in coal fired station
- Phase-II: Installation of pilot plant & process optimization

Benefits:

- Techno economical CO₂ capture from flue gas

Salient Details:

- CO₂ sequester capacity of algae – 200% of its weight
- Algae may contain bio-oil up to 30% by weight
- CO₂ in flue gas can accelerate algae growth
- Setup race way open pond pilot plant - 20 & 50Sq.M

Benefit :

- Utilisation of CO₂



Focus Areas - Climate Change & Environment Protection (Bulk Ash Utilization)

Setting up of Light Weight Aggregate (LWA) Plant



Salient Details:

- The Established technology
- Utilizing the fly ash in an eco friendly manner
- The alternate to stone aggregates

Benefits:

- Bulk Fly ash utilization for NTPC stations
- Light in weight
- Conservation of precious natural resource

Developing Cement Free Green Concrete - conversion of Fly Ash into Geo-Polymers and Construction of Road



Salient Details:

- University of Melbourne, Australia - 100 % use of fly ash with additives without cement requirement
- Developing Cement Free Green Concrete

Benefits:

- Bulk Fly ash utilization for NTPC stations
- Conservation of Environment

Use of Bottom Ash as replacement of fine aggregate (sand) in cement concrete



Salient Details:

- Replacement of conventional sand by bottom ash in concrete mixes.
- Casting & Testing of Concrete samples as per relevant IS/ASTM/DIN/ISO method

Benefits:

- Bulk Fly ash utilization for NTPC stations
- Conservation of precious natural resource



Focus Areas - Climate Change & Environment Protection (Waste Management)

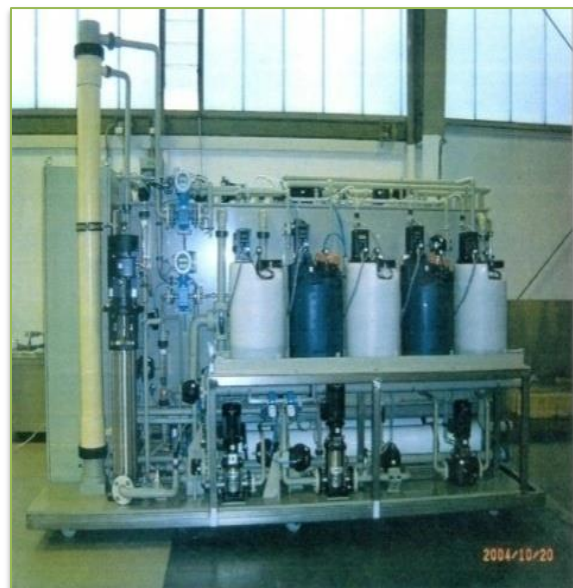
Effluent Recycling

Salient Details:

- 125 m³/hr Waste water recycling
- High cost of water charges
- High water requirement by DM plant

Benefits:

- Step towards zero discharge.





Focus Areas – Clean Coal Technologies

Development of Advanced USC Technology

Project objectives

Enable Indian industries to design, manufacture and commission higher efficiency coal fired power plants with indigenous developed technology and manufacturing process.

Initiatives and Current status

- ❖ Development of thermal power plant with steam parameters $310 \text{ kg/cm}^2 / 710^\circ\text{C} / 720^\circ\text{C}$ with plant efficiency of 46%
- ❖ Consortium of BHEL, Indra Gandhi Centre of Atomic Research (IGCAR) & NTPC
- ❖ Project : 7 years (R&D – 2.5 years; Demo plant – 4.5 years)
- ❖ Benefits: 20 % reduction in CO₂ emission at source, 20% saving in coal consumption compared to a sub-critical plant

Other Initiatives

- ❖ ESP efficiency improvement for SPM reduction
- ❖ Use of CFD for Flue gas and particle flow analysis
- ❖ Advanced coal combustion
 - Boiler combustion studies using CFD modeling
- ❖ Drop Tube reactor
 - Design and development of Drop Tube Reactor (DTR) to evaluate coal kinetics in boiler combustion condition of heating rate.
- ❖ Coal Combustion Simulation for Boiler parametric study



Focus Areas – Renewable Energy (Solar PV)

1. Indigenous Development of Solar PV floaters

Salient Details:

- 5 kWp Pilot Setup of Floating PV with indigenous designed floaters on patented technology

Benefits:

- Low cost Floating PV system
- Water & Land Conservation



2. Set Up of State of Art Concentrated PV and Solar PV Laboratories

Salient Details:

- Installation of 53 kWp CPV system & Test Tracker
- Studies: Spectral Response, Tracking accuracy

Benefits

- Explore possibility of CPV system in large scale & Capacity building for PV system testing



3. Comparative Study of 1-axis/2-axis Tracker based PV System

Salient Details:

- Single, Dual and fixed PV with 4 kWp each with same panels
- Technology comparison for tracking system

Summary of study:

- Average % increase (%) kWh of Single Axis Tracking system over fixed system is 15.54 and of Dual Axis Tracking system is 22.09.





Focus Areas – Renewable Energy (Solar PV)

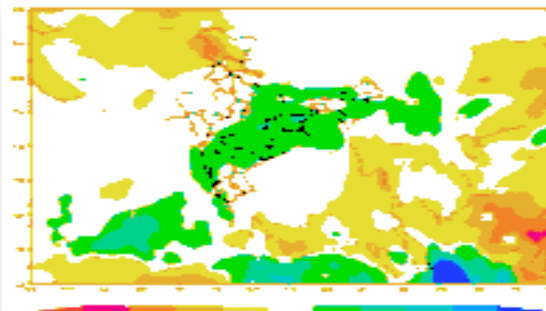
4. Development of Centralized PV Forecasting Solution

Salient Details:

- Day-ahead Uniform generation forecast across NTPC
- Study of fog, storm on generation forecasting accuracy

Benefits:

- Minimize the operational uncertainty and challenges
- Better understanding of local weather impact on solar resources



5. Indigenous Development of Robotic Dry Cleaning system

Salient Details:

- Dry cleaning of Solar PV panel using robotic units
- No external source of power, fully energy independent
- Self auto Cleaning
- Remotely operated

Benefit :

- No use of water
- Improved generation as soiling loss are minimized because of daily cleaning





Focus Areas – Renewable Energy (Solar Thermal)

6. Set Up of State of Art Solar Thermal Laboratories

Component & Prototype Evaluation Facility	DEFLECTOMETRY Test Facility
	PHOTOGRAMMETRY Test Facility
	Reflectance Lab
Solar Radiation Measurement and Modeling Facility	Solar Radiation & Meteorological station - ISO Secondary Standard
	Solar resource assessment - Site-specific
CSP Simulation Tools (Design, Optimization and Evaluation of CSP plants)	GREENIUS - Simulation tool for techno-economic assessment of CSP systems
	STRAL - Optical design and optimization tool
	EBSILON - Thermodynamic design and simulation tool



Focus Areas – Renewable Energy

7. Experimental Studies in Low energy nuclear reaction (LENR) for power generation

Salient Details:

- World is looking for clean energy solutions to replace fossil fuels.
- 10kW new energy power packs based on exothermic interactions between Nano metallic powders (Ni, Pd) producing excess, clean and sustainable energy has been proved.

Benefits:

- Feasibility of a cutting edge environmental friendly technology, to retrofit operating power plants, replacing fossil based boilers with LENR boiler
- Distributed power generation source.





Focus Areas – Energy Efficiency (Energy Storage)

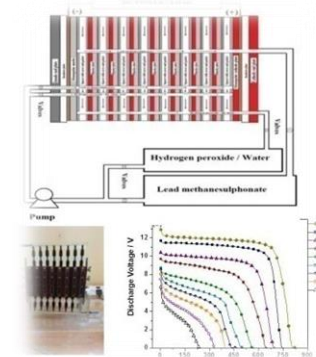
1. Development of 500 W- 5h Soluble Lead Redox Flow Battery (SLFB) Storage

Salient Details:

- Low cost grid scale battery storage
- Flow Battery with Lead acid technology, without membrane
- Project size: 500 W-5 h
- Scale up to 100 kW-5 h size (future project)

Benefits:

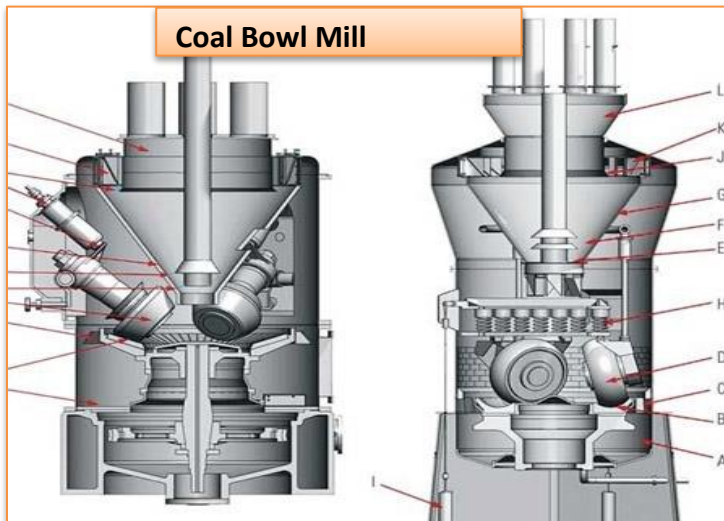
- Low cost Battery Storage



2. Study of operation of NGK's NaS battery for Storage in Indian Condition

Focus Areas – Energy Efficiency (NaNo Technologies)

Nano-lubricant for Coal Mill Gear Box



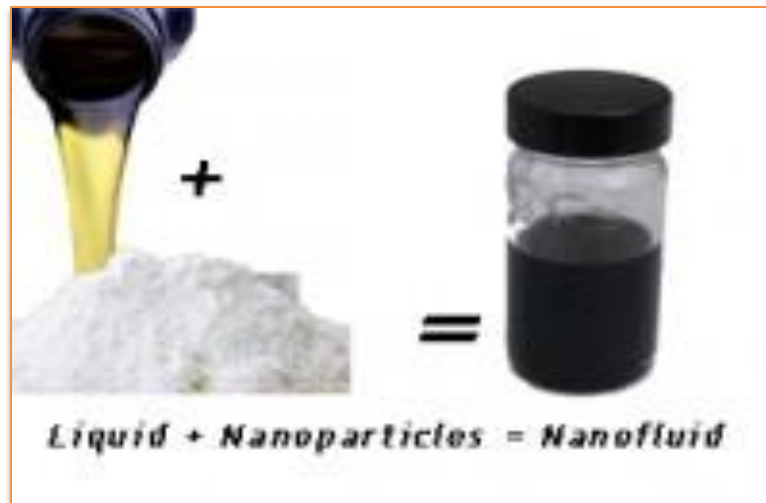
Salient Details:

- Modified Graphene Nano additives

Benefit :

- APC reduction
- Improved Equipment & Oil life

Nano-coolant for heat exchangers



Salient Details:

- Development of nanomaterial
- Field trials in power plants.

Benefit :

- Enhanced heat transfer
- Smaller heat exchanger,
- Reduced space requirement & water conservation



Focus Areas – Energy Efficiency (Low Temperature Heat Recovery)

Project objectives

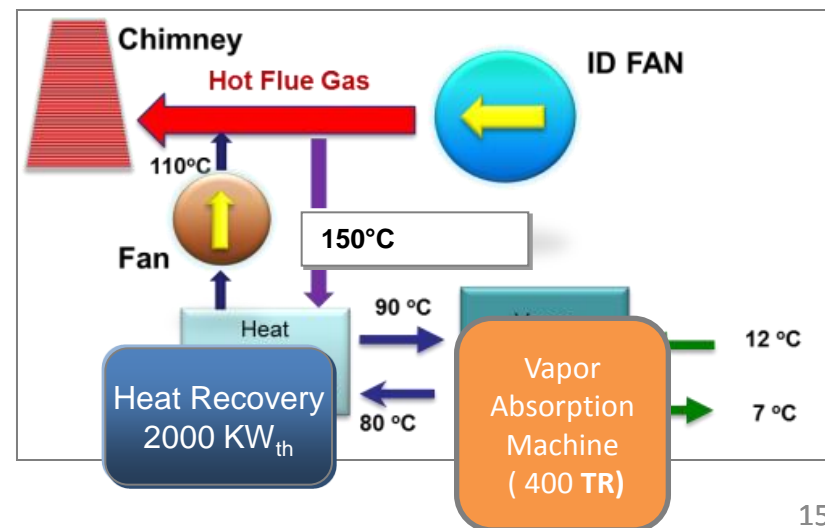
To utilize waste heat of Flue gas for useful purpose, thereby achieving higher efficiency of coal fired power plants

Salient Details:

- Capacity: 100 TR
- Single effect Li-Br VAM
- Utilizes LT heat from FG for AC

Benefit:

- Waste heat utilization for air conditioning of ESP and ASPH Control Room
- Green House Gas (CFC & HCFC) free VAM based AC system.
- 50 kW less power than conventional AC system of 100TR
- Low carbon foot prints
- CFC & GHG free system





Focus Areas – Energy Efficiency (Advance Control & Automation)

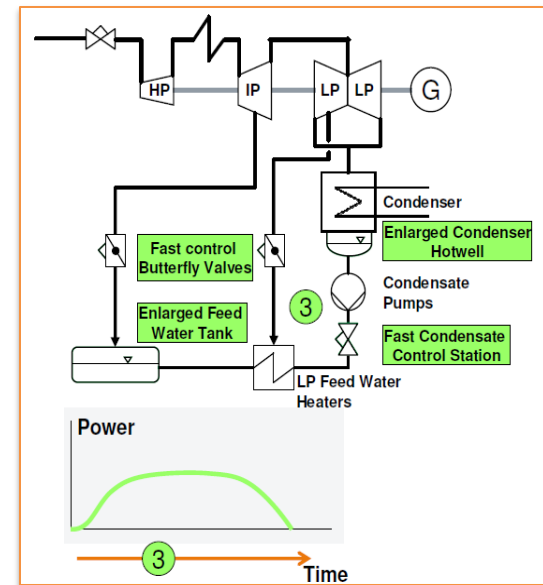
1. Flexible Coal Unit Operation

Salient Details:

- Assessment of unit for flexible operation and potential assessment
- Integration of condensate throttling and other solutions

Benefits:

- Use of thermal storage for quick increased unit output
- Unit Optimization for grid support in view of increased RE penetration



2. Installation of Phase Matching Units (PMUs) at Generating End on the Grid

3. NTPC e- Power Plant Solutions (NePPS)



Advance Scientific Support



1.Environmental Science Lab

2.Water Treatment Tech Lab

3.Coal & Combustion Lab

4.Creep Lab

5.Electrical Lab

6.Transformer Oil Lab

7.Corrosion Analysis Lab

8.Lub Oil & Tribology Lab

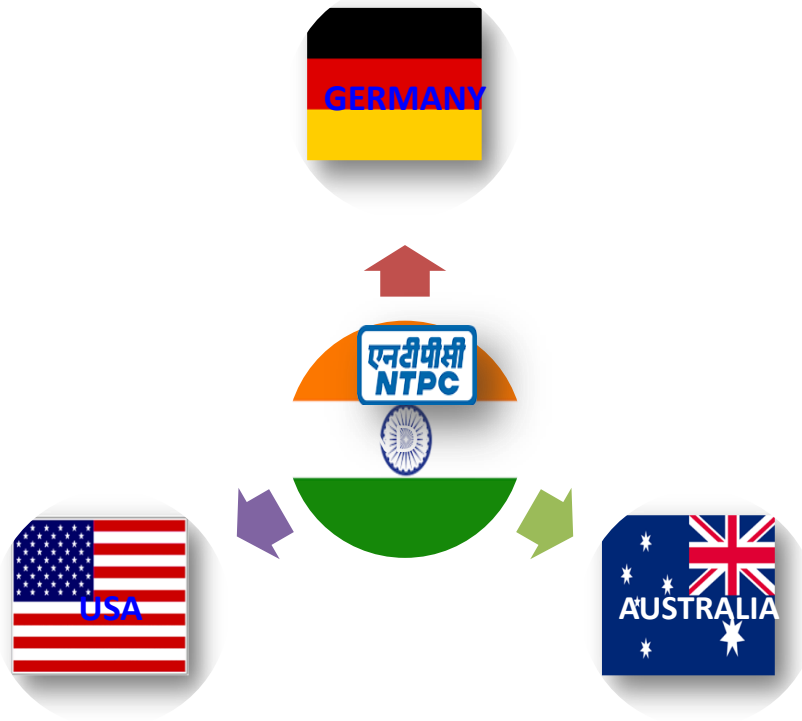
9.Analytical Lab

10.NDE & Imaging Lab

11.Metallurgy & Failure Analysis Lab



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DLR, Germany	Solar Thermal Lab
ISE ,Germany	Concentrated PV
VGB ,Germany	CFD modelling
CSIRO, AUSTRALIA	Advance Combustion and Gasification Technologies
MIT, USA	Renewable, CCUS
Curtin University, Australia	Advance Combustion and Gasification Technologies
Melbourne University, Australia	Bulk Ash Utilization



Mission Innovation – Accelerating the Clean Energy Revolution



**Our
collaborations**

**National-R& D Centers &
Academia**



IGCAR, Kalpakkam	AUSC
CIPET, Chennai	Floating Solar
CPRI, Bangalore	Drop Tube Reactor, Fly ash bricks
ARCI, Hyderabad	Nano coating
CGCRI, Kolkata	Fiber Optic Sensor for APH FG temp.
IIP, Dehradun	CO2 Capture
IIT , Guwahati	CO2 Capture
C-DAC , Pune	Computational hardware
Jadavpur University, Kolkata	Transformer health assessment
AMPRI, Bhopal	Ash Utilization
CBRI, Rookee	Ash Utilization

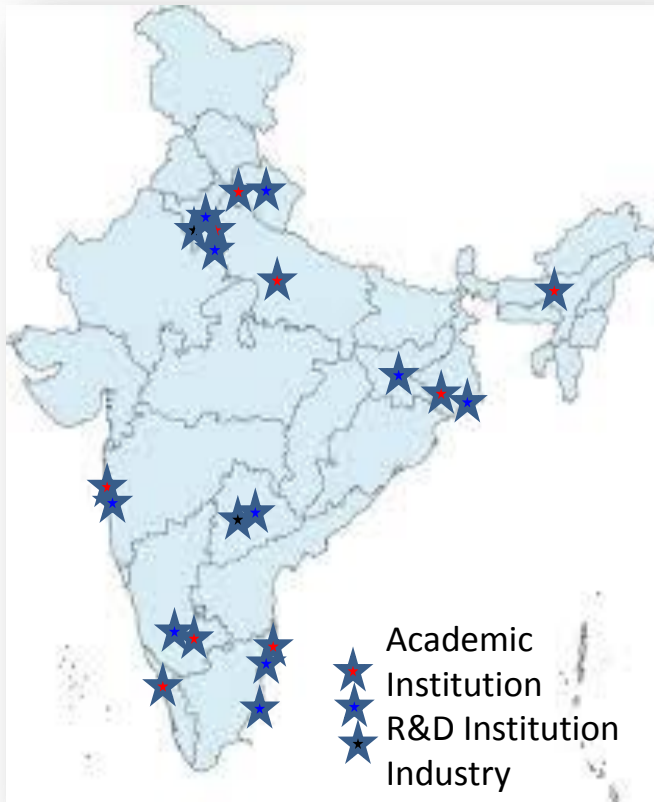


Mission Innovation – Accelerating the Clean Energy Revolution



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Academia**



IIT B	Solar, Robotics, MEMS, Corrosion
IIT K	Power System Smart Grid, Sensors,
IIT D	Simulation & Modeling, AI, CFD, Solar PV
MIDHANI	Development of erosion resistant component
TERI	Water Foot print
NCCBM	RCC Structure-Audit and Survey
EEC	ESP performance improvement using CFD Modeling
IISc	Process simulation, Flow Battery
NML	Creep Damage Assess of High Temp Headers & Pipe
IOCL	Micro-Algae based CO ₂ utilization

Thank You!

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