Coal Beneficiation Technology – 2007

INCORPORATING GENERIC ISSUES OF COAL BENEFICIATION TECHNOLOGY IN COAL R&D POLICY

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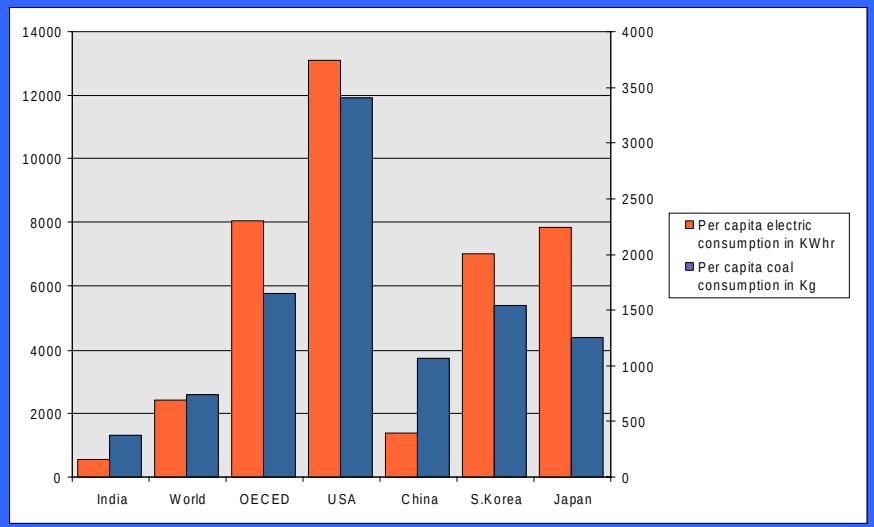
Workshop on Coal Beneficiation and Utilization of Rejects, Initiatives, Policies and Best Practices, at Indian Institute of Coal Management, Ranchi on 22-24 August 2007

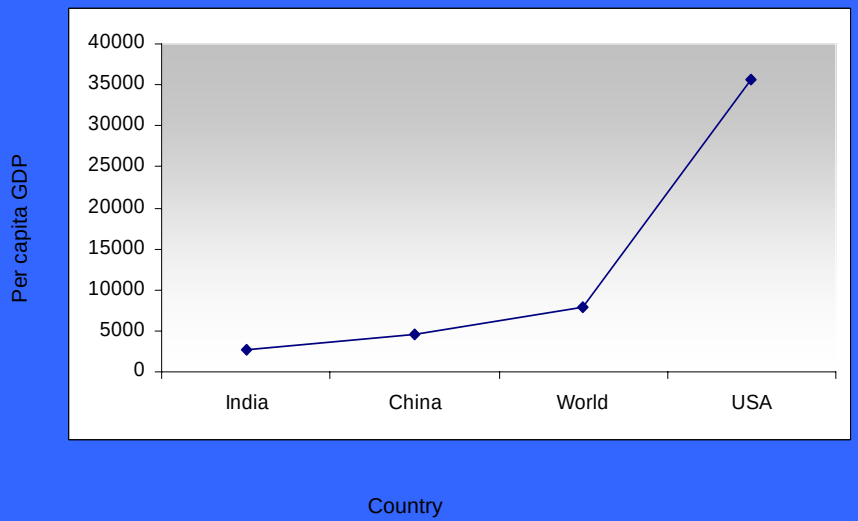
Current Status

PER CAPITA ENERGY CONSUMPTION AND COAL CONSUMPTION FOR DIFFERENT COUNTRIES



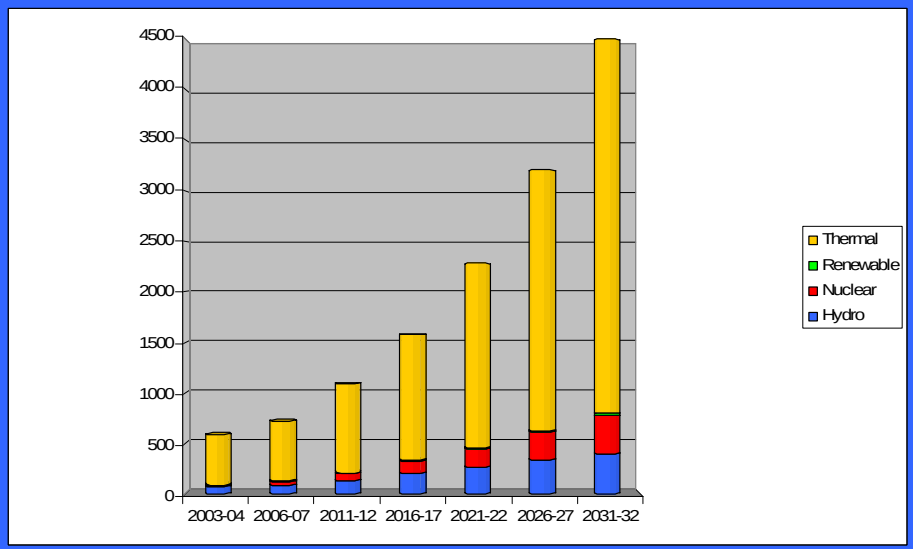
energy consumption per capita in India 553 kWhr

PER CAPITA GDP

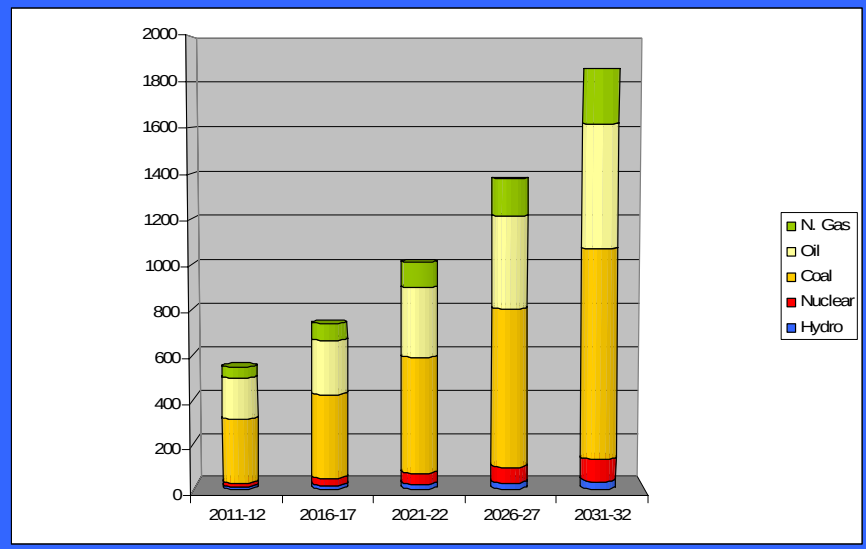


World average energy consumption per capita was 2429 kWhr in 2003,

Future Projections



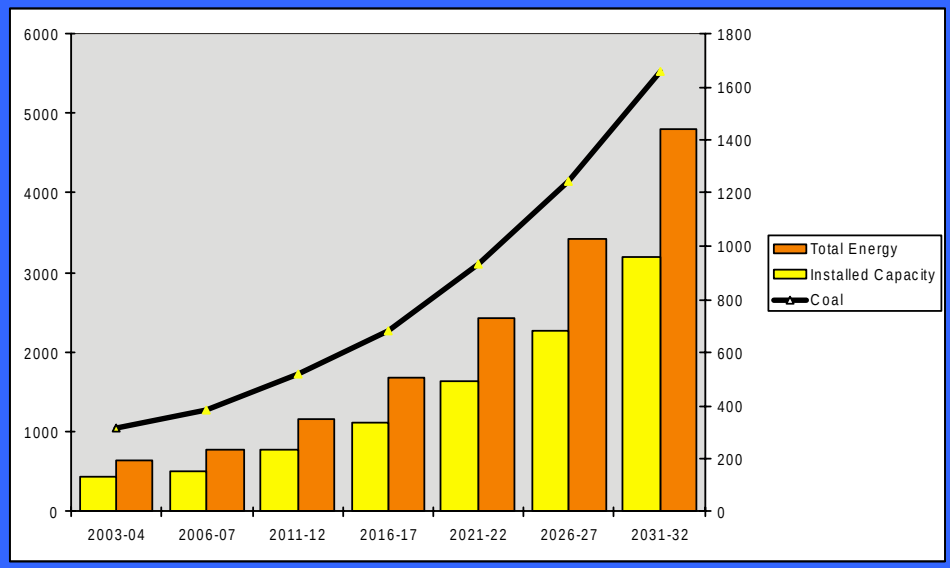
Projections of Electricity Generation



Fuel Scenario in India

Source: Integrated Energy Policy of India

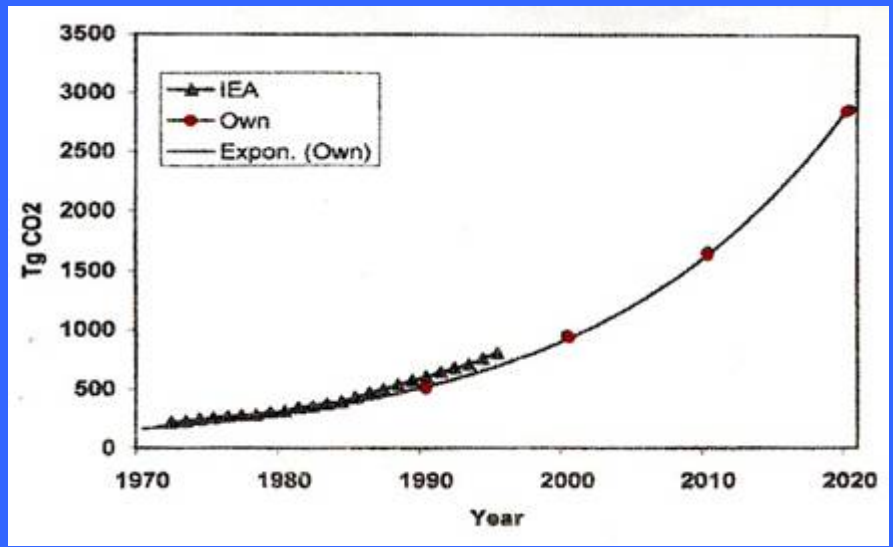
Coal Use Growth Scenario and CO2 Emissions Projections



Energy security in 21st century will rely on environmentally friendly use of fossil fuels

Integrated Energy Policy

Current Coal Production in India is about 450 MT/ annum



Source: Center for Global Change, India

Framework Actions For Coal Use in Energy Sector

- UN Framework Convention on Climate Change (UNFCCC) signed at the Rio Earth Summit in 1992. Ratified by India in 1993
- Kyoto Protocol introduced in 1997 and came into effect on 16TH Feb 2005
- US, DOE Initiative on Carbon Sequestration Leadership Forum launched in 2003, India is member among 22 countries
- Asia Pacific Partnership on Clean Development and Climate in 2005, US, Australia, China, Japan, India and South Korea as partners.
- World's first zero emission coal fired plant on FUTUREGEN, India joined in 2006 represented on Government Steering Committee
- Coal R&D programmes of other Nations include; CANMET, COAL2, EAGLE, ZECA, CCPC, CCTI

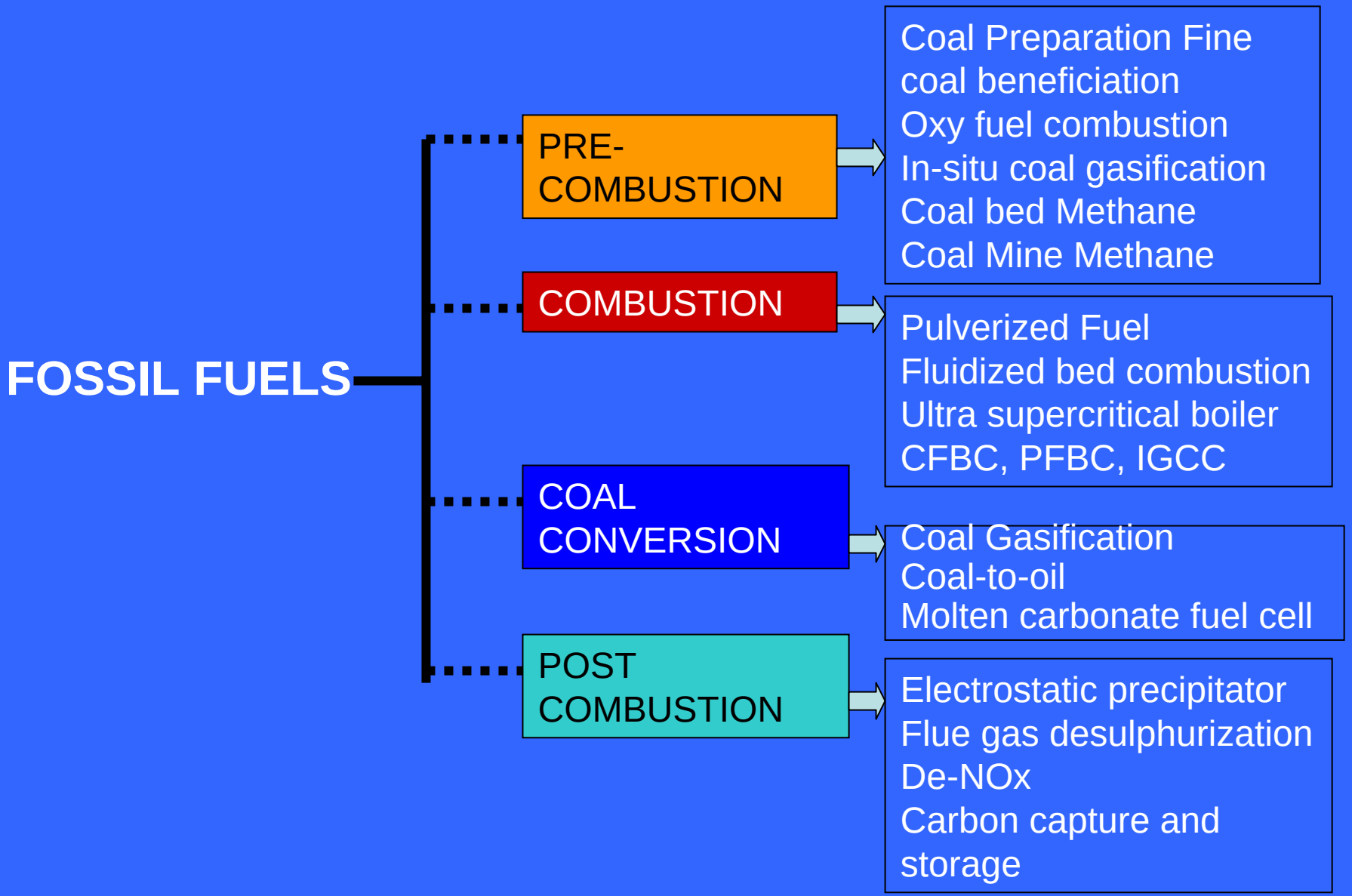
Science & Technology for Coal Beneficiation Technology

- **NCST Report in Energy Sector in 1973**
- **Thrust to R&D on Coal Beneficiation, Coal Gasification, Liquefaction and IGCC in 1986**
- **Pre Combustion Technology Assessment Study conducted by DST in 1996**
- **Gaseous emissions reduction using coal preparation,**
- **The Study led to Policy guidelines in 1997 for use of washed coal with < 34% ash in power plants at 1000km from pit head or in urban areas**
- **New guidelines for setting up coal Washeries by Ministry of Coal in 2005**
- **Clean Coal Technology Initiative (CCTI) – An Indepth Study by DST in 2006 to address issues in Coal-Energy Chain**

Science & Technology for Clean Coal Technology – Workshops

- **DST-CII Workshop on Pre-combustion Clean Coal Technology in 1996**
- **DST -BHEL Workshop jointly with Industry and concerned Government Ministries, participation of stakeholders to discuss the findings of the study on CCTI in an open forum on Oct. 26-27, 2006 and develop technology Roadmap.**
- **International Workshop organized on R&D Challenges in CCS Technology for Sustainable Energy Future organized by DST with NGRI on January 12-13, 2007 at Hyderabad attended by 19 eminent International experts.**
- **Inter-Sectoral Interaction Meets on CO2 sequestration Technology to give thrust to research in clean coal technology projects**
- **Indian CO2 Sequestration Applied Research (ICOSAR) network launched for wider dissemination of information**

Science & Technology For Using Fossil Fuels for Clean Energy



Problems in adoption of CCT

- Coal availability for desired application
- Increasing cost of Power generation
- Poor quality of coal
- Technology to suit local production lines
- Coal regulations
- Technology for coal mining

Generic Issues - Technical

- Understanding coal performance
- Fundamental generic research on coal combustion
- Rapidly advancing Clean Coal Technology to achieve goals of zero emission technology.
- In India efforts towards clean coal technology development began almost two decades ago, has not kept pace with the developments
- Lack of Research environment in Indian Industry

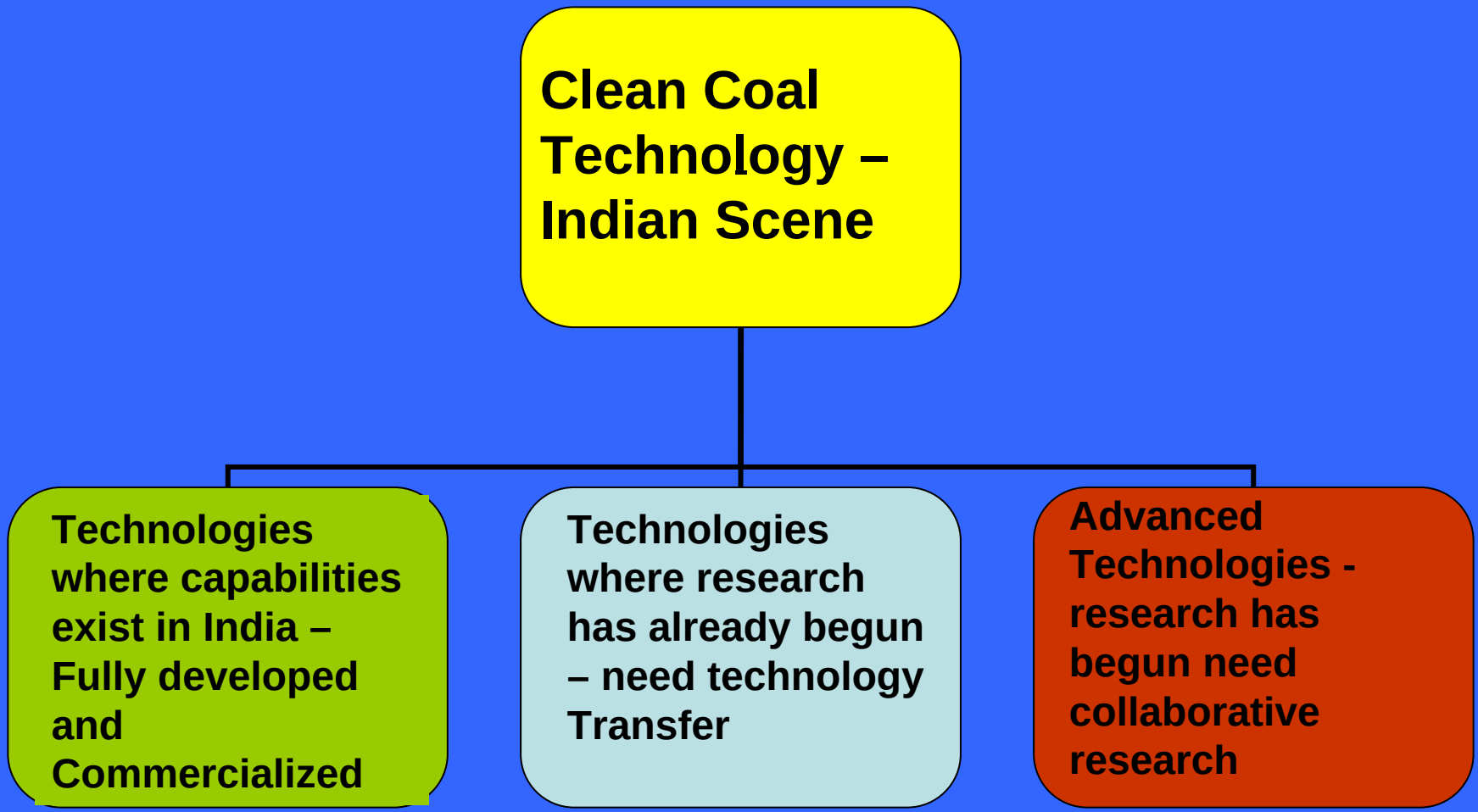
Generic Issues- Financial

- Low Pricing of Washed Coal
- Additional Cost involved in adoption of Clean Coal Technology
- Key questions are Who Invest and Why Invest in clean coal technology development,
- Inadequate R&D infrastructure in academic Institutions and National Laboratories
- Cost effectiveness in the long run

Generic Issues- Policy

- ✓ Research on Impact Assessment of Coal Quality for Clean Power Generation
- ✓ Integrated Energy Policy 2006 suggests creation of R&D fund for Energy
- ✓ Appropriate marketing strategy needed for utilization of clean coal
- ✓ Rate & Responsibility of Coal Producer and Coal user industry
- ✓ Generic Evaluation of Industrial Research

Coal Beneficiation Technology Status



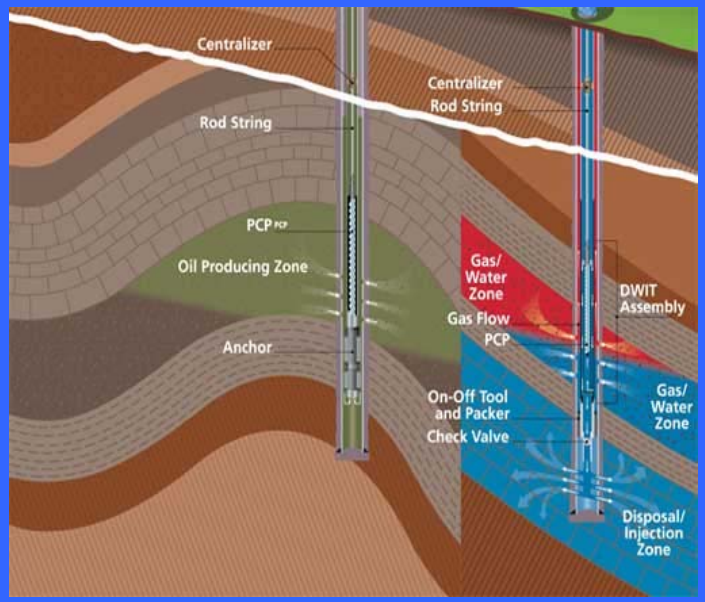
Technology Where Capabilities Exist

- Preparation of Low Rank Coal
- Coal Washing of Rejects
- Briqutte production
- Pulverized Fuel Combustion
- Electrostatic precipitator
- Fluidized bed combustion
- Fisher-Tropsch synthesis for coal-to-oil
- Super critical steam boiler
- Circulating fluidized bed coal combustion

Technology Where research has Begun- are in Commercial/ Demonstration Elsewhere

- Ultra supercritical steam boiler
- Pressurized pulverized coal combustion
- Integrated gasification coal combustion (IGCC)
- Pressurized fluidized bed coal combustion
- Integrated gasification fuel cell
- Coal Water mixture
- Selective catalytic conversion (De-NOx)
- Lignite liquefaction

Technologies of Future - are in Research Phase World wide



A CBM Field

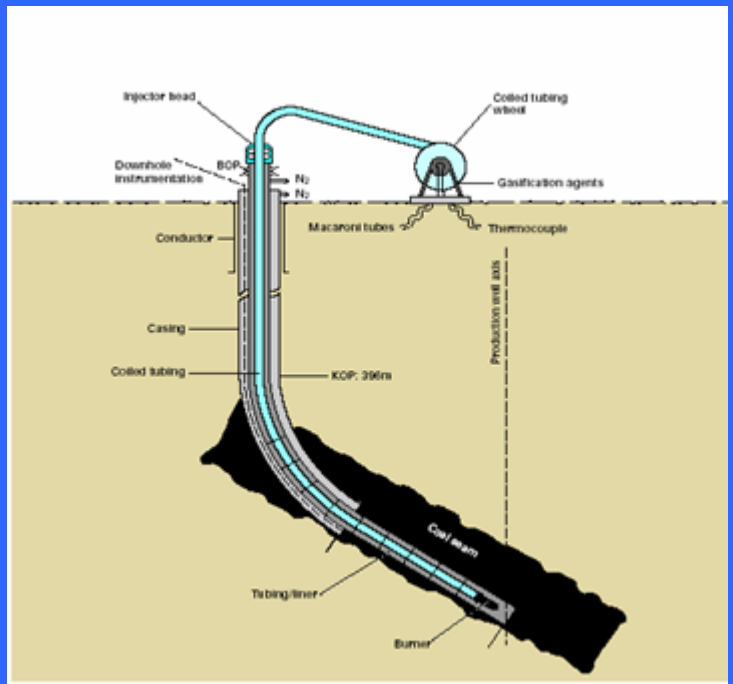
- In-situ coal gasification
- Coal bed Methane
- Coal Mine Methane
- CO2 recovery
- Carbon separation and sequestration
- Oxy fuel combustion
- CO2 Conversion and Utilization
- Hyper-RING

Flagship Technology - In-situ Coal Gasification

A Consortium of several organizations viz.

BHEL, SCCL, CMRI and ISM proposed

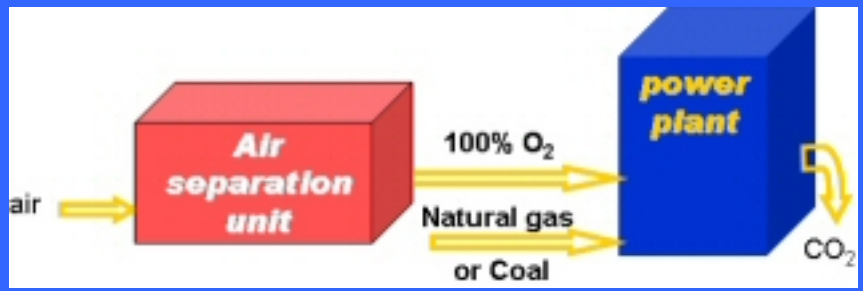
IGCC demonstration unit at Truchy



Controlled Retractable Injection Procedure (CRIP) in the inseam injection well of UCG

Flagship Technology - Oxy-Fuel Combustion

- Oxygen is separated from combustion air and used for burning coal
- CO2 concentration in flue gas can be as high as 90%
- Better technology feasibility for CO2 capture exists
- NOx emissions also reduced
- Improved economic efficiency expected



Flagship Technology - Carbon Capture Research

- Pre-Combustion
  - Coal gas separation
- Post Combustion or Industrial
  - Solvent
  - Cryogenic
  - Absorption
  - Adsorption

Third generation of clean coal technologies

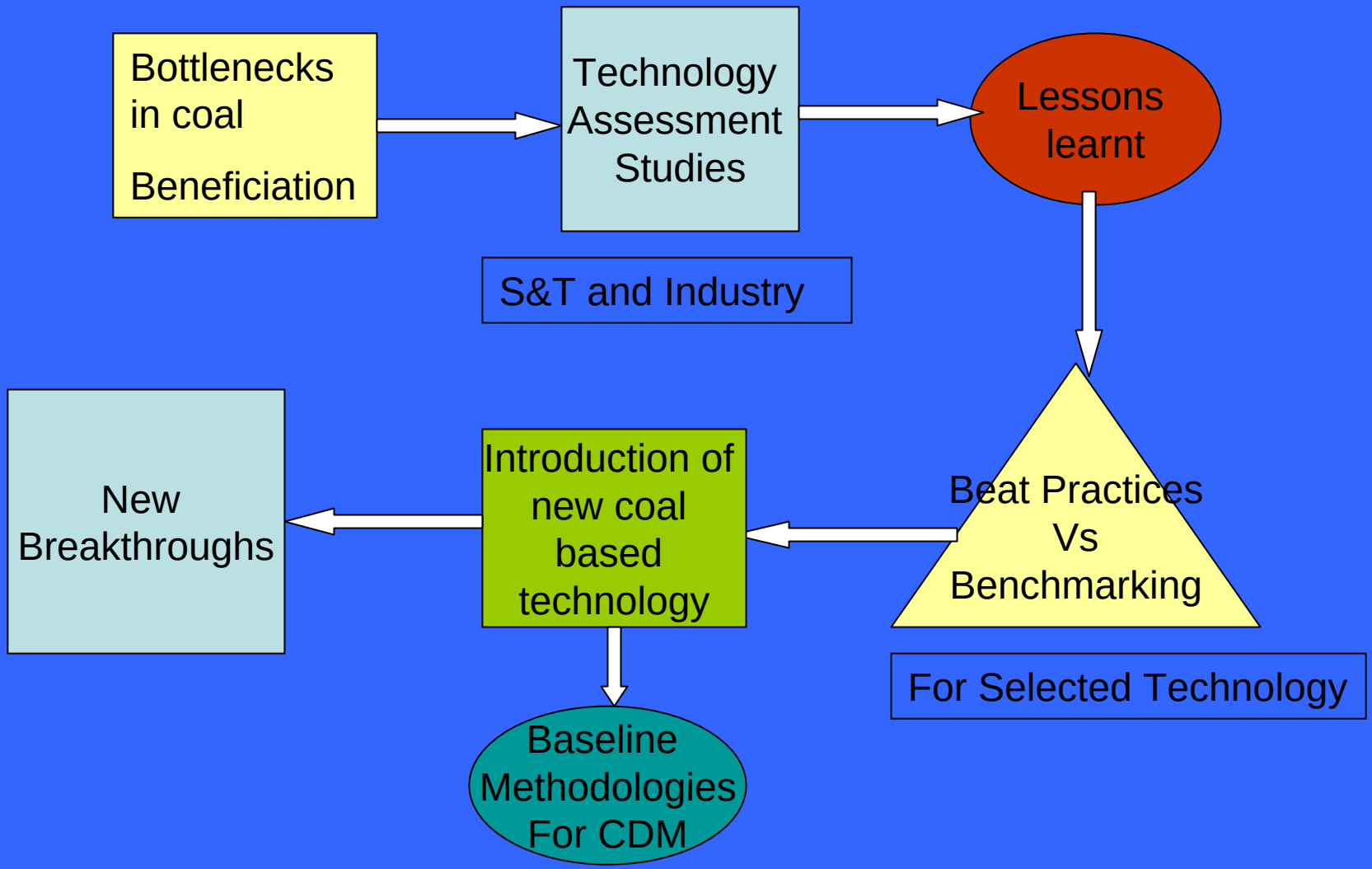
Carbon Storage Research Projects

- Geological sequestration pilot study in Basalt formations of Western India
- Collaborative research on screening criteria development for geological sequestration in Saline Aquifers
- Feasibility Studies on CO2 injection proposed for EOR from Hazira gas. Scoping studies carried out
- CO2 Capture by Photosynthesis is most efficient process of CO2 Capture at Low Concentrations to enhance sequestration of CO2 In Terrestrial eco system proposed

Addressing Generic Issues

- ✓ **Bottlenecks – Integrated approach to coal quality, quantity and its utilization in power generation in an environmentally friendly manner**
- ✓ **Technology Assessment and Feasibility Studies**
- ✓ **Lessons Learnt – Coal Gasification vs Coal Combustion**
- ✓ **Introducing Supplier Chain for improving coal quality**
- ✓ **Technologies for improving coal efficiency**
- ✓ **Best Practices or Bench Marking**
- ✓ **New coal based energy generation technologies that produce higher concentration of CO2 in flue gas would also facilitate carbon capture and storage**
- ✓ **Baseline Methodologies for CDM**
- ✓ **New breakthroughs on the horizon**

Suggestions for Addressing the Issues



Thank You Very Much!

For Further information: Email: mlg@nic.in