

***INTEGRATED GASIFICATION***

***~~COMBINED CYCLE(IGCC)~~***

***Technology for Power  
Development***

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# OUTLINE

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- Power Sector Vision
- R & D Investment
- Coal - The driver of Economy
- Technology Interventions
- Benefits
- R&D in Clean Coal Technology
- Challenges
- Conclusion

## Power Sector Vision

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- National Electricity Policy- Power For All By 2012
- Per Capita Energy Consumption to be 1000 units by 2012.
- Capacity addition in XII Plan: 78577 MW
- Integrated Energy Policy Stipulates installed capacity at 627,088 MW with 7% GDP growth by 2032.

# Energy Security & R&D

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- Mapping energy sources, technology choices, efficiencies and costs to evaluate trade-offs
- Investment in efficiency improvement
- Encouraging commercially viable, environmentally acceptable, goal oriented R&D
- Public R&D Cost to reduce energy delivery cost.
- Indigenous Technology Development

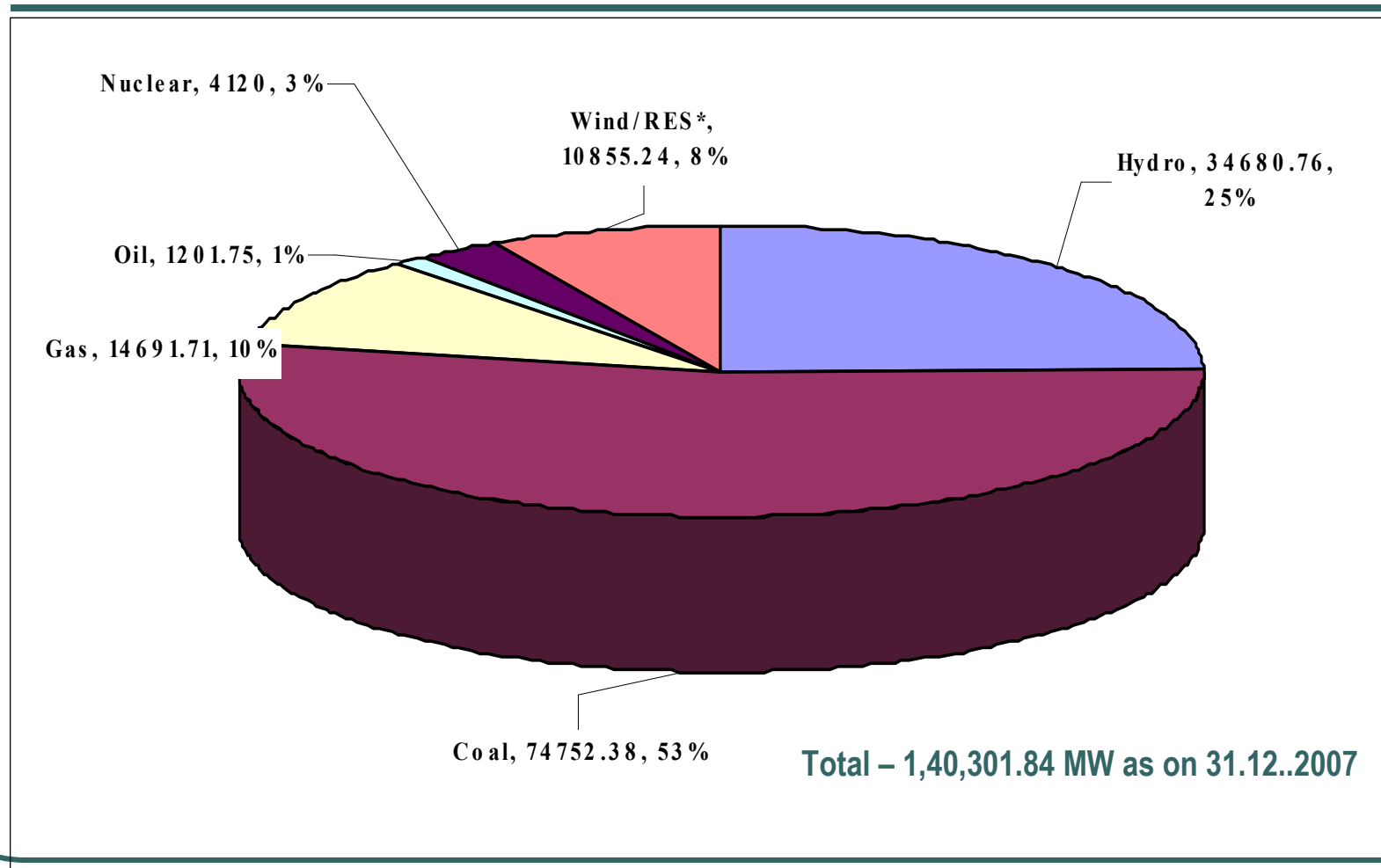
## **R & D Investment in India**

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- Indian investment in R & D is only 0.77% of GDP compared to 1.3% in China and 2.6-2.7% in South Korea & US
- Nearly 75% of investment is from the Govt and only 23% comes from the Industry as against a Govt contribution of 31% in US, 30% in China and 24 % in South Korea.
- Strong Indian presence needed in world-class basic science and technology R & D

# COAL - THE DRIVER OF ECONOMY

**53% of installed capacity is dependent upon coal followed by Hydro(25%)**



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# CONCERNS ASSOCIATED WITH COAL

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- Global Concerns:
  - Availability and price volatility of petroleum fuel
  - Green house gas emissions from coal based power generation.
- Indian Coal has
  - High Ash Content
  - High Ash-Fusion Temperature
  - High Reactivity
  - Low Sulphur Content
- Environmental concerns.

# Per Capita Carbon Emissions are low in India

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- Per capita Carbon dioxide (CO<sub>2</sub>) emission in India is 1.2 tonnes/year as against world average of 4.5 tonnes.

**(United Nations Human Development Report of 2007-08)**

- Per capita CO<sub>2</sub> emission in India is amongst the lowest in the world (USA - 19.61 tonnes, China - 3.88 tonnes).

**(Key World Energy Statistics – 2007, IEA)**

- India is committed to reduce emissions further

# India's Stand

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- India stands by UN framework convention Treaty on Climate Change and Kyoto protocol.
- India, a member of R&D effort in Carbon Sequestration Leadership Forum (CSLF)
- India has joined hands with China, Japan, Canada & EU countries in International Partnership for a Hydrogen Economy (IPHE)
- India collaborated with USA in the FutureGen Project for advanced technologies in thermal generation
- IGCC demonstration plant of 125 Mw is at the project planning stage.

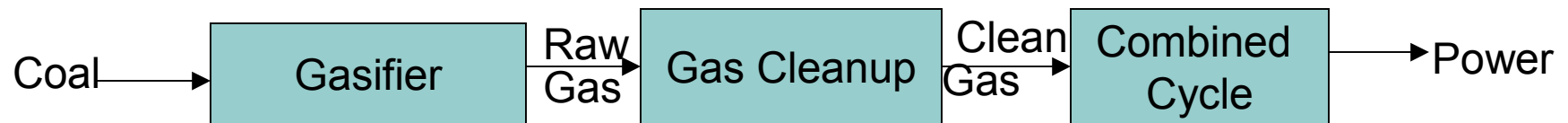
# Technological Interventions

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- Transition from Business as Usual to Zero Emission regime.
  - Near Term
    - Advanced Pulverized Coal-fired (PCF) steam cycles.
    - Fluidised bed Combustion
    - Supercritical technology
  - Long Term
    - Integrated Gasification Combined Cycle
    - Carbon Capture and Sequestration (based on IGCC)

# IGCC

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- Fixed bed gasifier
- Fluidised Bed Gasifier
- Entrained Bed Gasifier

• The type of gasifier suitable for Indian coal needs to be identified/developed.

Gasification could produce clean-burning hydrogen for tomorrow's power generating fuel cells.

## **Efficiency Benefits**

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- Combined Cycle more efficient
- Reduction in Green house gas emissions
- Less (30%) water requirement
- Efficient use of natural resources
- Smaller physical size of plant
- Lack of waste products
- Hydrogen for fuel cell technology

## Environmental Benefits

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- Achieve low Sox, NOx and particulate emissions from burning coal derived gases.
- In IGCC, syngas produced is virtually free from fuel-bound Nitrogen
- Selective Catalytic Reduction(SCR) can be used to reach levels comparable to natural gas firing.

## **R & D Challenges**

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- Reservations about the technological feasibility
- Cost impact
- Needs breakthroughs in other frontier technologies
- While carbon capture is effective, there are reservations about the sequestration

# R & D Strategy

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- Mission mode approach
- Dedicated and time bound effort
- Accelerated R&D focusing on:
  - Economic Viability
  - Commercial sustainability
  - Environmental acceptability
- Extensive Research based on Coal Characteristics aiming at:
  - Combustion efficiency improvement / Heat rate reduction
  - Gasifiers suitable for Indian coal
  - Combined cycle technology for syngas
  - Minimization of CO<sub>2</sub> emission impact / CO<sub>2</sub> Fixation technologies
  - Hydrogen economy

## Conclusions

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- Fossil Fuels to remain dominant energy source in foreseeable future.
- Environmental constraints demand cleaner, more efficient utilization
- Mid term answer is coal gasification.
- Coal gasification could augment hydrogen economy
- R & D effort is critical in this area

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THANK YOU

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