SBSTA

WORKSHOP ON CARBON CAPTURE AND STORAGE

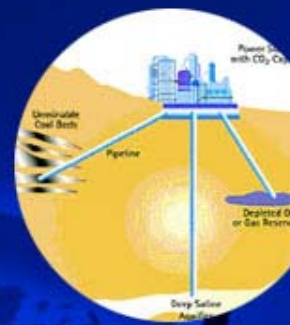
20 May 2006, Bonn Germany

UNFCC 24TH Session of SBSTA-

WORKSHOP ON
CARBON CAPTURE AND STORAGE







CO_2 sequestration

energy

fossil fuels

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CONTENTS

- Fossil fuels for energy
- Technology for clean coal
- Carbon capture and storage
- Current research overview

ENERGY FOR US IN 21ST CENTURY

'The 21st Century global energy context is dominated by demand growth and has a vital role to play'

WCI/IEA Report on Coal

WHY FOSSIL FUELS?

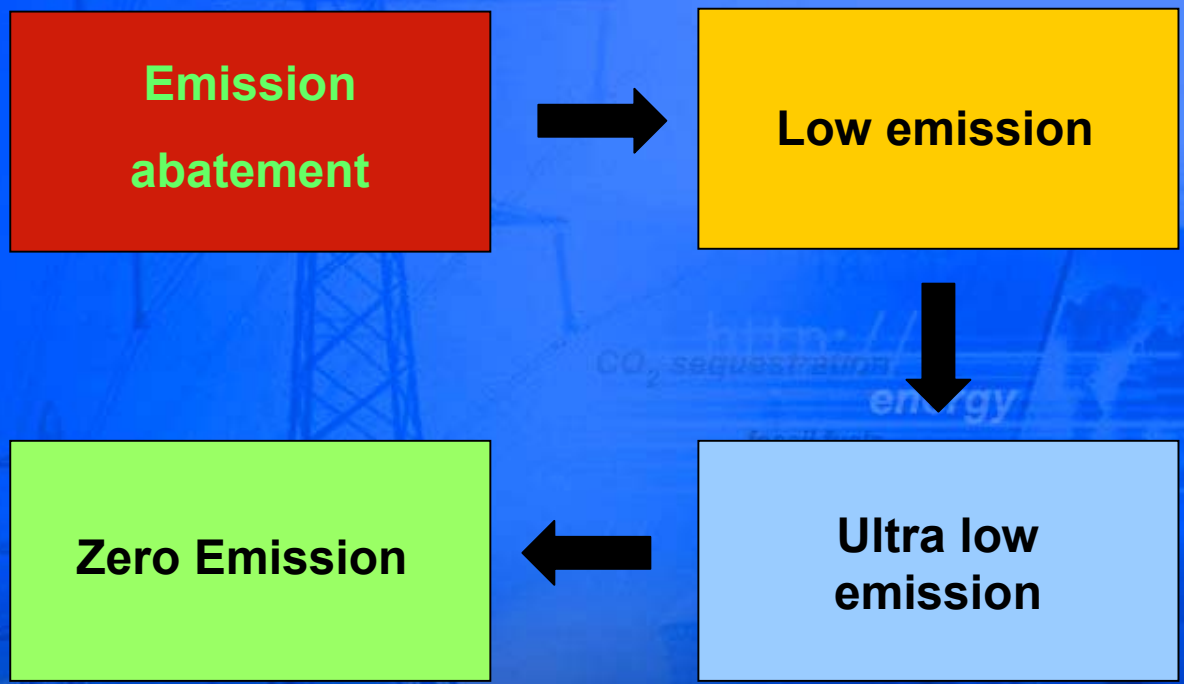
- All developing economies are facing the challenge of energy security
- Coal contributes to 40 % of world's electricity production
- Fossil fuels have 80% share in world primary energy consumption
- Fossil fuels are major source of greenhouse gas emissions CO_2 alone contributes to 50 % of global warming

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

SCIENCE & TECHNOLOGY FOR USING FOSSIL FUELSF OR CLEAN ENERGY

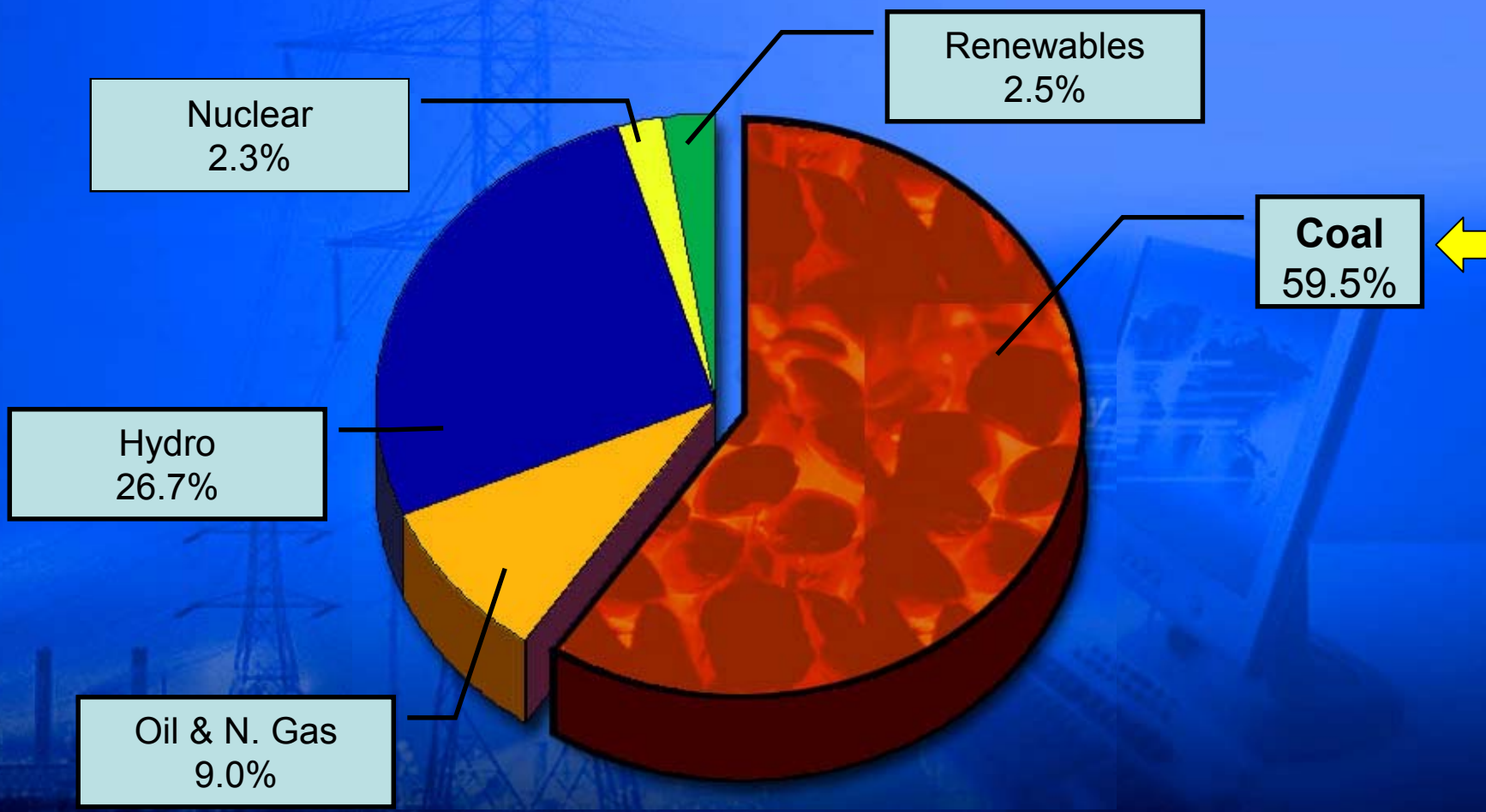
- **FOSSIL FUELS**
  - PRE-COMBUSTION
  - COMBUSTION
  - COAL CONVERSION
  - POST COMBUSTION

TECHNOLOGY CHALLENGE



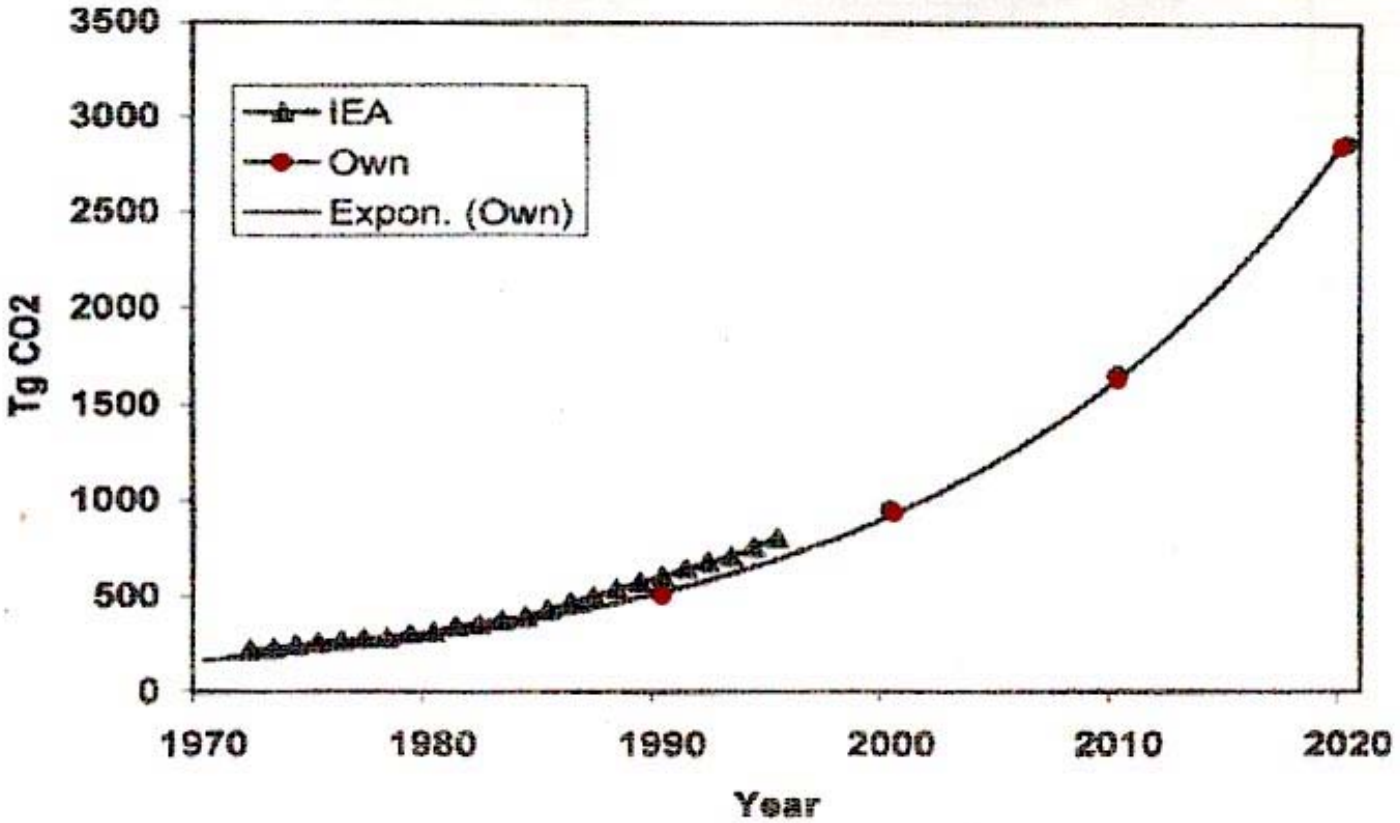
COAL: DOMINANT PRIMARY ENERGY RESOURCE IN INDIA

Share of different fuels in installed capacity in 2005



Source- CEA

CO2 EMISSIONS AND PROJECTIONS



Source: Center for Global Change, India

INDIA'S APPROACH TO CLIMATE CHANGE

- Per capita greenhouse gas emissions are nearly 0.5% of world average
- India accepted Kyoto Protocol to UNFCCC on 26th August 2002
- Initiated Joint Activities to be implemented under JI/ AIJ mechanisms
- Constituted National Clean Development Mechanism Authority for considering projects for availing carbon credits by eligible industry projects

CO2 (problem) although global, (solution) unique to every country

TECHNOLOGY PERSPECTIVES FOR CARBON MANAGEMENT IN INDIA

- Adoption of high efficiency in thermal power generation through fuel and boiler technology
- Increasing use of renewable energy sources
- Growing nuclear power production
- Energy efficiency in end use sectors
- Promotion of clean coal technology
- Research on carbon capture and storage

STEPS INITIATED TO DEAL WITH ADVERSE IMPACT OF INCREASED USE OF COAL

- Thrust to R&D on Coal Beneficiation, Coal Gasification, Liquefaction and IGCC
- Policy guidelines to use coal with < 34% ash in power plants at 1000km from pit head or in urban areas
- New guidelines for setting up coal washeries
- Creating Awareness about environment pollution
- Specific measures adopted by power companies and other major coal consuming industries like steel and cement for technology upgradation

Clean Coal Technology Initiative for promotion of research in the value chain

STATUS OF CLEAN COAL TECHNOLOGY

First Generation

- Coal Preparation
- Pulverized Fuel
- Fluidized bed combustion
- Electrostatic precipitator
- Flue gas desulphurization
- Super critical boiler

Fully developed and commercialized

STATUS OF CLEAN COAL TECHNOLOGY

Second Generation

- Fine coal beneficiation
- De-NOx
- Fisher-Tropsch synthesis
- Ultra supercritical boiler
- Circulating fluidized bed coal combustion
- Pressurizd pulverized coal combustion
- Integrated gasification coal combustion
- Pressurized fluidized bed coal combustion
- Molten carbonate fuel cell

Demonstrated on commercial scale - need Technology Transfer

STATUS OF CLEAN COAL TECHNOLOGY

Third Generation – Coal's Future

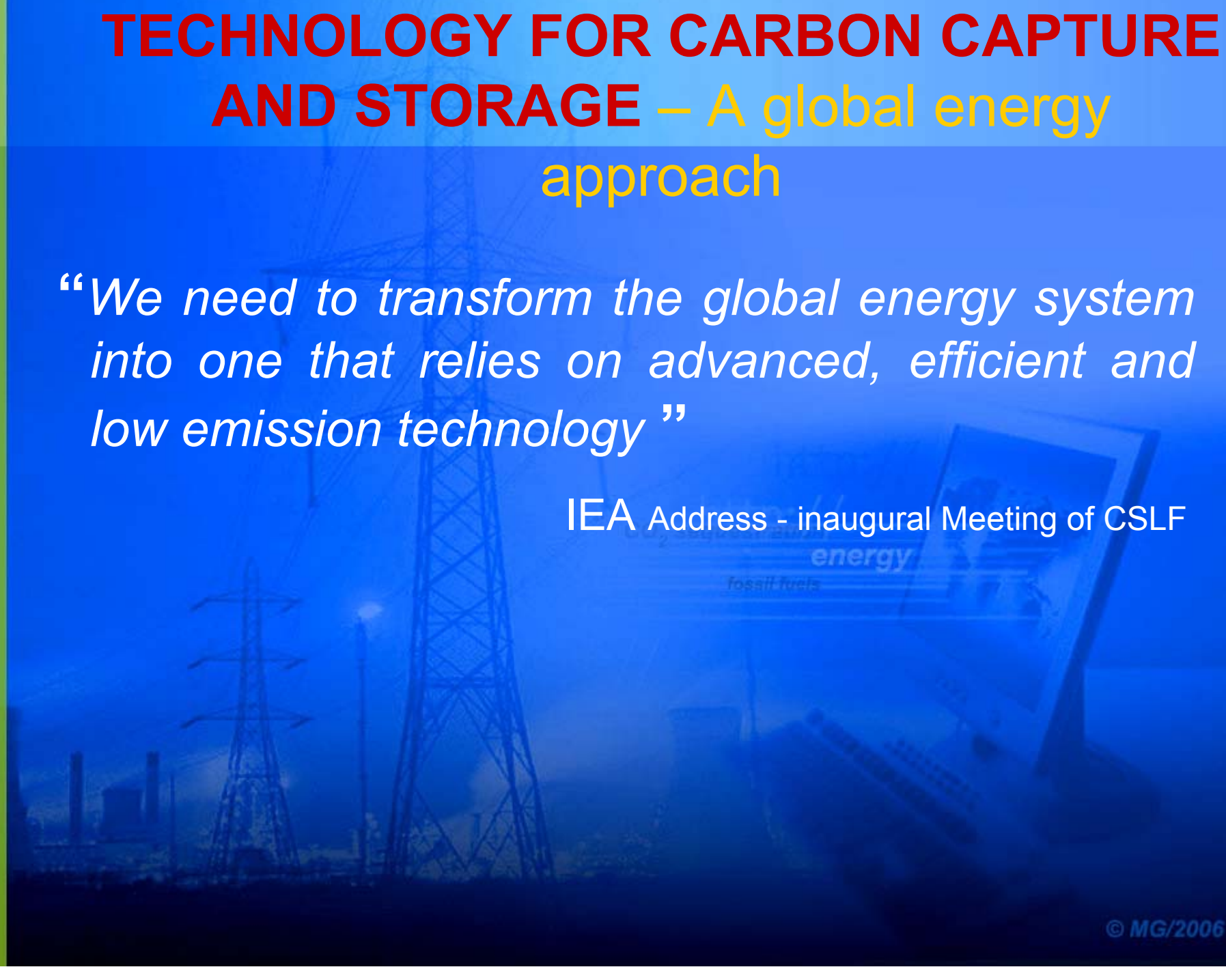
- Oxy fuel combustion
- In-situ coal gasification
- Coal bed Methane
- Coal Mine Methane
- Integrated pulverized fuel and ZET
- IGCC and ZET
- Integrated gasification fuel cell
- Carbon capture and storage

Early demonstration stage – need collaborative research

TECHNOLOGY FOR CARBON CAPTURE AND STORAGE – A global energy approach

"We need to transform the global energy system into one that relies on advanced, efficient and low emission technology"

IEA Address - inaugural Meeting of CSLF



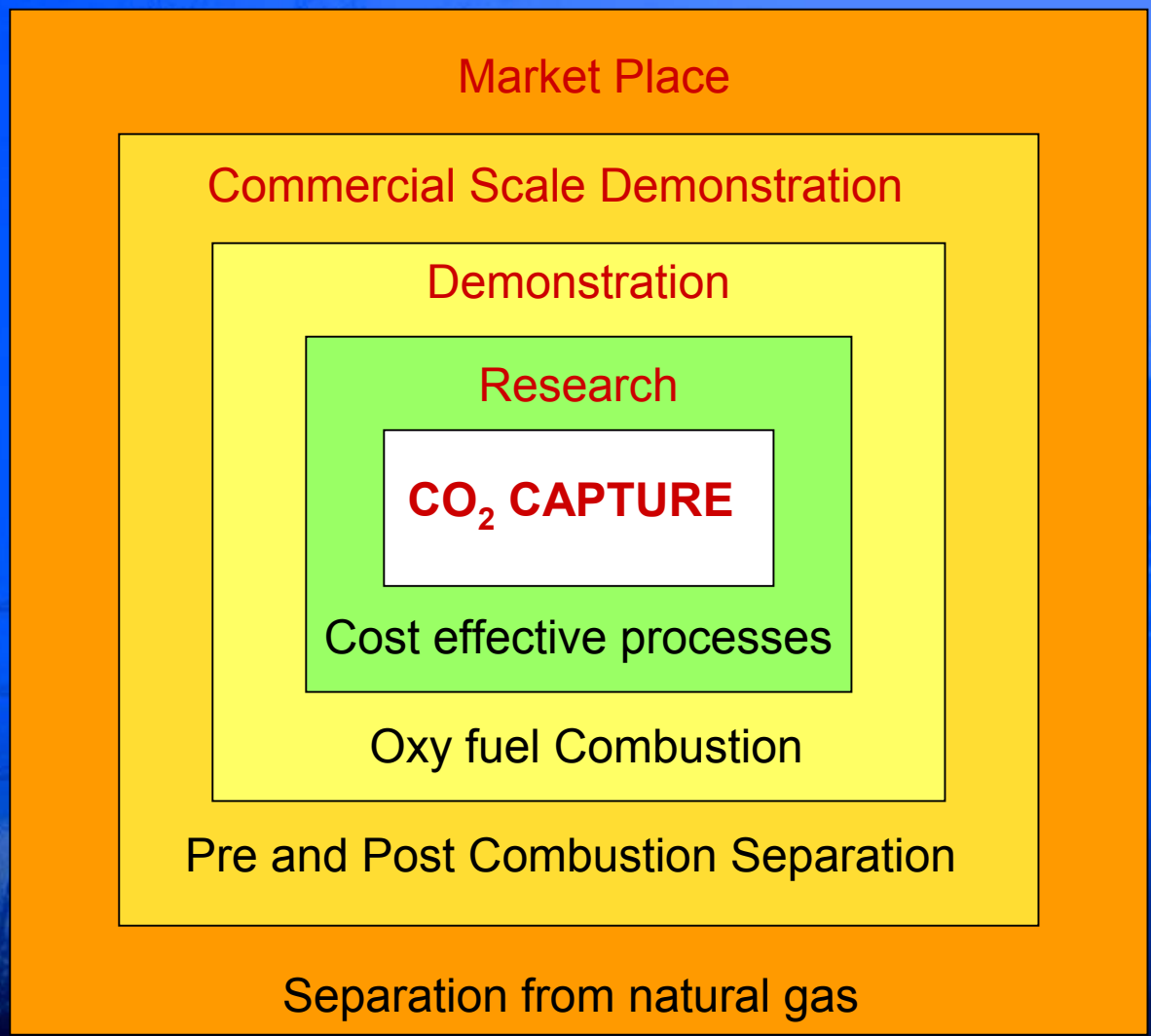
WHY CAPTURE CO2?

- CO2 has almost 50% contribution to global warming
- IPCC report defines CO2 capture as process of separation of CO2 from industrial and energy related sources
- 4946 fossil fuel based power generation sources are identified as having emission of more than 0.1 mt/annum adding to 10.5 bt/annum
- 2945 other sources adding to about 3 mt/annum

HOW TO CAPTURE CO2 ?

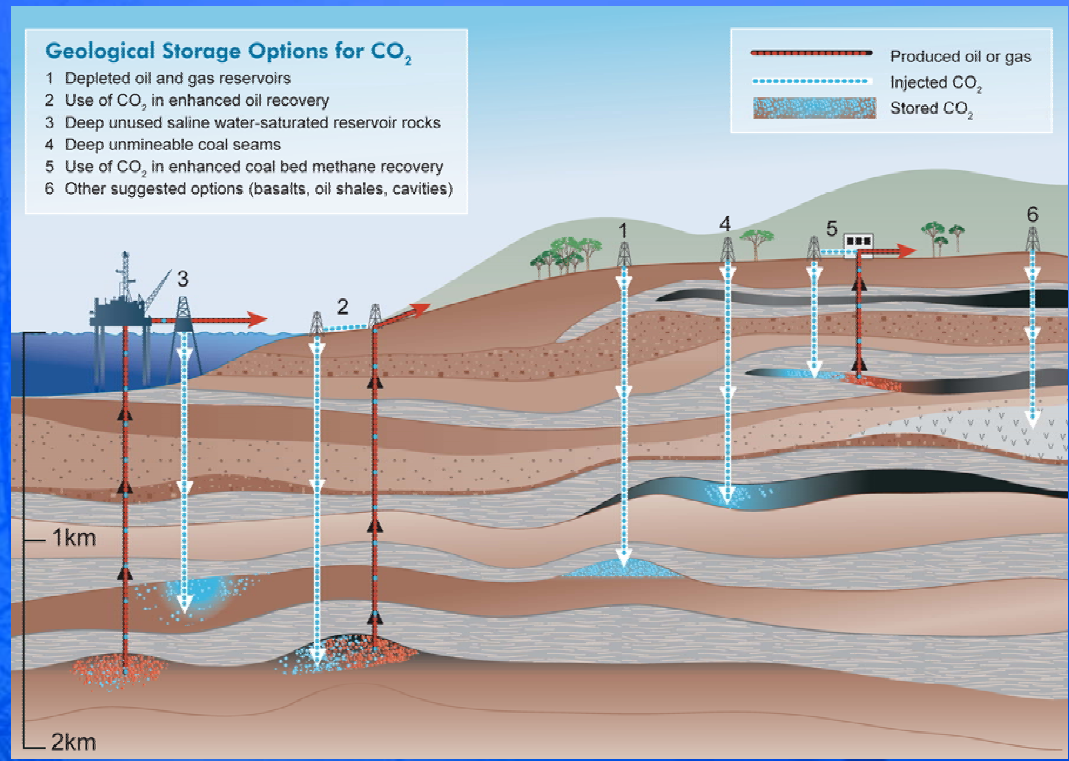
- Pre-Combustion
  - Coal gas separation
- Oxy-fuel Combustion
- Post Combustion or Industrial
  - Solvent
  - Cryogenic
  - Absorption
  - Adsorption

GLOBAL STATUS OF CARBON CAPTURE TECHNOLOGIES



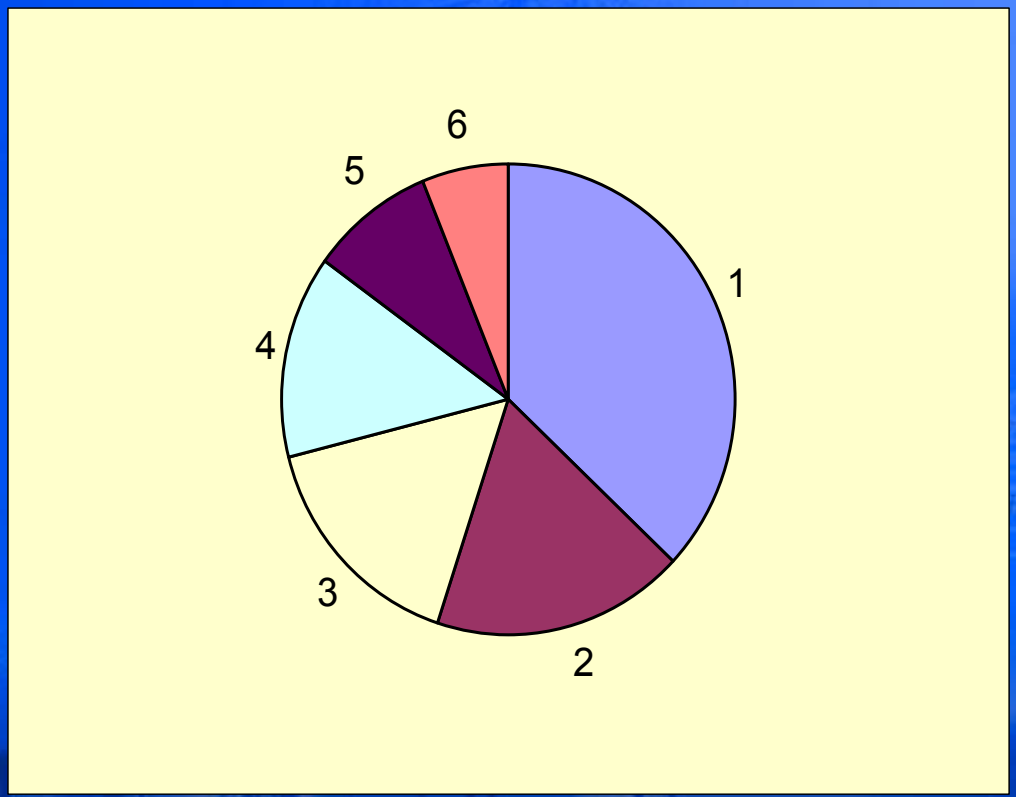
POTENTIAL SITES FOR CARBON DIOXIDE STORAGE

- Empty oil fields
- Empty natural gas fields
- Enhanced oil recovery
- Enhanced coal bed methane
- Saline aquifers
- Terrestrial sequestration like plantation of forestry in degraded areas



CO2CRC

WIORLDWISE CO2 SEQUESTRATION STORAGE POTENTIAL IN DIFFERENT BASINS



1. N gas fields on-shore
2. N gas fields off-shore
3. Coal beds
4. Aquifers
5. Oil fields on-shore
6. Oil fields off-shore

ECOFYS

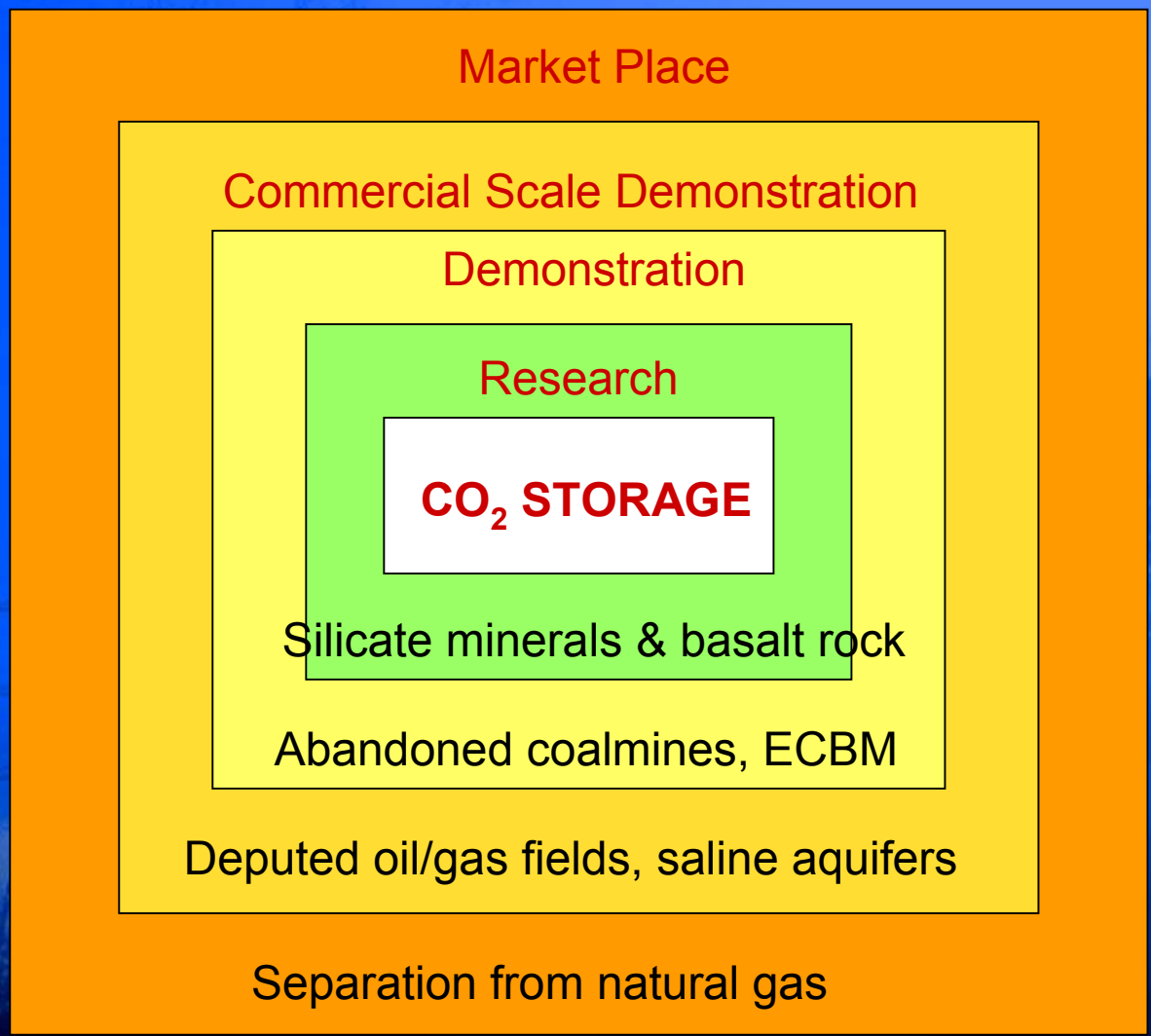
REGIONAL CO2 STORAGE POTENTIAL IN UNDERGROUND RESERVOIRS

Region	CO_2 Storage potential	Surface area of sedimentary basin
USA	6%	7%
Oceania	4%	12%
Europe (inc SU)	26%	18%
Middle east	20%	4%
Entire Asia	23%	18%
South Asia	3%	9%

Total storage potential worldwide 1660 Gt of CO_2

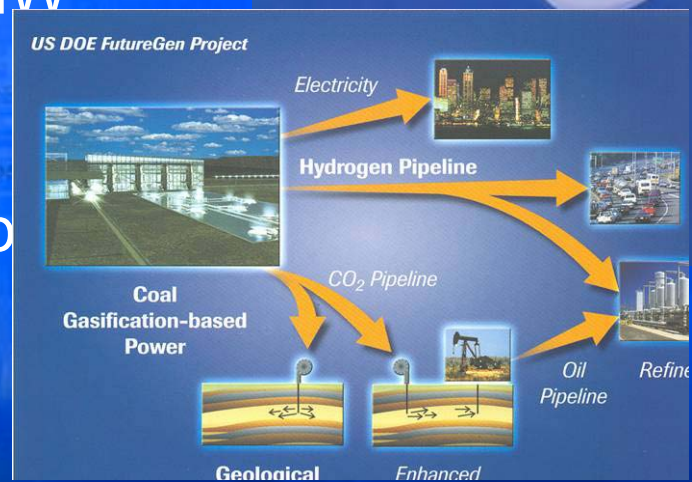
Source:ECOFYS

STATUS OF CARBON STOARGE TECHNOLOGIES



COOPERATIVE EFFORTS IN CCS

- India is member to Carbon Sequestration Leadership Forum (CSLF)
- Signed an agreement with US Government in April 2006 for partnership in FutureGen – 275 MW Zero emission power plant
- Institutional partner in BIG SKY Carbon Sequestration Partnership
- Joined Asia Pacific Partnership in Clean Development



CO_2 SEQUESTRATION IMPLEMENTATION IN INDIA

- India joined CSLF in 2003 with Ministry of Power as Lead Ministry
- The objective of Indian Participation is to develop cost-effective technologies by organizing collaborative R&D
- Collaborative research on basalt rock studies under a CSLF project initiated with USA. The results on mineral trapping studies would be useful for other countries having similar formations.
- Feasibility studies in oil fields for enhanced recovery and saline aquifers started
- Scientific institutions are engaged in CCS research and Technical Workshops to disseminate knowledge and create awareness held

KEY TASKS OF SUCCESSFUL CCS

1. High cost of capture and storage require financial mechanisms to be established

2. Breakthrough concepts in CCS can lead to innovative ways of CO2 sequestration and cost reduction

3. Geological screening criteria for saline aquifers, storage in oil fields and coal beds with economic benefits in terms of value addition in energy fuels and basalt rocks must be the target

4. Risk management and safety issues from storage in geological media must be addressed as well as monitoring issues for improving scientific understanding of natural processes

5. The goal of carbon management strategy should be a move towards hydrogen economy

Thank you very much

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