Energy Growth and Carbon Sequestration

Global energy poverty
1.3 billions: no electricity
2.7 billions: no clean cooking
Coal consumption energy growth
Asia primary driver
Coal-Oil-Gas remain mainstay
Large amounts of GHG emissions
Fossil fuels emit CO₂
Lead to warming
Carbon management
Sequestration
Geo-sequestration: Storage of CO₂ from anthropogenic sources into deep lithological units for geologically significant periods of time.

Carbon Storage Vs. Enhanced Gas Recovery

Coalbed Methane (CBM)/Shale Gas
Cleaner, low-carbon energy
India leading CO₂ emitter
Increased global warming
India is a coal rich country: Ranks 4th in the world
Huge CBM potential + Huge CO₂ storage capacity
Contains significant shale deposits – gas extraction

Salient Findings: Subcritical CO₂ permeability

Aspects of CO₂ permeability in Indian coals
Role of injection pressure
Role of confining pressure
Role of effective stresses
Role of coal matrix swelling

Salient Findings: CO₂ saturation

Assessment of coal strength
Water saturation:
High reduction
Seam pressure management
Pressure related weakening
CO₂ saturation:
High sorption
Sorption induced weakening
CO₂ plus water saturation:
Worst hit scenario
Maximum reduction
Coupled influence

Salient Findings: CO₂ flow

Change in Coal permeability
At different depths
In different phases of CO₂
Different durations of saturation
Scheme of Fluid Flow

Conclusions

Characteristics of coal vary at different stress conditions
Behaviour of CO₂ changes with depth – both pressure and temperature
Saturation of coal with CO₂ causes reduction in coal strength
Higher injection pressure causes high permeability
Coal matrix swelling causes reduction in permeability
Supercritical CO₂ induces significant changes in coal
Need to develop large scale models for deeper reservoirs
Need for Advanced Research and Understanding

References
1. CIDCRC (Cooperative Research Centre for Greenhouse Gas Technologies)