
Pre-Combustion Capture of Carbon Dioxide

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Pre Combustion Capture Technologies

- Chemical Solvents
 - MEA monoethanolamine
 - MDEA methyldiethanolamine
 - DEA diethanolamine
- Physical Solvents
 - Rectisol Methanol
 - Selexol Dimethyl ether of polyethylene glycol
 - Purisol Normal Methyl Pyrrolidone
- Membranes
- Advanced Concepts ZECA

Physical Solvents

- Typical Solubility

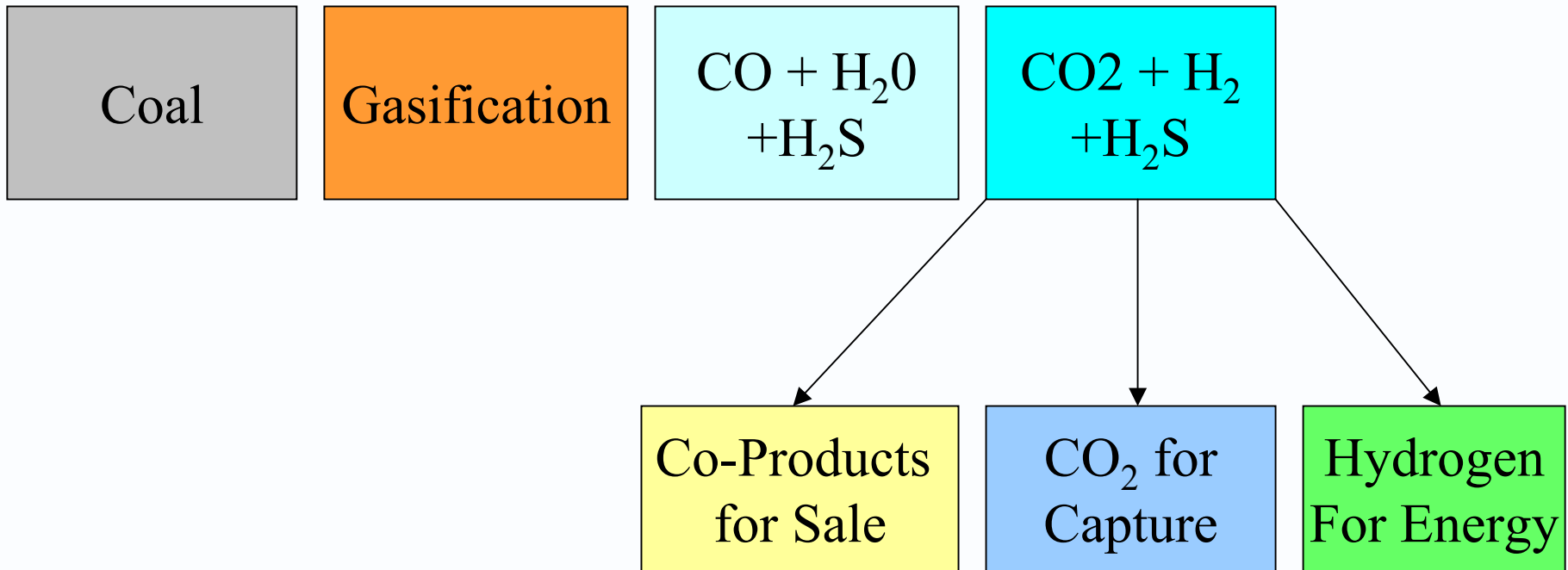
– Hydrogen	1
– Nitrogen	1.5
– Methane	5
– Carbon Dioxide	76
– Carbonyl Sulphide	175
– Hydrogen Sulphide	670
– Water	55000

- Solubility dependent on partial pressure: Henrys Law

Pre-combustion capture of CO₂: Chevron Texaco

- Use of Shift Reaction
 - $\text{CO} + \text{H}_2\text{O} > \text{H}_2 + \text{CO}_2$
- CO₂ available at High Pressure (70 bar) and High Concentration (~40%)
- Suitable for capture by physical solvents
- Low volume of solvent required
- Low cost solvent regeneration through pressure let down
- Capture of 85% CO₂
- Commercial scale of around 2Mte/year

IGCC for CO2 Capture and Hydrogen Production: Chevron Texaco: Houston



Chevron Texaco

- Use of physical solvents, e.g Selexol
- High pressure flowscheme
- Pressure let down for solvent recovery
- Low cost route to CO2 removal
- Technology approach proven in ammonia projects in China

Great Plains Synfuels Plant, South Dakota



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Great Plains Synfuel Plant

- Coal Gasification and shift to CO₂ rich syngas
- CO₂ and H₂S capture by physical solvents
- Hydrogen used primarily in methanation plant to produce synthetic natural gas
- Fuel flexibility
 - Inputs, coal and wastes
 - Outputs, Methane, Carbon Dioxide, Fertiliser
- 1.5-2Mte/annum of CO₂ captured and sold to Encana under long term contract for Enhanced Oil Recovery

USDOE Washington: Vision 21

- Futuristic concept of power plant of future
- Accept a wide variety of fuels
- Produce multiple products
- Carbon Dioxide Capture and Storage
- Capture through chemical or physical separation methods
- Hydrogen production
- Desired Outcome: Efficient, low-cost Electricity and Hydrogen from fossil fuels with low Greenhouse Gas Emissions

Canadian Clean Power Coalition

- Goal to secure place for coal fired generation
- Ambition to develop, construct and operate a full scale greenfield coal-fired project by 2010
- Gasification technology + pre-combustion CO2 capture
- Phase 1 Design Study: Completion mid 2003
- Phase 2 Detailed Engineering and Construction
- Coalition Members
 - Atco Power, EPCOR, EPRI, Luscar Ltd, Nova Scotia Power, Ontario Power Generation, Sask Power, TransAlta



ZERO EMISSION CARBON: Hydrogasification

Pure CO₂ for Safe,
Secure Disposal

EOR, CBM, etc.

Hot Gas
Cleaning

Electricity Output
70% efficient

Serpentine
Or Dunite

No: SO_x, NO_x,
Particulates or
Mercury

Solids:
Magnesite-MgCO₃
Silica-SiO₂

Coal or
Bitumen

Ash

O₂ from Air (Fuel Cell Membrane)



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(From ZECA)

Pre Combustion Capture

- Capture technology and equipment is available and has been demonstrated at large scale
- The approach is being recognised in US/Canada energy strategy
- Support for further development is being provided in USA and Canadian government clean energy programmes