Carbon capture and sequestration (CCS). Technology status and capture costs

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Un desarrollo regional bajo en emisiones de carbono
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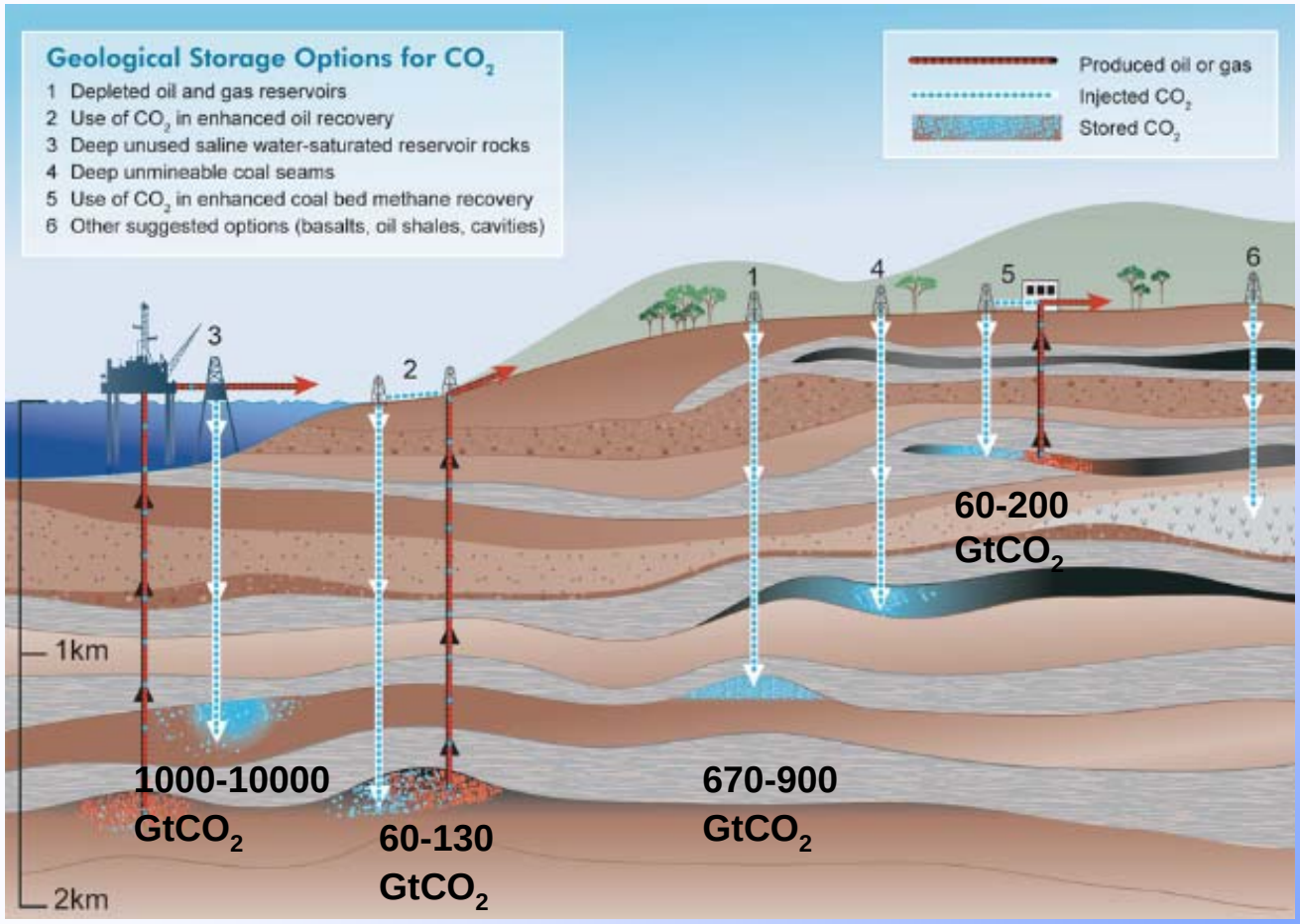
Options for geological storage



IPCC Special Report on Carbon Dioxide Capture and Storage 2005

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Commercial projects

Sleipner- deep saline aquifer over 800m below the seabed.
1 million tonnes CO_2/year since 1996.

Weyburn- enhanced oil recovery (EOR)
1 million tonnes CO_2/year since 2000

In Salah- deep saline aquifer 2,000 m below the surface.
1 million tonnes CO_2/year since 2004.

Snohvit- stored in a geological formation at 2,600 m below the seabed.
700000 tonnes CO_2/year 2008 (at full operation)

Key aspects to consider

Site selection
Monitoring the storage reservoir
Social acceptance

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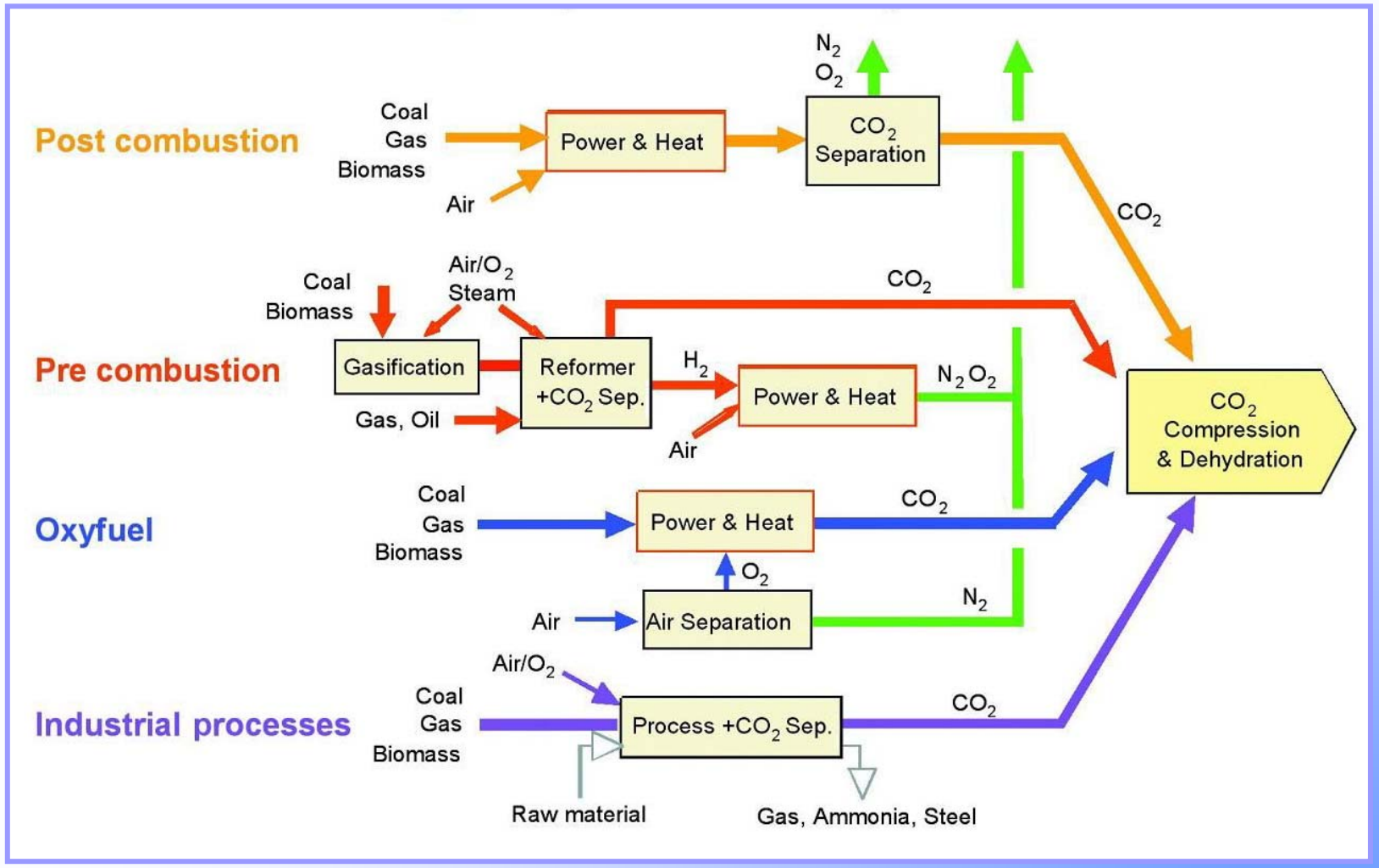
CO_2 capture



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CO_2 capture

- **Post combustion processes**
  - CO_2 is captured from flue gas, after combustion in air.
  - Low CO_2 concentration (3-15 %).
  - High energy penalty >10%
  - Amine absorption (MEA)

- **Precombustion decarbonisation**
  - CO_2 is captured from a gas mixture with predominantly H_2 at medium pressure (15-40 bar) and 15-40 % CO_2 content.
  - Complex process including gasification/reforming steps
  - O_2 is needed for gasification

- **Oxyfuel combustion**
  - Combustion in O_2/CO_2 mixtures
  - Energy penalty from cryogenic O_2 separation

Many improved and new technologies are in development to reduce the energy penalty and significantly reduce CO_2 capture costs.

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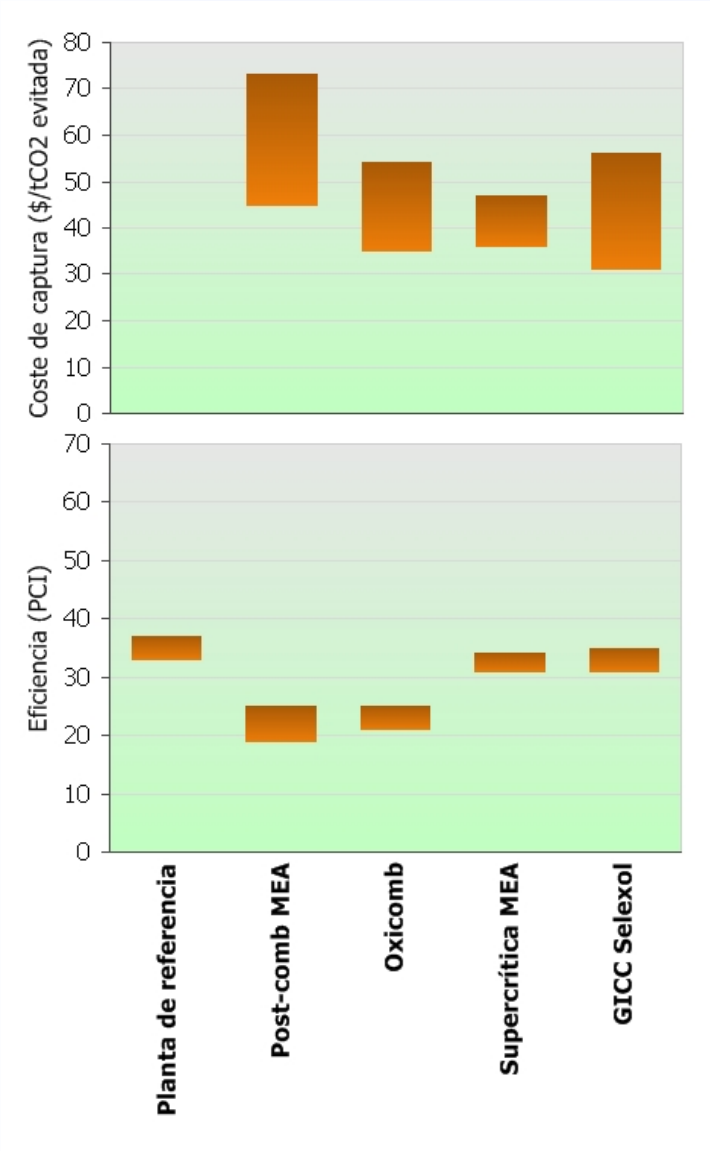
Estimated costs for CO_2 capture



- Existing plants using coal
- Costs of CO_2 avoided
- Capture costs are highly dependent upon technical, economic and financial factors related to the design and operation of the power system as well as the design and operation of the technology employed.

Data and assumptions from IPCC 2005

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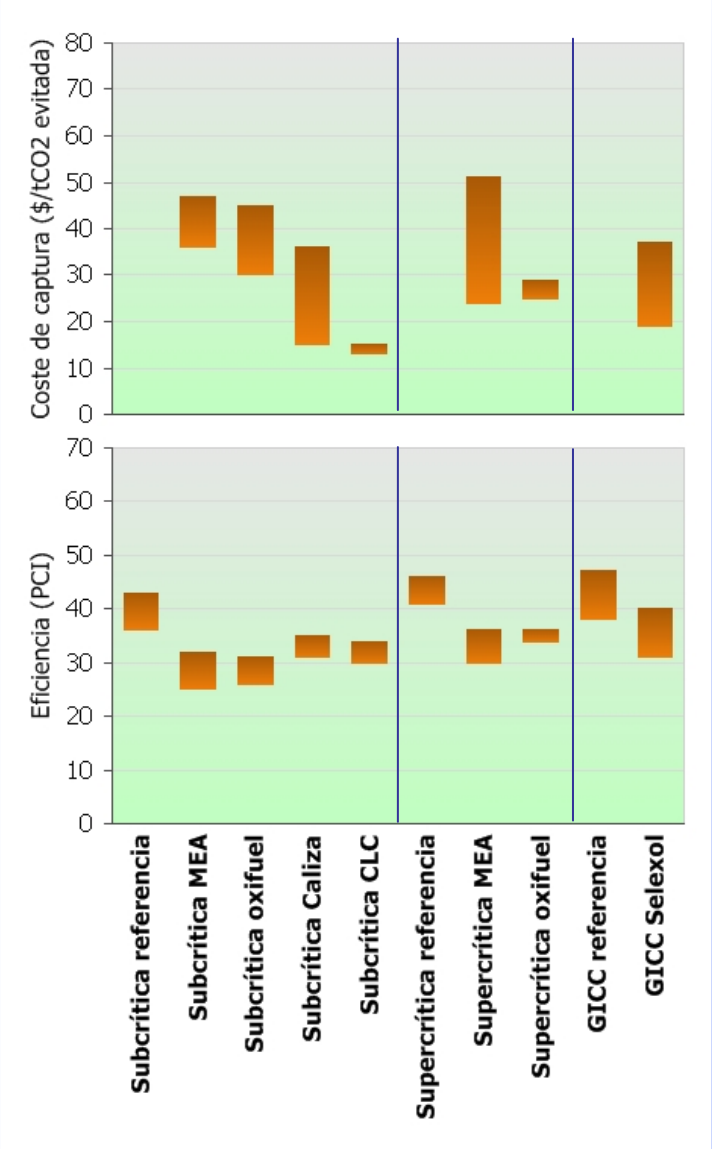
Estimated costs for CO_2 capture



- New plants using coal.
- Improved efficiency with lower capture costs.
- New technologies have higher decreases.

Data and assumptions from IPCC 2005

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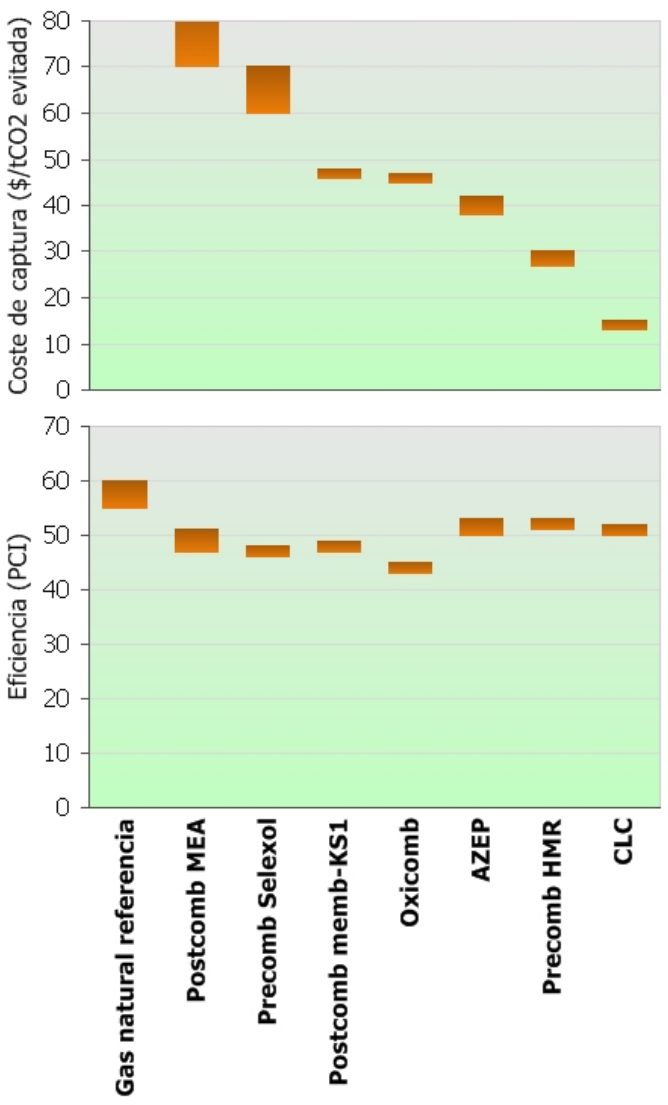
Estimated costs for CO_2 capture



- New plants using natural gas.
- Improved efficiency with lower capture costs.
- New technologies have higher decreases.

Data and assumptions from IPCC 2005 and CO_2 Capture Project (CCP) 2005

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- CCS allows energy generation from fossil fuels without CO_2 emissions to the atmosphere.
- Existing technologies have a high energy penalty which decreases energy generation efficiency.
- More fossil fuel is necessary for the same energy generation.
- Improvements to commercial technologies can reduce capture costs by 20-30% the next decade.
- Development of new promising technologies to reduce energy penalty with a more substantial cost reduction for CO_2 capture.
- Capture costs are higher than actual costs for CO_2 in the carbon market.
- There are not a driving force of costs to implement CCS.

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