IV Congreso de Ingeniería Municipal

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CAPTURA Y USO DE CO2, REALIDAD Y NECESIDADES FUTURAS

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CO_2 capture and use, reality and needs

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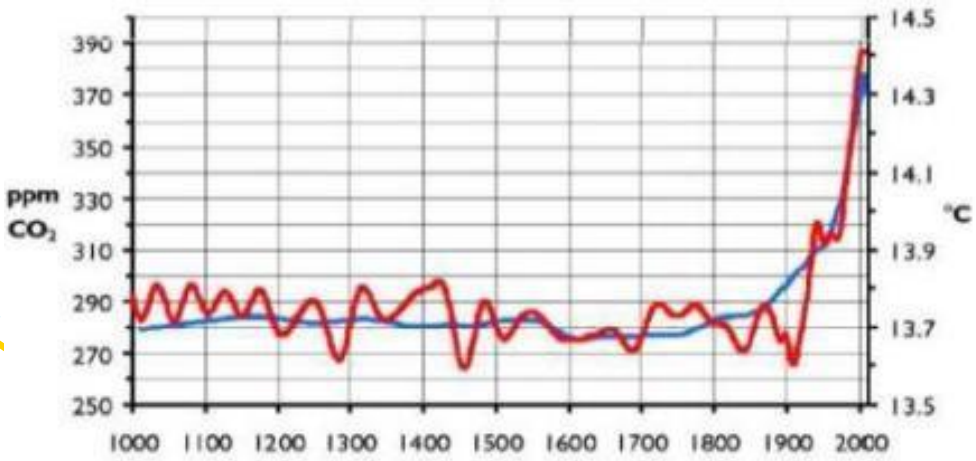
CO_2 and Climate Change

- The use of fossil fuels has increased CO_2 emissions and displaced the natural equilibrium of CO_2 in the air
- Strong evidences between increasing [CO_2] and global warming
- Through the Paris agreement, commitment to reduce CO_2 emissions to minimize temperature change <2 ºC (aiming to 1.5 ºC)
- EU target: CO_2 emissions reduction of 40% (1990 basis) by 2030, focusing on renewable energy, efficiency and GHG emissions trading
- The capture and storage or utilization of CO_2 (CCUS) is a powerful tool to reduce those CO_2 emissions that cannot be avoided
- CO_2 utilization could contribute to reduce CO_2 emissions and improve the sustainability of our world
- Need to see **CO_2 as valued resource** instead as a waste



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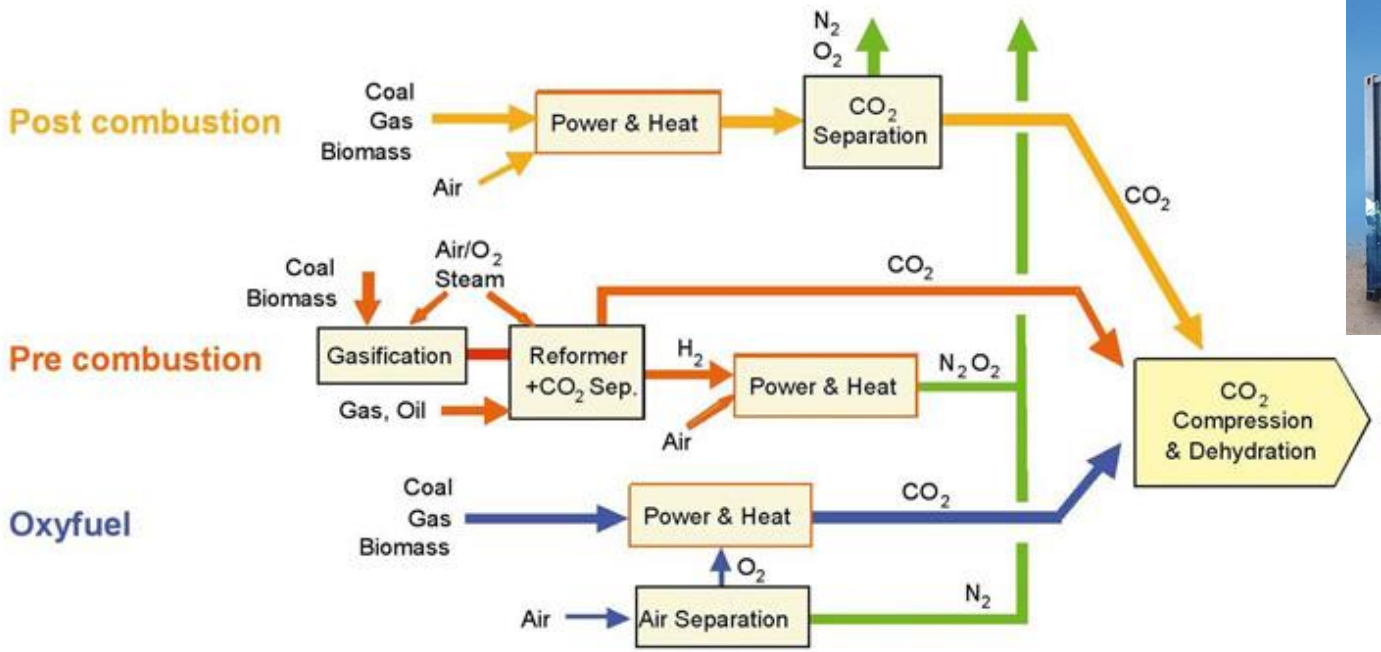
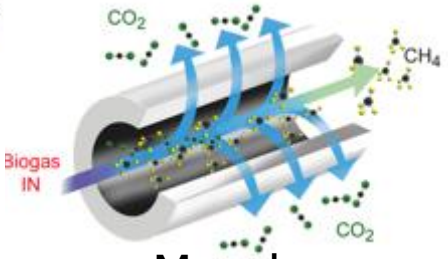
CO_2 Capture Technologies

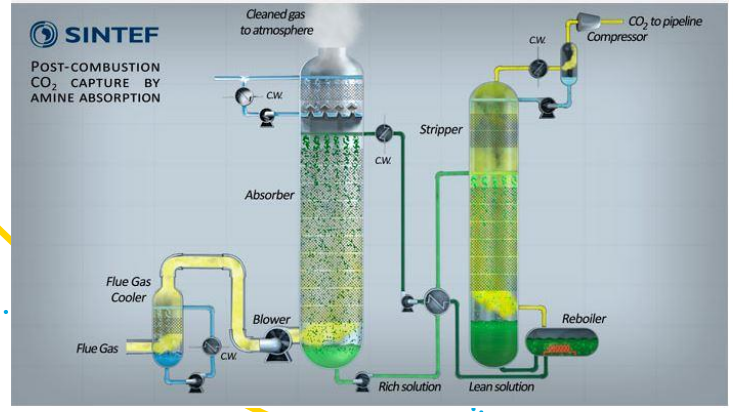


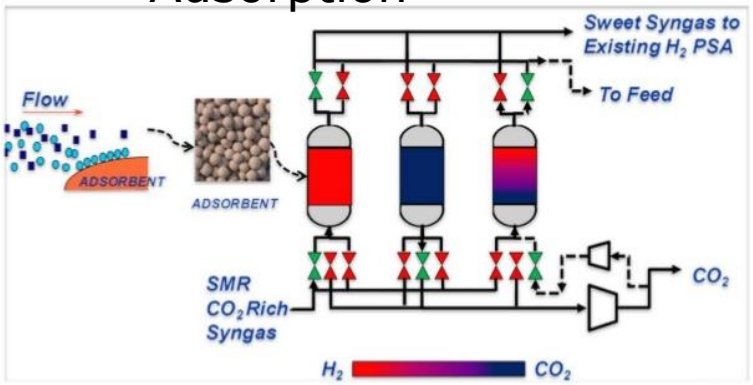


Source: http://www.technip.com/en/our-business/onshore/renewable-energies

Adsorption

Membranes





Absorption

CO_2 Separation Technologies

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Source: Global CCS Institute (2018)

Current and future of large CCS

- 17 projects in operation on 2018 having capture capacity of 30 MTPA CO_2. The oldest operating since 1972!
- Mainly from industrial sources (Ethanol, Hydrogen, Natural Gas processing). Only 2 from power Generation!
- Final goal 75% Enhanced Oil Recovery (EOR), only 25% Geological Storage. Need to add value to captured CO_2
- CO2-pipelines: Existing>2500 km; planned>2000 km
- Planned 20 new projects to increase capacity to 36 MTPA CO_2
- Nowadays, most of CCS located in USA. Only 2 in Europe (Norway) but Asia emerging as big player (50% new projects)

Port Arthur (USA) capture of CO_2 from SMR for EOR (> 3.1 Mbarrels oil/year) - Air Products.

Current locations of large CCS projects

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Spain: CO_2 capture experiences

The Spanish administration promoted CO_2 Capture and Storage projects to reduce CO_2 emissions from power generation:

- Ciuden – oxy-combustion of coal/biomass and storage in deep saline aquifer (Leon/Burgos)
- Elcogas – Oxy-gasification of coal/biomass/NG capture: 100 tones/day (Ciudad Real)

Several projects on CO_2 recovery from private companies:

- Fermentation for biofuels and breweries
- Gasification of Natural Gas for H_2, Fertilizers and Ethylene production
- Post-combustion from glass production in Canarias (Carburos Metalicos)

CO_2 Applications

- Beverage (Bier, Soda drinks…)
- Food preservation (MAP, control pest, cooling and freezing)
- Removal of astringency of persimmon fruits
- Enhancing production in greenhouses
- Water treatment
- Cooling/refrigeration as alternative to Freons
- Natural products extraction
- Supercritical CO_2, alternative to organic solvents
- Cleaning (dry ice blasting, dry cleaning)
- Production of chemical and materials

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$SCCO_2$: Surprising applications

Above 73 bar and 31 ºC, CO_2 behave as an organic solvent, being able to dissolve materials like:

- Natural products, oils and fats
- Drugs and active ingredients (Aspirin, Ibuprofen)
- Most of the non-polar compounds

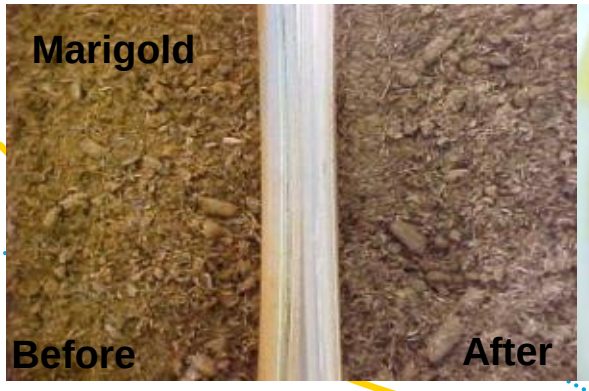
Allowing surprising applications for a gas like:

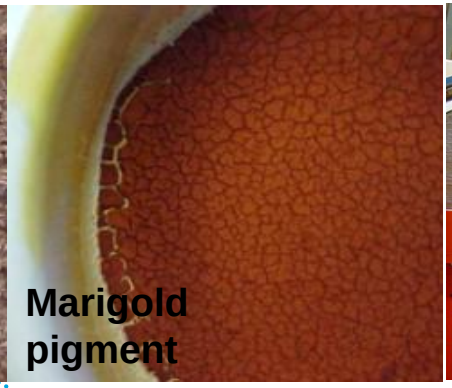
- Extraction of natural products (Decaffeination of coffee, defatting of cacao or cleaning of cork)
- Cleaning and dying of textiles
- Micronization and encapsulation
- Sterilization of medical devices
- Synthesis of materials (aerogel, new concretes)

Dyed Team shirt from Nike

Aerogels

Dry cleaning of textiles





Wood protection by $scCO_2$ impregnation

Source: NATEX webpage

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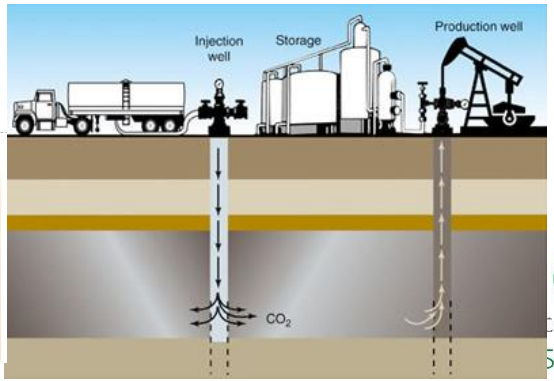
CO_2 utilization versus storage

- CO_2 emissions estimated in 33,4 MTPA (2016 - BP energy)
- Main limitation of CO_2 capture is its high cost, need to add value to this CO_2 to leverage the cost of capture
- Current worldwide use of CO_2 estimated on 200 MTPA, < 1% of global emissions
- To reduce CO_2 emissions, we need to research and develop:
  - Cheaper capture technologies
  - Develop new and promote current CO_2 utilization technologies
- Most relevant Spanish experience was SOST-CO2 project, where several companies collaborated, led by Carburos Metalicos and granted by Spanish government, to develop new CO_2 technologies.

Nuevas utilizaciones industriales sostenibles del CO_2 (SOST-CO_2)

CEN-20081027

Líder: Carburos Metálicos



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CDTI Centro para el Desarrollo Tecnológico Industrial
GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

Summary

- To minimize global warming, we need to significantly reduce the CO_2 emissions
- Available options: renewable energy, improve efficiency and CO_2 capture.
- Major barriers for CO_2 capture are scale and cost. Utilization allows us to leverage cost and reduce net emissions
- **CO_2 is a valued resource** with multiple applications on nearly all markets (food, water, chemical, pharma, energy…)

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