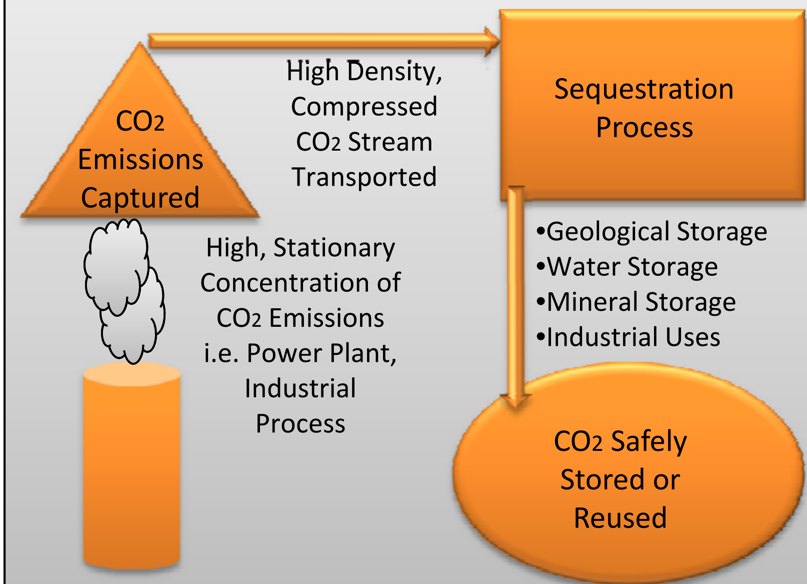
Carbon Capture & Sequestration

LAFAYETTE

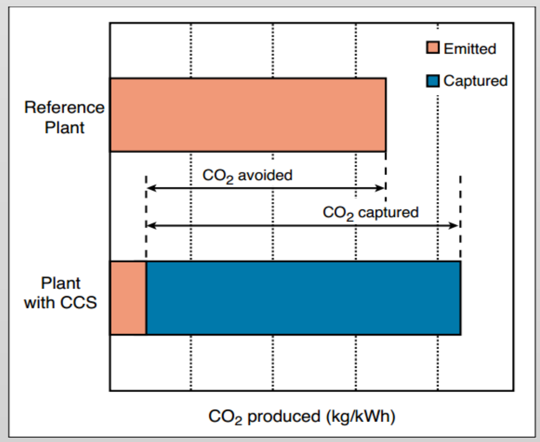
How it works



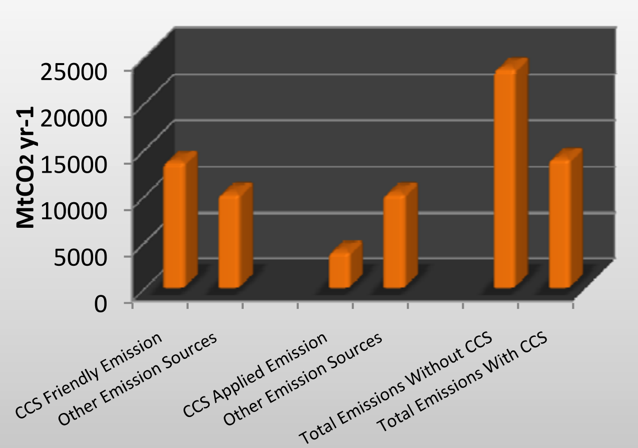
Why CCS

- •High Efficiency (80-95% captured)
- •No major energy infrastructure changes because CCS allows for use of fossil fuels without having high GHG emissions
- •60% of CO_2 emissions are large stationary emissions sources (suitable for CCS)
- •CCS is an integral part of any realistic low-cost scenario for the future
- •Captured CO_2 can be used for enhanced oil recovery (EOR) and other industrial processes

Comparison of plant with and without CCS



Potential Effects of CCS on CO_2 Emissions if Applied to all Stationary Sources



Sequestration

- •Geological Storage
  - ▪Deep Saline Formations
  - ▪Un-minable coal seams
  - ▪Oil and Gas Reservoirs
- •Ocean Storage
  - ▪Lake Type
  - ▪Sinking plume
  - ▪Rising plume
- •Mineral Storage
  - ▪$MgO \rightarrow MgCO_3$
  - ▪$CaO \rightarrow CaCO_3$
  - ▪EOR, Beverages, Welding, Urea etc.
- •Industrial Uses
  - ▪Lake Type
  - ▪Sinking plume
  - ▪Rising plume

Costs

- •Significantly more power needed for plant with CCS
- •Large uncertainty in upfront capital costs
- •No infrastructure set up for transportation and storage of CO_2
- •USD 30-50 million will be needed to launch 20 full-scale CCS

The Future

- •Without CCS the capital investment to create a similar low carbon future would be increased by 40%
- •Costs are significantly decreased when built into a new IGCC/GTCC plant
- •Policy is required to support the development of CCS
- •IPCC predicts 9-12% by 2020 and 21-45% by 2050 of CO_2 emissions
- •IEA predicts 17% by 2020
- •Plenty of Storage opportunities

Carbon Capture & Sequestration

LAFAYETTE

How it works

Global CCS Institute. "Global Status of CCS 2011." *Global Carbon Capture and Storage Institute*. Global Carbon Capture and Storage Institute, 4 Oct. 2011. Web. 15 Apr. 2014.

Storage

"CO2 Capture and Storage." *GreenFacts*. GreenFacts, n.d. Web. 15 Apr. 2014

IPCC. *Carbon Dioxide Capture and Storage*. By Edward Rubin. IPCC, 1 Jan. 2005. Web. 15 Apr. 2014.

Costs

Global CCS Institute. "Global Status of CCS 2011." *Global Carbon Capture and Storage Institute*. Global Carbon Capture and Storage Institute, 4 Oct. 2011. Web. 15 Apr. 2014.

"CO2 Capture and Storage." *GreenFacts*. GreenFacts, n.d. Web. 15 Apr. 2014

The Future

IEA. *Technology Roadmap*. Rep. Iea, 1 Jan. 2013. Web. 15 Apr. 2014.

Global CCS Institute. "Global Status of CCS 2011." *Global Carbon Capture and Storage Institute*. Global Carbon Capture and Storage Institute, 4 Oct. 2011. Web. 15 Apr. 2014.

IPCC. *Carbon Dioxide Capture and Storage*. By Edward Rubin. IPCC, 1 Jan. 2005. Web. 15 Apr. 2014.

Why CCS

"CO2 Capture and Storage." *GreenFacts*. GreenFacts, n.d. Web. 15 Apr. 2014

IPCC. *Carbon Dioxide Capture and Storage*. By Edward Rubin. IPCC, 1 Jan. 2005. Web. 15 Apr. 2014.

"CO2 Capture and Storage." *Energy Technology Analysis*. International Environmental Agency, 1 Jan. 2008. Web. 15 Apr. 2014.

IPCC. *Carbon Dioxide Capture and Storage*. By Edward Rubin. IPCC, 1 Jan. 2005. Web. 15 Apr. 2014.

Numbers From:
IPCC. *Carbon Dioxide Capture and Storage*. By Edward Rubin. IPCC, 1 Jan. 2005. Web. 15 Apr. 2014.

Assumptions:
60% of CO_2 emissions CCS able
40% extra power for power generation equipped CCS to fuel CCS
CCS for industrial processes takes the same amount of power
80% capture efficiency