The Sustainability of CCS

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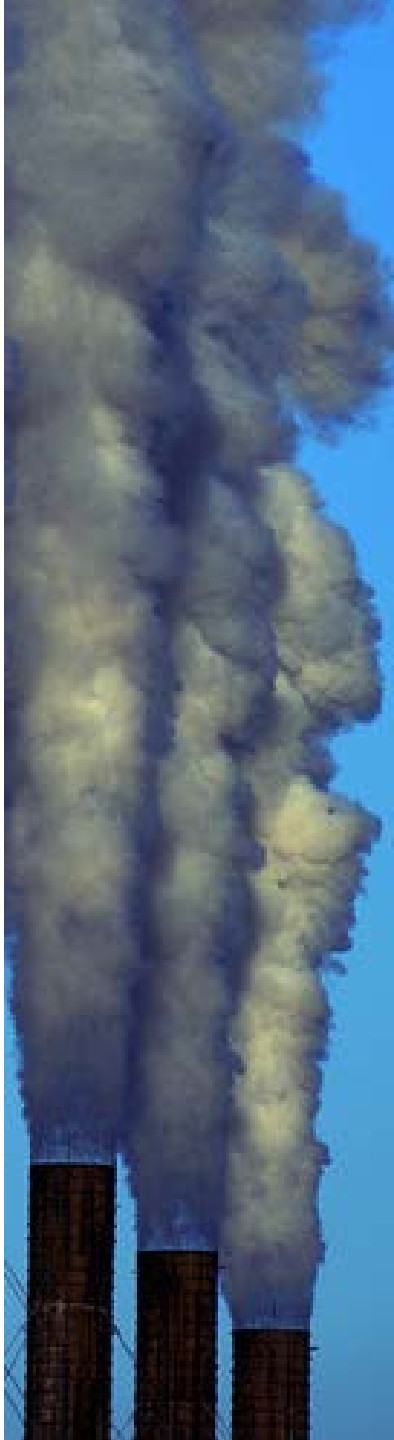
Alternative CCS pathways workshop
Oxford Martin School, June 2014



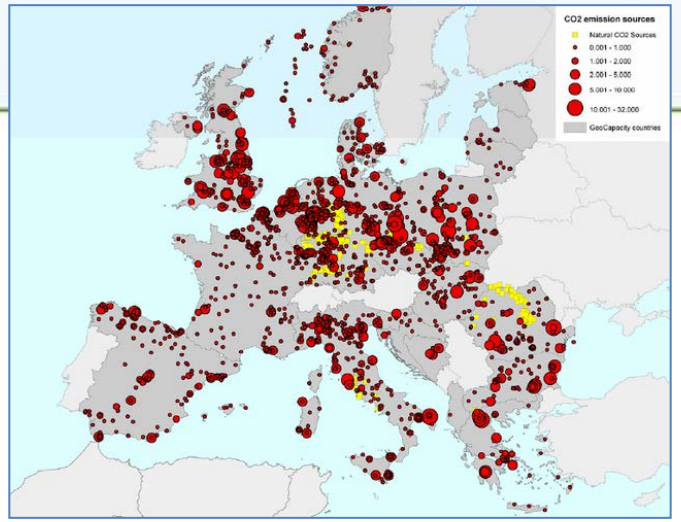
Fossil fuels produce waste at a massive rate

Human activity-related CO_2 emissions: around 80 million tpd

or 1 million tons every 18 minutes.

15 million tons of CO_2 are photosynthesised every 18 minutes

Carbon Capture



IEA, IPCC

The location of stationary CO_2 emission sources

~8000 sources produce ~15 bn tpy

Carbon Capture

We might capture 15 bn tpy in 8000 plants at a capital cost of around $US 1 trillion – this treats all large stationary sources of CO_2.

CO_2 from flue gas: 70 000 tpy plant, Malaysia

Amine treating: A Shell project (1975)

Tertiary amines can absorb H_2S and CO_2

Demonstrated by pilot plant in Germany, methyldiethanolamine (MDEA) is now a widely applied solvent

Eg used at Sleipner

The natural gas plant at Grossenkneten in Lower Saxony treats 6.5 bn m^3/y.
850 000 t/y sulphur removed by amine solvents.

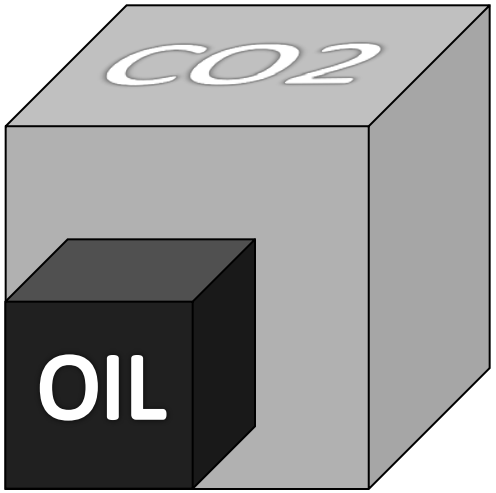
Carbon Capture

CCS – size of the industry

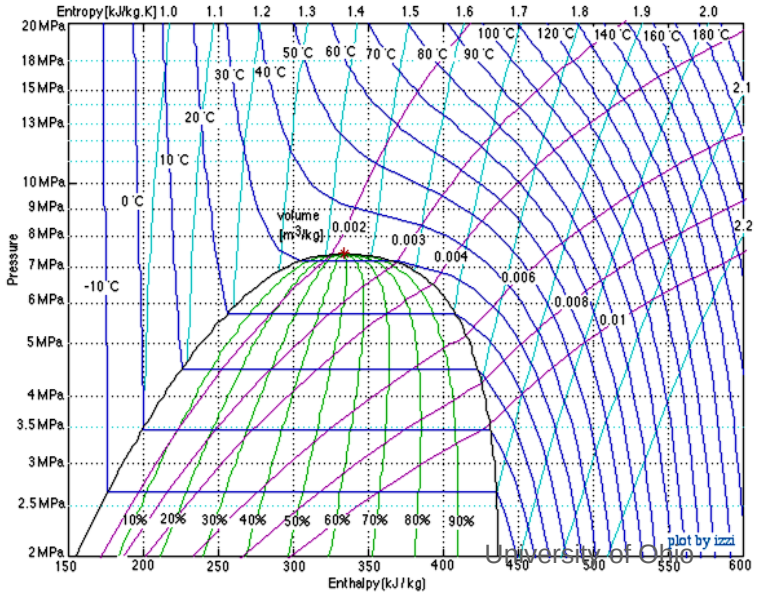
If we capture all 15 bn tpy CO_2 from stationary sources, and compress to critical point (73.82 bar) we obtain 32.1 bn m^3, which is a cube of side 3.2 km.

Current world oil production is 3.88 bn tpy, equivalent to 4.52 bn m^3, a cube of side 1.65 km.

By volume, CCS is potentially a larger industry than the oil business.



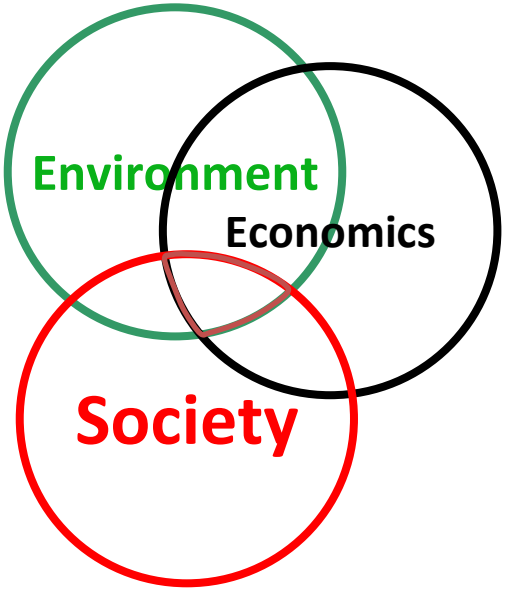
CO_2
Vc = 0.00214 m^3/kg
Tc = 31.1 ^oC
Pc = 7.382 MPa



Carbon Capture

What does the public think of storing CO2 underground?

Some are not keen at all.



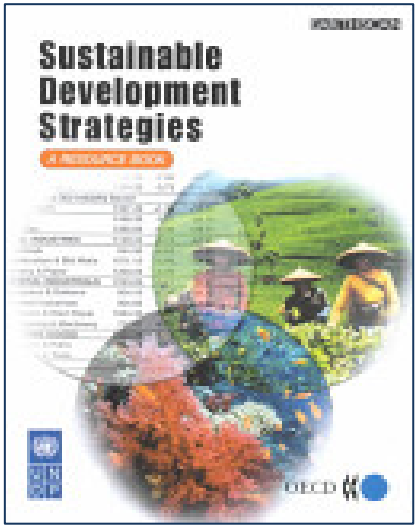
Joseph Stiglitz

"What we measure affects what we do... If we use the wrong measures we will strive for the wrong things."

Joseph Stiglitz
Nobel laureate, Former Chief Economist, World Bank

Sustainability measurement – main steps

- *Designing a framework*
  Systemic, hierarchical, logical, communicable
- *Choosing indicators for each component*
- *Generating indices by weighting and aggregation*
- *Identifying priority issues and policy options*

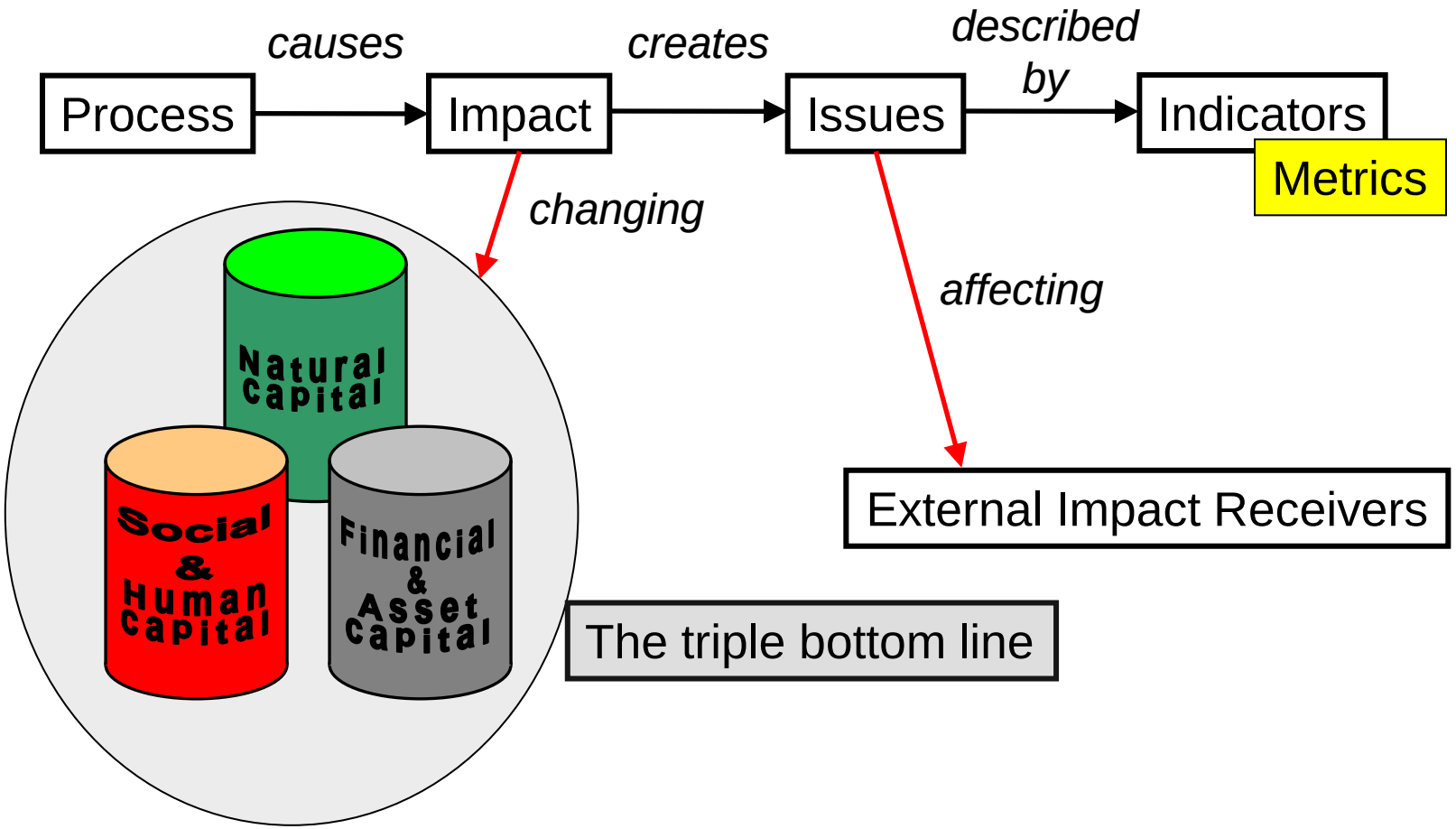


Source:
Dalal-Clayton and Bass
Sustainable Development Strategies, Earthscan, 2002

See also:
Global Reporting Initiative, G3 guidelines, from https://www.globalreporting.org/

Handbook on Constructing Composite Indicators, OECD http://www.oecd.org/std/42495745.pdf

The Process Analysis Method PAM



Chee Tahir, A.C. and Darton, RC. (2010) The process analysis method of selecting indicators to quantify the sustainability performance of a business operation. J. Cleaner Production 18: 1598-1607.

The Process Analysis Method PAM

PAM case studies

- **Palm oil fruit production**
- **UK motor car fleet (distributed service provision)**
- **Arsenic mitigation in Bengal**
- **Yellow River management system**
- **Geoengineering**

Summing up…

- **CCS could become a really large industry**
- **Its impact would be large**
- **We need credible, holistic sustainability assessment**
- **Geoengineering (a technological imaginary) also needs assessing (IAGP)**