

Overcoming barriers to CCS

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How to identify barriers?

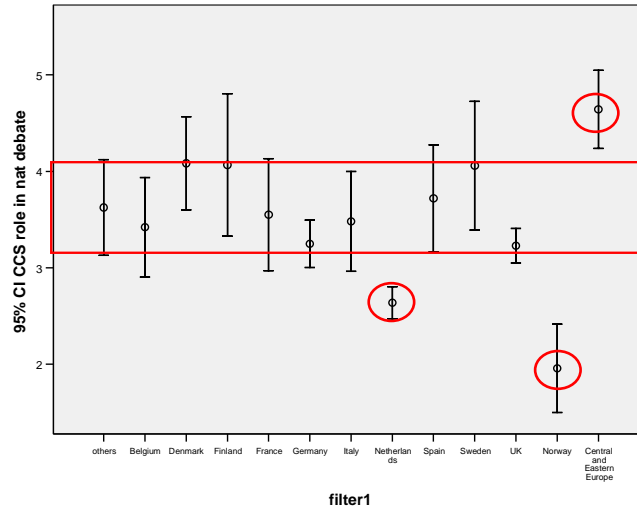
- Surveys
- Policy research
- Observations and reconstructions existing projects
- Brainstorm

Understand the problem to arrive at a solution



ACCSEPT project: survey results (2007)

- Stakeholders
- Government
- Needs
- Significant

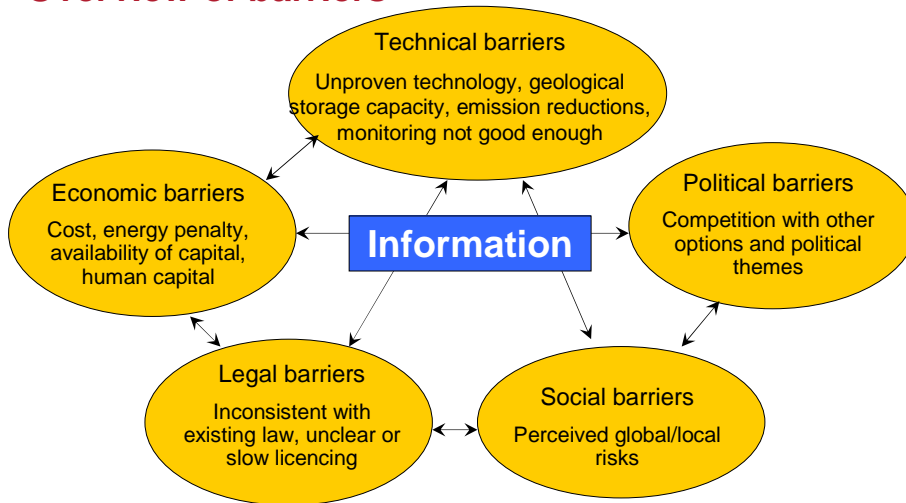


Barriers most often mentioned

- availability of suitable geological storage sites
- price of carbon under EU ETS
- reduction in costs of CO₂ capture
- development of R&D base
- a post-Kyoto phase with tighter national emission reduction requirements
- development of legal & regulatory basis
- public perceptions



Overview of barriers



Role of information



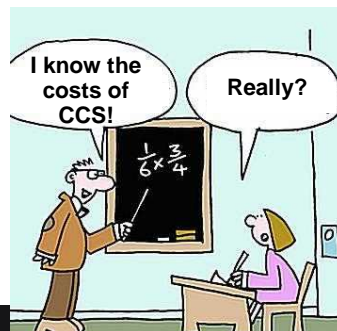
- Public, political and stakeholder awareness
- Information on costs with policymakers and operators
 - Information basis seems large but in reality is quite small and rarely based on real data
 - Variation: Fuel and material costs
 - Confidentiality of information
 - Optimism in cost assessments
 - Incorporating technological and policy risks in decisions, depending on external developments
- We don't know what we don't know
 - Unlikely or hidden barriers are hard to address

Do we know what CCS costs?

When someone tells you he knows the costs of CCS:

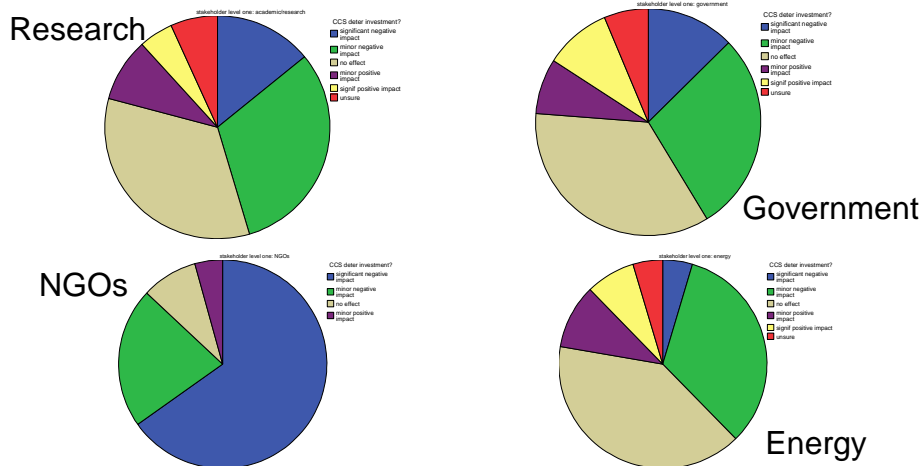
- 1) Be sceptical
- 2) Ask questions on the project specifics
- 3) Ask questions on the underlying assumptions
- 4) Apply rule #1

Rehearse this!



Not hard science...

Impacts of CCS investment upon investment in other LZCTs?



Perception of CCS is important

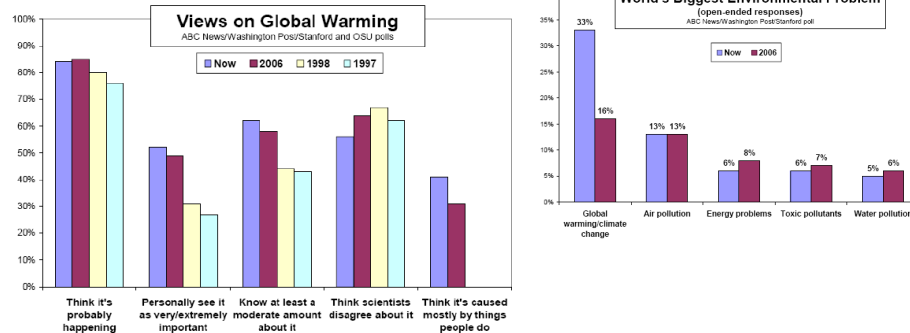


Perception of CCS is important



Public awareness of climate change

- Curry et al (2007): environment 11th highest ranked priority for Americans
- Palmgren et al (2004): “Reducing climate change” lowest social priority of the 15 choices provided



Public awareness of CCS

- Low awareness in Australia, USA, Japan, Canada, UK, Sweden, France, Germany, the Netherlands:

Between 4% and 29.9% can give some kind of answer as to what CCS is.

(Ashworth et al, 2006, 2009; de Best-Waldhober et al, 2006, 2008; Ha Duong et al, 2009; Itaoka et al, 2008; Reiner et al, 2006; Sharp et al, 2006)

- Dutch representative samples in 2004, 2005, 2007, 2008: No increase in awareness over time

Measuring public opinion of unknown technology

Many researchers inform their respondents

- In focusgroups with experts explaining
- In surveys with information to read or to evaluate

Both difficult and time consuming, risk of bias

➤ Issue: lay ideas that experts would have never guessed

Instinctive responses

“Carbon dioxide could change the DNA of organisms, and this will cause a vicious circle” (by a chemist!)

“Leakage could lead to bad air, health problems for people living nearby, for example lung cancer”

(Wallquist et al, 2009)

“This is among the DUMBEST ideas that I've ever seen. There is no way anyone with a brain would ever get near a suffocation pocket like that.”

“... when I was a kid in school I seem to recall being taught plants eat CO₂ and crap out oxygen...maybe we need to plant more plants to eat all the CO₂? probably too simple an idea, Shell can't make a profit on it!”

(Houston Chronicle website, day before yesterday)

Public perception may not be what you think

- Take the perspective of a lay person living near a potential storage site
 - What is this technology? Sounds scary.
 - I wonder: why me?
 - Worried about safety, the value of my property
 - The experts do not make the impression that they understand my concerns
 - Nobody is listening
- Stop convincing, start involving

Barendrecht, the Netherlands

Actors:

- Shell and NAM
- Dutch government
- Barendrecht city council
- Greenpeace and Green party
- EIA commission

CO₂ from refinery, storage in depleted gas fields

EIA conducted and approved

Information meeting

Fully legal: what went wrong?



What went wrong? (tentative...)

Government and Shell in a hurry,
seemed the ideal project

Environmental Impact Assessment

- Information or consultation?
- Who pays for the EIA?
- Who provides information?
- What kind of information?

Public relies on trusted sources

Barendrecht already under pressure

Industry, government afraid of public



The role of CCS experts

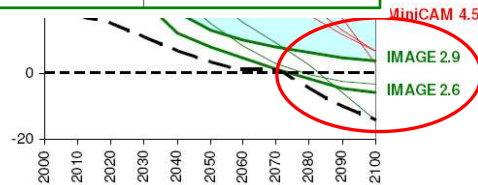
- CCS community: a multidisciplinary mix of academic researchers, policymakers, service companies, power sector, manufacturers, etc.
- “Group think” can be observed:
 - Leading to strong, coherent message to policymakers
 - As a community: possibly blind to drawbacks, selective listening and dismissing certain categories of criticism
- Public trust needs an independent expert community that improves, not promotes the technology
- **Including YOU!**

CCS: are emission reductions sufficient?

Scenario category	Region	2020	2050
A-450 ppm CO ₂ -eq	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO ₂ -eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO ₂ -eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

MES-A2R 8.5

AIM 6.0

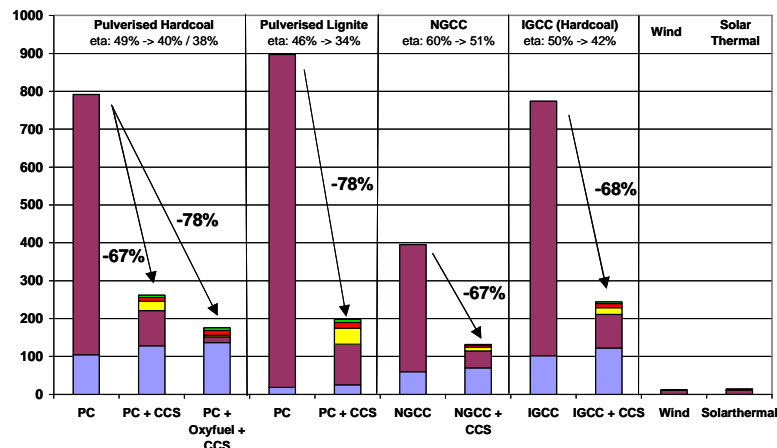


Negative emissions required

CCS: are emission reductions sufficient?

g CO₂-eq / kWh_{el}

■ Fuel supply ■ Power plant ■ Capture & Liquefaction ■ Transport ■ Storage

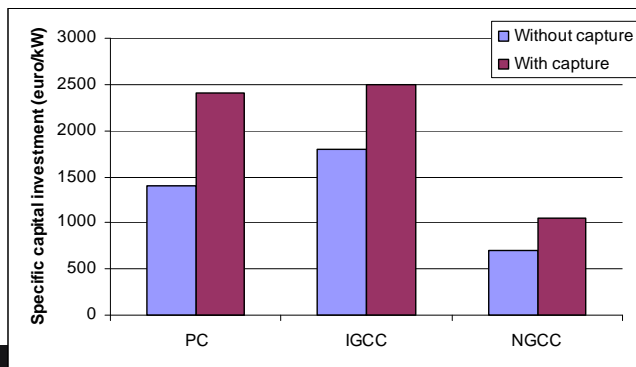


Finance does not equal costs

Numbers expressed in US\$/kWh or US\$/tCO₂ hide the distribution between capital and O&M costs

Competition for capital based on return on investment

Capital-intensive options require different incentives



Source: Seebregts and Groenberg, 2008

Take-home messages

Delving into barriers is useful

- Explains why things are not happening
- Provides basis for a solution
- Identify areas of further research
- Basis for policy, legislation and practices in industry
- Moving field: new barriers emerge and go away

Independent experts have a responsibility to be critical of CCS, to see, highlight and repair the disadvantages

**What is the most unlikely CCS
barrier you can think of?**

Thank you!
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