

Public Perception of Industrial Carbon Management

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Outline

- What do people really think?
- What is carbon sequestration?
- Speculation about current politics and public perception

What's Industrial Carbon Management

Yet another means to control the environmental impact of fossil energy:

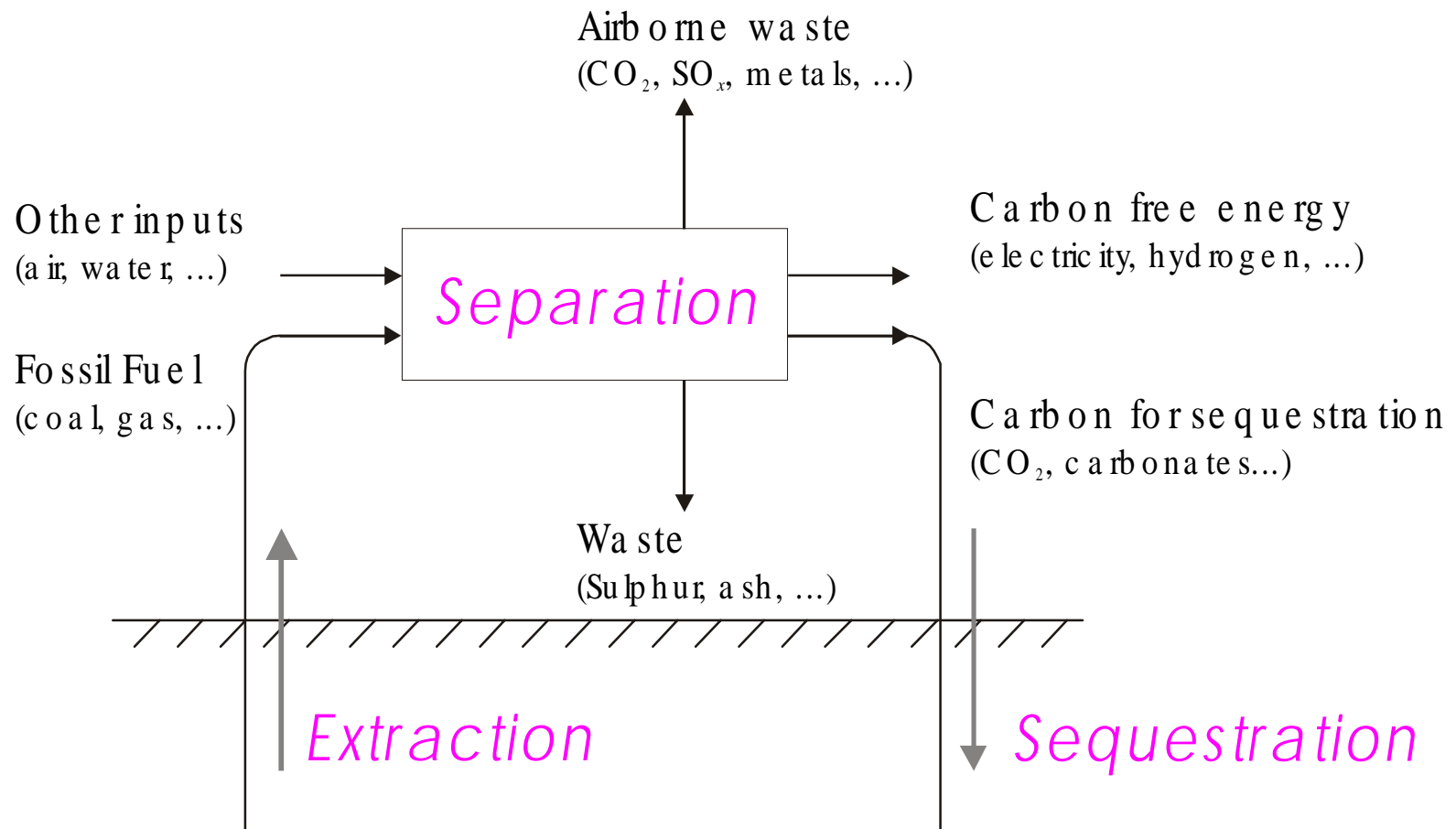
SO_x , NO_x , Fine Particulates, Mercury, ... CO_2 Sequestration

Or

Yet another overreaching risky band-aid that avoids the real problem:

Nuclear power, weather control, ... CO_2 Sequestration

Industrial Carbon Management



What do people really think?

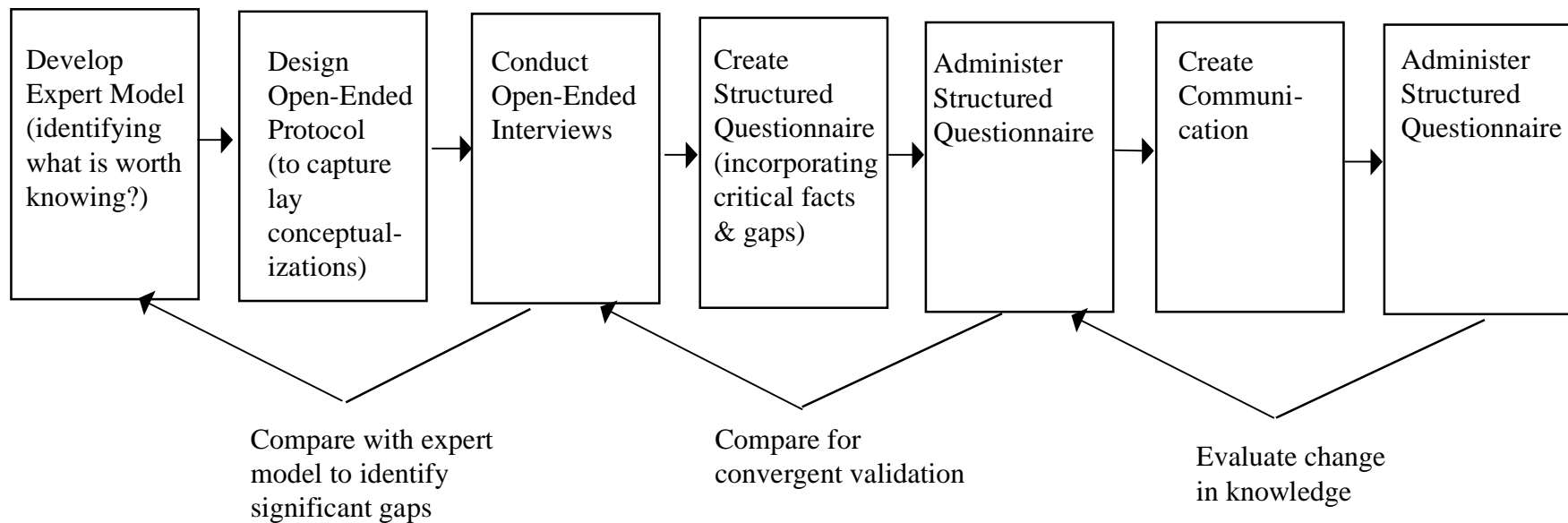
Public Perception of Industrial Carbon Management:
Speculations and Preliminary Evidence

David Keith, Claire Palmgren and M Granger Morgan

Tools for Assessing Lay Judgments About Climate & Energy Policy

- We know very little about lay understanding of *responses* to the climate problem
- Closed form surveys can produce meaningless results
 - Lay language differs from expert language
 - Expert may not understand lay mental models

"Mental Models " Strategy for Risk-Communication Development



From: Fischhoff, B., D. Riley, D. Kovacs, M. Small. 1998a. "What Information Belongs in a Warning?," *Psychology and Marketing* 15,663-686.

Application to Industrial Carbon Management

- Knowledge of issue is so slight that open mental model approach will not work
- Solution: Prepare short briefing document that the expert read then use MM methods to probe further
 - Subject reads briefing aloud to help us assess *their* interpretation
 - The communication *inevitably* shapes the results
 - Focus group and unstructured probing (*hopefully*) dilute framing effect of our communication

Interview Results: Structure of Study

- Individual Open-Ended Interviews: 45-Minutes
 - “Read aloud” protocol
 - Non-judgmental probing
- Focus Group: 1 Hour
 - Facilitate group dialogue
 - Non-judgmental guidance

Interview Results: Study Sample

- Convenience sample of 11 CMU staff without engineering or science degrees
- No active environmentalists
- Age: Range 21 - 63 years (Mean 37.1 years, +/-13.3)
- Gender: 4 Men and 7 Women

Interview Results: General

Initial Reactions to
Separation and Sequestration

Subjects (n=11)

Positive	4
Negative	3
Ambiguous	2
Too little info	2

Interview Results: General

Initial Reaction to S and S: Sample Comments

- Positive
 - Well, it's the beginning, somebody has to start somewhere. And so this sounds like a good beginning. [S 5]
 - I think it's a good idea because of the problems that we attribute to the CO₂, the global warming. [S 10]
- Negative
 - It makes me feel uncomfortable, the thought of putting the CO₂ either deep in the ground or deep in the ocean. [S 3]
 - It's just polluting it in a different place or putting it somewhere else. [S 4]
 - Because, sometimes things are done to fix a problem and then you find out the fix was worse than the original thing. And again, I'm still, I'm not sure that the carbon dioxide is a problem in the atmosphere yet. [S 8]

Interview Results: Kinds of Problems

Potential Problems Mentioned

	<u># Subjects (n=11)</u>
Negative impacts	8
Substituting one problem for another	7
Don't know enough before we do it	4

Interview Results: Kinds of Problems

Potential Problems: Sample Comments

- Negative impacts:

I'm not sure the ecological—we're talking about ecology—what possible damage putting this down into the ocean and some of the different, the deep geological formations. . . . [S 9]

- Substituting problem for another:

But it's almost kind of like the old analogy, robbing Peter to pay Paul. You're doing one thing to improve something, but you're creating a problem elsewhere. [S 7]

- Don't know enough before we do it:

And I don't think they know what's going to happen when they stick it somewhere. [S 4]

Interview Results: Ocean & Geological

Initial Preference for Geological or Ocean Sequestration

- Only 2 out of 11 subjects explicitly preferred geological
- However, number of comments on oceans outnumbered comments on geological by 2.5:1

Interview Results: Ocean & Geological

Ocean Sequestration Comments

- I think the concern that really strikes me the most would have to be pumping it under very high pressure into the deep ocean . . . I know the ocean is very big and is very deep but I'm wondering what kind of effect it would have on our oceans. [S 1]
- That, if this extra CO₂ is absorbed into the ocean, would it disrupt whatever balance is in the ocean. That it might be harmful to things that live in the ocean. [S 3]
- Well, where are they going to build these? Are they have to be near the ocean? Or are they going to build big pipelines into the ocean to flush the stuff away? In the process of doing this, is there going to be pollution occurring, from this process?[S 5]
- So, I don't necessarily like the fact that it's being pumped down deep in the ocean, kind of like out of sight, out of mind. [S 7]
- So if we were to put it, like, in the ocean, we could be messing with some form of life that's on the bottom. I don't think we have much knowledge of what's down there. Because we really can't explore that deep. So we'd be messing with something we have no knowledge of. [S 8]

Interview Results: Ocean & Geological

Geological Sequestration Comments

- I don't know how they would pump it into rocks without it escaping somehow. But that's technology that's way over my head. And yes if it can be made cheap and reliable it would be wonderful. [S 5]
- In the deep formations, how are they going to –we're already having problems with our water table. Are they sure that they're dissolving it in salty water or how will they make sure it doesn't contaminate or taint what's left of the Artesian Wells and things like that. [S 4]

Interview Results: Slow Leaks

Concerns of Critics:
Slow leaks of CO₂ over a long time

- Low concern
- Sense that if most of it stays down there, that's progress
- Doesn't have to be 100%
- Some concern about drinking water

Interview Results: Slow Leaks

Concerns of Critics:

Slow leaks of CO₂ over a long time, Sample Comments

- Well, if they weren't directly a threat to people or animals, so what? They were going to go into the atmosphere anyway. So, monitor them and fix them when you find them, but it doesn't really seem like this would be much of an issue. [S 2]
- I don't really—I think that's kind of presumptuous to think that anyone knows that much about the forces on earth that control deep ocean and deep land formations. [S 4]
- And if you're able to capture this and create a good idea to trap it, this slow leak just seems like it's, you know, instead of a hundred percent of the CO₂ being released into the air, you're letting one percent or two percent released. I think you've still created a much better benefit. [S 6]

Interview Results: Fast Burps

Concerns of Critics:

Fast "burps" of CO₂ in a short time, Sample Comments

- Just thinking about it scares me . . . [S 1]
- It could happen if – I mean, the Titanic sunk; the experts aren't always right. [S 3]
- You're not talking about sticking it into a small man-made storage tank that's going to be kept in a large building in remote area that's never experienced. . . It's just too unpredictable. [S 4]
- Well, we had Three-Mile Island. That was a large burp. We had a place in Africa where they blinded – I don't know what that was. I forget what that was, it was a chemical that was burped into the air and a lot of people went blind. [S 5]

Interview Results: Changing Attitudes

Final Attitude towards S & S: Sample Comments

- Positive to Ambiguous:
 - I think I couldn't give a flat out good or bad. I think they could be a good idea if they were proven --all the things I mentioned – cost effective and as safe as can be made. It's a judgment call being made, whether they are safe enough to implement. It would have to be the government that would decide that. [S 2]
- Ambiguous to Positive
 - I think overall, I think the technologies definitely sound like a good idea. And it just needs to be, you need to take these ideas and proceed with the right amount of caution to hopefully really create a better solution down the road. To just not address the problem that's been presented, or say, wow this is just too much opposition and walk away from it, obviously that doesn't make sense. I just think that –yes I think there's a lot of benefit to move forward with these ideas and technology. [S 9]

Interview Results: Issue Framing

Subjects Overlay CO₂ Sequestration Concepts onto Existing Environmental Risk Frameworks

- Pollution Framework
- Garbage/Trash Framework
- Nuclear Waste Framework
 - We're talking about putting something down in there. This almost sounds like nuclear waste, putting it down, storing it somewhere. Gee, it will be safe for ever and ever and ever. [S 9]
- Chemical Waste Framework
 - Nuclear waste being stored here, garbage being put there, to store it to other places—it's going to storage as an unwanted product. So then there's going to be arguments over where to put it. [S 8]

Underlying Concerns : Speculation

Concerns about Industrial Carbon Management

- End-of-pipe solution
- Novel environmental risks
 - Catastrophic venting of CO₂
 - Earthquakes
 - Disruption of oceanic ecology
- Allows continuation of an over-consumptive lifestyle
- Prolongs use of fossil energy
 - Intrinsically undesirable
 - Upstream environmental problems (oil, coal & gas extraction and transport)
 - Not sustainable
- Will divert resources from renewable energy

What is carbon sequestration?
Words matter!

What's Industrial Carbon Management

Yet another means to control the environmental impact of fossil energy:

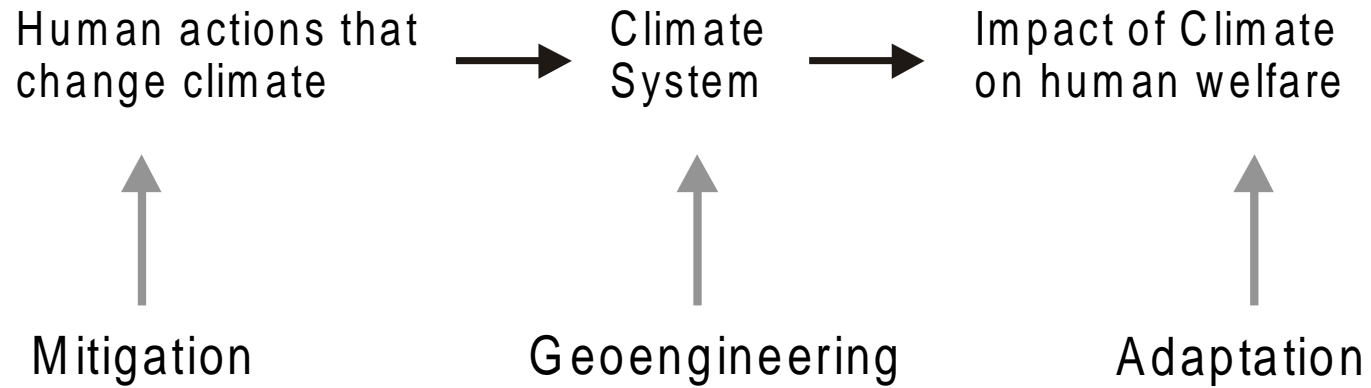
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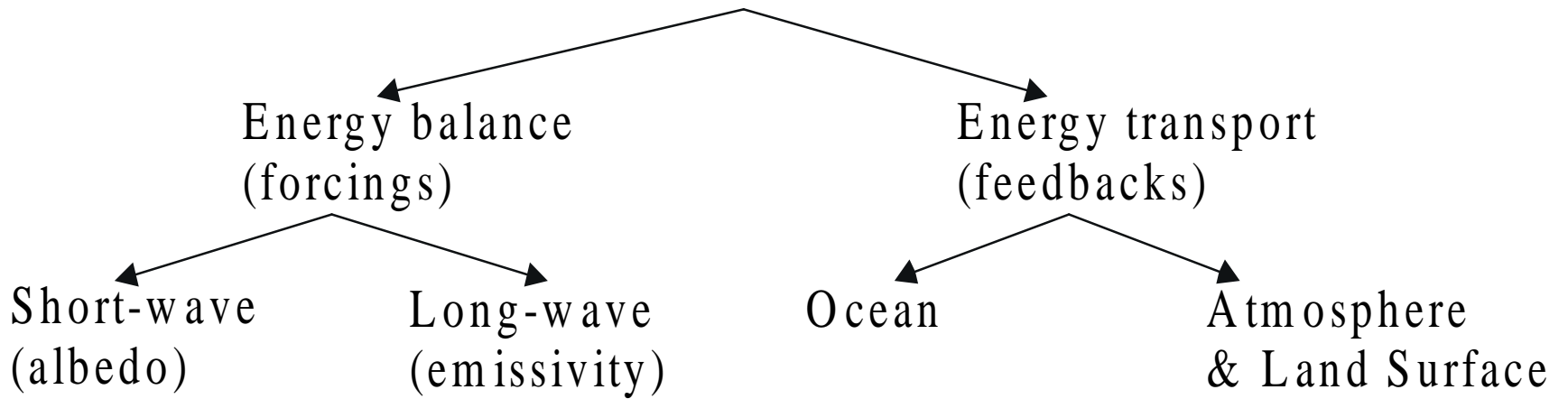
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A Simple View of the Climate Problem



Climatic Geoengineering



Geoengineering

- / Space-based scatterers
- / Atmospheric scatterers
- / Land surface albedo modification

- / Ocean fertilization
- / Terrestrial ecosystem carbon capture
- / Accelerated weathering
- / Ecosystem productivity enhancement by genetic modification

- / Large dams: Gibraltar or bearing strait
- / OTEC
- / Iceberg transport

- / Chemical or physical control of evaporation
- / Hydrological engineering
- / Weather control
- / Modification of surface roughness

Impacts

- / Sulphuric and carbonaceous aerosols: Direct and indirect effects
- / Surface albedo change: Clearing forests
- / Built structures: Cities & roads ...

- / Radiatively active gases: CO₂ CH₄ N₂O, etc

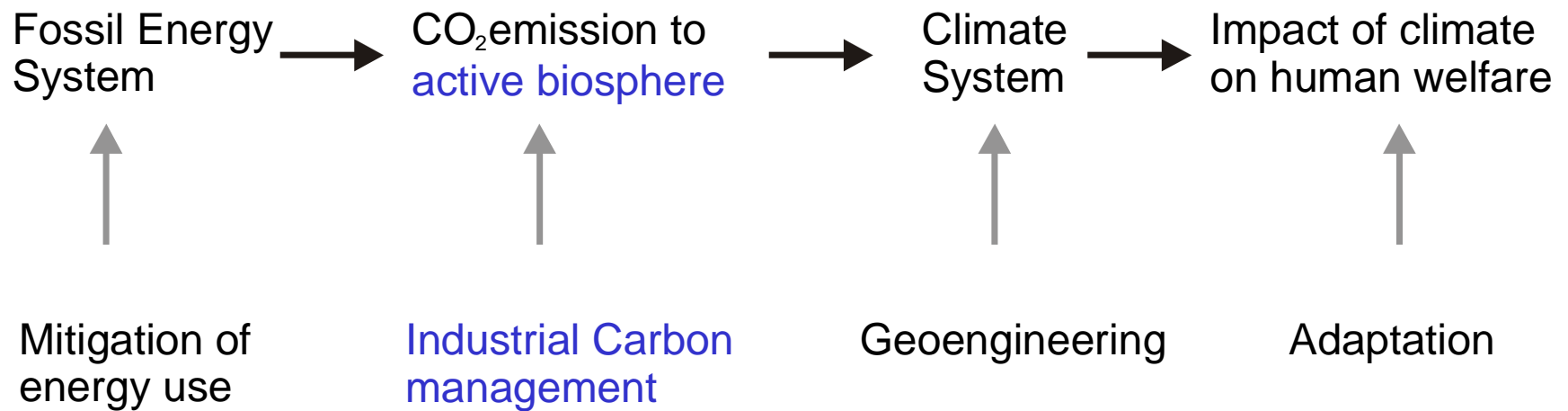
- / Secondary effects of land use change: E.g., salinity changes in Atlantic due to increased evaporation in Mediterranean

- / Hydrological engineering
- / Modification of surface roughness

Defining Characteristics of Geoengineering

- Environmental manipulation that is:
 - Large scale
 - Deliberate
- High Technology
- Countervailing

Where Does Industrial Carbon Management Fit?



Three key distinctions

- Regulating CO₂ concentration is different than regulating climate.
- Regulation of CO₂ concentration by minimization of sources is different than regulation by counterbalancing sources with sinks.
- Mitigation of climate impacts by reduction of consumption is different than mitigation achieved by technological improvements that reduce net environmental impact per unit of final product.

Definitions Matter

US Department of Energy has defined Carbon Management as:

- demand side regulation through improved energy efficiency
- decarbonization via use of low-carbon and carbon-free fuels or non-fossil energy
- carbon sequestration by any means
 - Enhanced biological including ocean fertilization
 - Management of terrestrial ecosystems for carbon capture
 - Sequestration of CO₂ in geological formations or in the ocean

This definition obscures distinctions that are likely central to policy implementation and to public perception.

Words

Sequestration/disposal/storage?

- Sequestration: to set apart, to separate for a special purpose
- Disposal: to regulate the fate or condition finally or definitively
- Storage: to collect as a reserved supply

Distinctions that matter

Mode of action: Before or after emission of CO₂ to the atmosphere

Timescales of carbon sequestration

- Carbon in terrestrial ecosystems has lifetimes of years to decades.
- Carbon dioxide in geological systems probably has lifetimes of centuries to millions of years.
- Deep ocean to atmosphere exchange time is ~300 years.

Speculation about current politics and public perception

ENGO's

- Industrial sequestration (mostly) not an issue
- A representative view
 - Oceanic sequestration a non-starter
 - Energy penalty matters
 - Source of CO₂ matters (fossil vs biomass)
 - Must not be an excuse for delay
 - Must not be an excuse for reduced effort on renewables
 - Might support if these technologies could accelerate action (treaty commitments or technology deployment) on mitigation