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<u>Policy Making in the Indeterminate World of Energy Transitions</u>

<u>Carbon Capture and Storage as Technological Transition or Enhanced "Carbon Lock in" by James Meadowcroft and Matthew Hellin.</u>

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<u>Article Objective:</u>

The article analyzes the consequences of using Carbon Capture and Storage (CCS) technologies as a climate change mitigating tool. The article addresses potential drawbacks with CCS that would have long term impacts that raise concerns around the viability of the technology.

<u>Article Summary:</u>

The main points raised by the article are as follows:

1. One big pull towards CCS technologies is that they would enable a reduction in CO_2 emissions without impacting current business practices. Companies could continue business as usual practices by deploying these technologies.
2. The main storage techniques would be to extract CO_2 and then store it in current geological formations such as well sites that have been decommissioned.
3. From a process point of view CO_2 extraction is energy intensive. It can be extracted during 3 main parts of the combustion process:
    a. Pre- combustion
    b. After regular combustion from the flume gasses
    c. After oxygen rich combustion from the flume gasses

The main challenges encountered for CCS technology

1. The technology needs a large amount of investment in the development side. While it has the potential to be one part of an intermediate solution, spending money to develop CCS technology would take money away from the development of zero carbon technologies
2. The geological storage of CO_2 does not guarantee that there will not be leakage of the gas. The sites would need to be constantly monitored. There is an additional concern that while initial CCS sites would be closely monitored to ensure safety, overtime these regulations may become lax and increase the potential of leakage.

Potential Consequences

One main failure consequence of CCS technology is presented. The potential risk of leakage would be devastating to any effort made to limit CO_2 emissions. The hypothetical scenario is posed that if the world effort gains momentum and is able to limit its emissions to prevent the 2 degree climate change point by 2100, then if any amount of leak occurs from CCS sites this could tip the scales over past the 2 degree and cause potentially catastrophic consequences.

Analysis:

The more dire consequence of CCS technology would be the risk of leakage. CCS sites would need to be monitored in a stricter manner than even nuclear waste storage sites. Nuclear waste can be contained easily, it is a solid waste product, radiation is easily detected and breaches in nuclear waste containment would result in localized impacts to the environment. CCS on the other hand is the storage of a gas that cannot be easily contained once it leaks. This risk is also reflected in the amount of methane and natural gas that currently leaks out from exploration sites. The amount of technology and monitoring needed to secure CCS sites would be significant. Even with the monitoring in place, there is no way to actually contain a breach. If a geological site becomes unstable and the gas begins to escape into the atmosphere- what kind of technology could remove that gas from the atmosphere?

CCS technologies would create a new set of concerns that would need to be mitigated. Essentially a ticking time bomb for the environment that would have no predictability in when it were to go off and how to contain its impact.

Questions:

1. Given the potentially dangerous impacts of CCS, could they still be a part of the intermediate solution to fighting climate change?
2. How could investment in CCS be done without impacting investment in zero carbon technologies?
3. Who would bear the cost of monitoring CCS sites and containing the leaks?
4. Would the potential cost of CCS, with monitoring and risk mitigation, make the idea of ‘business as usual’ economical if each company is to pay for their share of CCS usage?