

Carbon Capture and Storage: Risk Governance and Rent seeking

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1) Introduction

One reason Carbon Capture and Storage (CCS) is becoming increasingly relevant for climate policy is that it provides a major opportunity for rent seeking. The financial interests at stake are huge, and very different parties are positioning themselves in view of the rents that may be allocated in this area. The issue of rent seeking is somewhat neglected in the climate literature, and this is a serious deficiency for two reasons. First, rent seeking is one of the most important mechanisms in the arena of energy and climate policy, and second, it is likely to shape the cost dynamics of CCS as well as the liability regimes dealing with the risks of CCS.

Besides rents, risks will be allocated, too, and some of these risks have a spatial reach spanning the globe and a temporal reach of centuries and millennia. The parties interested in potential rents have an obvious interest to shed the burden of those risks on other parties. These are the kind of circumstances where the general public is likely to be wary of cheap talk about the safety of CCS. To avoid gridlock and mismanagement, there is a need to design mechanisms in such a way as to set credible incentives for sound risk governance. In particular, mechanism design must take into account the strong information asymmetries that are inevitable with large-scale technological developments like CCS.

I first discuss the main risk of CCS: that it might be implemented at a very large scale and found to fail in the long term. My point is not that this risk is very likely, quite the opposite: it is one of those low probability . high impact events that form key challenges in risk governance. I then look at rent seeking in relation to climate policy, in particular to CCS. Finally, I analyze what combination of incentives will be needed to establish credible and efficient risk governance for CCS.

2) Risk

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Like any large scale industrial operation, CCS involves a series of risks. Many of these are similar to those known from other fields . e.g. the risk that locally leaked CO₂, being heavier than air, could kill people as these can't find enough oxygen to breathe. Here, I will focus on the large scale risk peculiar to CCS, namely that leakage rates undermine the climate policy goal pursued by CCS. If this risk will be handled in a way that is credible *ex ante* and reliable *ex post*, CCS may become part of a successful global climate policy, if not, it is unlikely to get beyond a mixture of experimentation, confrontation, and litigation.

Over the next two centuries, humankind is perfectly able to emit some 5000 Gt of carbon (Rogner, 1997). In the current public mood it is often taken for granted that emissions will soon be reduced to levels that will avoid dangerous climate change (perhaps keeping global temperature increase below 2°C). The experience of nuclear weapons accumulation and proliferation, however, shows that humankind may well engage in highly dangerous activities for a long time. 5000 Gt of carbon are likely to be available at a cost that will make their use economically profitable, even much larger quantities cannot be ruled out (Hasselmann et al., 2006). A possible emissions trajectory is sketched in figure 1 (following Archer and Brovkin, forthcoming).

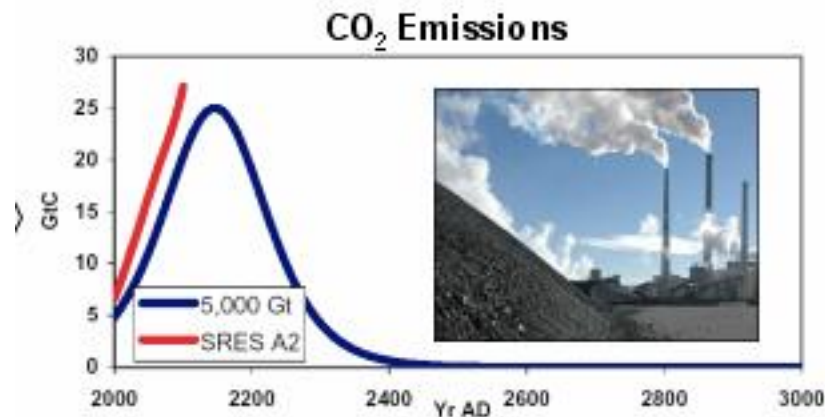


Figure 1: Feasible emissions with available carbon

The emissions trajectory of figure 1 is likely to lead to global warming of about 5°C within two or three centuries. Even rapidly declining emissions would not lead to a similar decline in temperatures. Instead, temperatures more than 4°C above pre-industrial level have to be expected for millennia (figure 2, following Archer and Brovkin, op cit.).

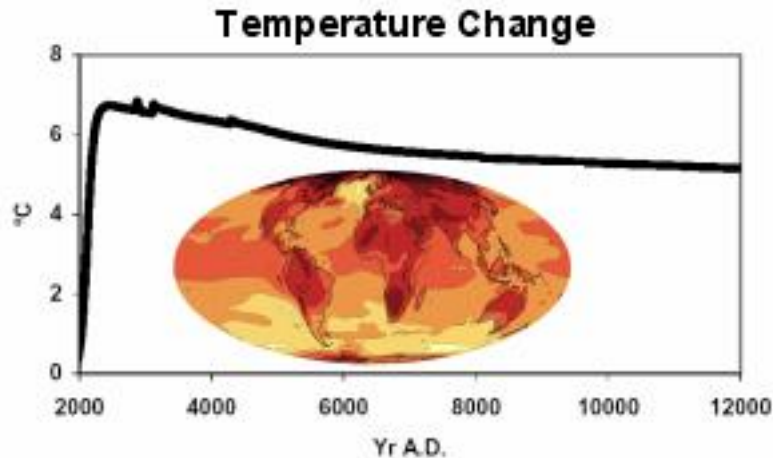


Figure 3: Temperatures resulting from the emissions of figure 1

Sea level rise is still slower than temperature dynamics, and this is highly relevant to the long-term risks of CCS. Paleoclimatological data suggest that there is a robust linear relation between global mean temperature and equilibrium sea level at that temperature: per degree C of warming, about 15m of sea level rise result (figure 3, following Archer & Brovkin, op cit.). The scenario of figure 1 would then imply more than 50m of sea level rise. There is no point in thinking about dams of that height . the coastal cities of the present would all be submerged by the ocean. Our descendants might look at the ruins of our civilization from submarines.

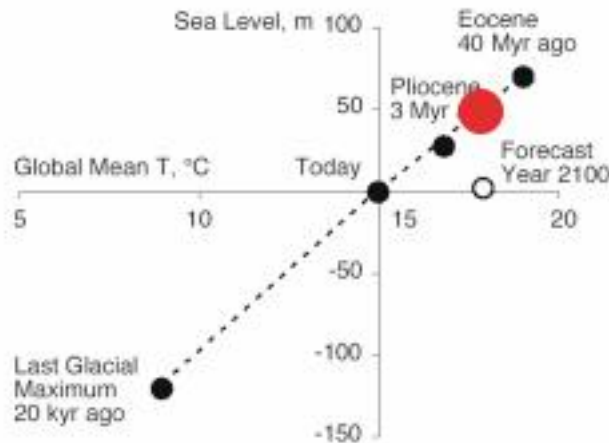


Figure 3: Long-term sea-level rise

These are the risks CCS is supposed to deal with. To analyze the challenge of risk governance involved, suppose first that about 5000 Gt of carbon are sequestered and stored between 2010 and 2200. As the buildup of such a huge CCS scheme will take several decades (Toth and Rogner, 2006), global mean temperatures may well increase

by at least 2°C before direct emissions are effectively reduced. If a leakage rate of 1% should obtain, more than half the amount of carbon stored would be released within one century, leading to an additional temperature increase of at least another 2° C. The coastal cities of our world would be as lost as without CCS.

Next, suppose that a much smaller amount of carbon, say 1000 Gt, is stored up to 2200. With the same leakage rate of 1%, indirect emissions . i.e. emissions generated via man-made storage - of more than 500 Gt would result in one century. This in turn might lead to even greater temperature increases per ton of carbon than if they had never been stored, because the absorption capacity might be smaller with slower accumulation of carbon in the atmosphere. Long-term sea level rise would still be way above the level of today's coastal cities.

Two conclusions can be drawn for risk governance of CCS. First, claims that leakage rates will be drastically smaller than 1% must be credible. And second, sound CCS risk governance needs a plausible worst case contingent plan for the possibility that leakage rates in the order of 1% do result. Before discussing how these two requirements can be met, however, it is necessary to look at the economic interests involved in CCS risk governance.

3) Rents

Since their introduction as a resource for producing commercial energy, most fossil fuels have commanded a rent. This is mainly due to the fact that they usually compete with more costly resources used for the same purpose. Oil from Saudi Arabia, e.g., can compete with North Sea oil and with coal from relatively costly mines. The owners of the rent-commanding resources have been able to limit their exploitation to a rate that keeps the more expensive resources in the market.

The rent is appropriated by the governments of the countries of production, by energy companies, and by the governments in the countries of use. The distribution between the different parties is the result of a struggle that is part of the fossil fuel industry no less than engineering efforts and market mechanisms. More generally, rent seeking . the attempt to appropriate sources of income that yield an income without labor or entrepreneurial activity being needed . is a key mechanism at the interface between the economy and politics (Tullock, 1987).

Limiting the use emission of carbon for reasons of climate policy will add a new rent to the world of fossil fuels . call it the climate rent. Under the current EU emissions trading scheme, e.g., the current grandfathering practice means that energy companies are handed out an annual rent in the order of magnitude of \$50 billion.

Current carbon prices in the EU emissions trading scheme are in the order of \$20 per ton (pretty much the price advocated by the most widely quoted climate economist, Kyoto critic W.D. Nordhaus). If this price will be applied to global annual emissions of about 7Gt, it will result in a rent of about 140 billion \$, nearly four times Exxon's record 2005 profits of \$36 billion. The Stern Review of the economics of climate change,

however, advocates a carbon price of 300\$ per ton . at current emissions, this would result in a rent of about 4 trillion \$ - twice the GDP of Germany. And of course, global emissions will keep rising for quite some time.

Once energy companies will come to the conclusion that some form of global emissions reduction is imminent, strong pressure towards a grandfathering scheme for emissions permits should therefore be expected. If then some fraction of greenhouse gas emissions will be avoided with relatively expensive CCS processes, this will drive the price of permits up, and the climate rent will increase accordingly.

At the same time, the companies seeking climate rents from CCS will have a strong interest to avoid liability for the risks involved. These risks will then stay either with consumers or with government, and so ultimately with taxpayers. Given the fact that the general public so far has no great trust in CCS proposals (Curry, 2004; de Figueiredo, 2007; Palmgren et al., 2004), CCS is unlikely to become an effective instrument of climate policy without a mechanism design that addresses the interaction between rent seeking and risk sharing in this area..

4) Incentives

In order to develop a risk governance framework for CCS, it is important to keep in mind that this development will be shaped by a systematic information asymmetry: the companies involved in developing the relevant technologies and infrastructure will necessarily have greater know-how on most aspects of implementing CCS than government agencies, scientific institutions, mass media, etc. There is nothing wrong with this situation as long as suitable incentives lead companies to use their know-how to minimize risks, to share their knowledge about these risks, and to minimize the costs of CCS for their customers and shareholders as well as for the general public. Ill-designed regulatory frameworks, however, can lead to the opposite effects.

It is useful to distinguish two phases in the possible development of CCS. In the first phase, the effect on global emissions is marginal, say less than 5%. This phase has already begun with a series of pilot projects in different countries. In the second phase, that may or may not be realized, CCS would affect a large fraction of global emissions, rising from 5% to perhaps 50% and more. During both phases, global fossil fuel consumption may keep growing, stagnate, or actually be reduced.

In the first phase, it is essential to make sure that the climate rent is used mainly for financing the costs arising as a consequence of climate change. From Ricardo to Walras to Tullock, economists thinking about rent incomes have emphasised that private appropriation of those incomes sets highly problematic incentives: actual and potential owners of the relevant property rights get a strong interest to lobby public policy in favor of their own prospective rents. Such was the case with the British Corn Laws in the days of Ricardo, and such will be the case with global climate regimes if this issue is not addressed.

Probably the best way to collect the climate rent is by auctioning emissions permits, as then the market simultaneously determines the height of the rent and hands it over to public authority. In principle, taxes on carbon and other greenhouse gas can be used to the same effect, but the information needed to make those taxes equal to the climate rent is usually not available and the policy process for defining levels of taxation is driven to a large extent by concerns that have little to do with the specific problem a carbon tax is meant to address.

Collecting the climate rent by public authority sets strong incentives for companies to minimize the costs of CCS for customers, while the incentives work the other way round if the climate rent is collected by companies. Take the example of an emissions permit scheme where permits are issued by grandfathering. The costs of marginal CCS activities may then set the permit price and so the level of the climate rent . as a result, companies have an interest in expensive CCS techniques. If the permits are auctioned, however, their interest works towards cheap CCS techniques

What should be done with the climate rent? The reason to establish that rent is the need to internalize an external effect: to create a market signal that creates a trade-off between enjoying the advantages of greenhouse gas emissions . like the possibility to drive a car . and causing the costs that arise as a consequence of these emissions . like the need to build a dam against rising sea levels. Therefore, the receipts from auctioning permits should be used to finance the policy measures needed to deal with climate change. These measures include policies aiming at adaptation, at mitigation, and also compensation. They do not include investments of firms that reduce emissions in order to stay competitive in a world where emissions have a cost. Inducing these investments in an efficient manner is precisely the point of creating a carbon price.

The costs for climate policy, however, do not arise continuously. Extreme events can cause large costs stochastically, as may opportunities to trigger innovations by means of pilot-projects subsidized by government. On the other hand, revenues from an emissions permit scheme or a carbon tax may vary stochastically, too. There may be reasons to try to limit the volatility of energy markets, but to some extent this volatility is simply the way markets deal with all sorts of random events that affect demand and supply of different energy carriers. If at each moment in time climate policy was driven by current receipts from permits auction or carbon taxes, it would become erratic and extremely inefficient. Therefore, a significant fraction of the receipts from these sources should go into a climate funds that would enable climate policy to react quickly to needs and opportunities arising stochastically (Jaeger, 2004).

As climate change is a global problem, there will be a need for a global climate fund (Bhagwati, 2006). However, the climate rent will reach a volume that sovereign nations will hardly be willing to hand over to global institutions. And there are good reasons to expect a system of regional and national funds linked by a framework convention to work more efficiently than a single global structure (Asheim et al., 2006, Victor et al., 2005).

As long as the quantities of carbon captured and stored are negligible at a global scale, a combination of national regulations with a system of regional climate funds would be

sufficient to manage the risks of CCS. If the quantities stored should become a sizeable fraction of global emissions, we would enter the second phase. Here, international relations and obligations need to be addressed.

Suppose that in a hundred years leakage rates from stored carbon do reach the level of 1%, with the foreseeable consequences discussed in section 2. The question would then arise as to who is responsible, and, yes, liable, for the flooding of New York, Shanghai, etc. One way of dealing with the resulting situation is to limit the liability of firms engaged in carbon capture and storage and let national governments deal with whatever damages may result beyond this limit. This is how low probability, large impact risks have been dealt with the nuclear industry . with the result that the credibility of that industry has been wrecked, perhaps beyond repair.

If the general public is to support large scale CCS, it needs serious proof that the people and institutions declaring that carbon storage is safe can be trusted, and that they can be trusted at the unusual level needed to deal with the unusual risks involved. Scientific findings and public statements by decision makers will simply not be enough. Credibility can be established, however, if the businesses involved are willing to commit their assets for the case that their promises should turn out to be wrong. Of course, this has to be done on a pool basis, as otherwise individual firms would simply go bankrupt to escape serious liability. If the businesses involved in CCS would accept collective liability for the safety of CCS, they could establish the kind of credibility the nuclear industry is lacking. For such a system to work, it must be based on national jurisdictions: collective liability for large-scale CCS risks needs to be established at the national level. Climate funds run by government can then be used to settle international disputes about CCS leakages: the fund may cover whatever costs result from international obligations while being able to claim compensation from the national pool of businesses with CCS commitments.

The point is to distinguish between those risks that are an inevitable aspect of a large-scale industrial operation like capturing and storing a significant fraction of global CO₂ emissions, and the risk that the whole operation may turn out to be a failure. The former risks can be handled by applying established schemes of insurance and liability to the specific conditions arising with CCS. The latter require a different approach. The companies that will undertake large-scale CCS need to convince the public that the operation will not fail . global climate is nothing we want to gamble with. By collectively committing their assets for the case that leakage will exceed a well defined threshold . say 0.1% -, companies can create the trust that the threshold will indeed not be exceeded.

If a company wants to engage in CCS but is not willing to undertake such a commitment, the public has strong reasons to doubt the claim that CCS really is as safe as it needs to be. And if the stock market does not accept the stock of companies that do undertake such a commitment, the public has even stronger reasons to doubt that claim. On the other hand, if companies to undertake the commitment and stock markets keep trading their stock, then the conditions are given for large-scale CCS to actually work.

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