EUROSOLAR Info

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"Carbon free" power stations: No protection against climate change

With catchwords like **"Carbon free" power stations** or **"clean coal"**, operators of fossil fuel power plants suggest a contribution to protect against climate change. The very phrase "clean coal" is misleading however. Burning coal inevitably produces carbon dioxide. The actual meaning of “non”-CO_2 “emitting“ in the context of power stations is that the substances escaping up their chimneys into the air do no longer contain CO_2. But to achieve this, the CO_2 must have been completely removed before and, will have to be stored somewhere. The new technology to that effect is known as ***"Carbon Capture and Storage"***, or *"**CCS"*** for short (CO_2 capture, transport and storage).

CO_2 capture in power stations is very energy demanding. CCS technology reduces the overall plant efficiency by up to 15 percentage points, while the fuel input rises by up to 25 per cent. Moreover, considering the entire process chain, the expected maximum reductions in CO_2 emissions captured from power stations ranges between 65 - 70 per cent only. Added consumption of resources and potential leaks occurring on transport and storage are some of the underlying reasons.

Vattenfall Europe AG will build a pilot power plant using CCS technology (about 30 MW) nearby the existing power station at “Schwarze Pumpe” in the Lausitz area, Germany. It is to be the first of its kind worldwide and, operation is to start 2008. At present, still one kilo of the greenhouse gas CO_2 is emitted there per kWh from lignite-based electricity generation. The idea behind the future research facility is to capture the CO_2 from the plant’s flue gas, compress into a liquid and store it in underground reservoirs afterwards.

The problem of CO_2 storage

CO_2 sequestration may be achieved by using different geologic formations (e.g. depleted oil and gas fields, saline aquifers). Since the CO_2 storage cost will rise with increasing transport distance, storage is likely to occur mostly in Germany. The available storage capacity is limited however. The proven storage volume of disused oil and gas fields in Germany amounts to ca. 2.6 billion t, while the estimated CO_2 storage potential of saline aquifers is ca. 20 billion t. Assuming that all CO_2 emissions from German power stations can be completely stored, the repositories would be filled within the span of a few decades.

In addition to geological storage of carbon dioxide, ocean sequestration is another option under consideration. The direct disposal of CO_2 into ocean waters would be tantamount to an ecological catastrophe however, because it would make the oceans more acidic and put marine organisms at risk. The problem would thus be transferred from the atmosphere to the oceans instead.

Yet, the storage in geologic formations may entail problems as well. CO_2 could leak through holes drilled, migrate up and escape into drinking water aquifers, soil, and ocean waters and ultimately into the atmosphere. Compressed and injected into saline layers of rock, CO_2 displaces the salt water there and dissolves heavy metals from the surrounding rock formations. Moreover, a pressure increase within the rock formations due to CO_2 injection may cause micro earthquakes.

Against this background, CO_2 needs to be stored permanently and safely. No one can guarantee this. As a consequence, the questions of liability and follow-up costs for potential CO_2 reservoirs remain open as well. The operators of fossil fuel power plants would like a timely transfer of responsibility for the CO_2 reservoirs to the hands of the state when the storage process has been concluded.

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Impact on electricity prices

The market rollout of so-called "non-CO_2 emitting power stations" would probably cause a marked price increase for electricity. The added cost of CO_2 storage depends on a variety of factors such as capture technology, transport, type of reservoirs, monitoring the reservoirs etc. Experts anticipate added cost ranging between 3.5 and 5.0 ct/kWh of electricity. Since the coal-fired plants in Germany today are not situated near potential CO_2 reservoirs, the cost would probably be at the upper end of the range, due to the longer transport routes. This means the technology would more than double the cost of electricity today. By contrast, most forms of Renewable Energy are already competitive today.

CO_2 storage v. Renewable Energy

Should CO_2 storage become widely accepted, today's centralized energy supply by a few large power plants will persist, at the expense of further Renewable Energy expansion. The argument of the large electricity conglomerates that CO_2 storage would buy the time for the shift in energy supply toward Renewable Energies, because Renewable Energies would not be available quickly enough in large-scale capacity, is not correct in three respects:

1. The construction of new large power plants would cement today's energy supply structures and postpone the necessary shift in energy supply by up to 40 years.
2. CO_2 injection into natural gas or petroleum deposits is common practice at some production sites, where it is intended to enhance recovery, but not as a measure of controlled CO_2 storage. By contrast, the effects of long-term and safe CO_2 storage underground are not sufficiently known as yet.
3. To date there exists no large-scale application of CCS technology in power stations. "Carbon free" power stations are still in development and could come on line at the earliest in 15-20 years. This means they cannot make a contribution to protect against climate change until 2020. Thus, they are not relevant to meeting the targets of the Kyoto protocol either. Should the CCS technology be available by the year 2020, it will be too late, since electricity producers have to replace much of their power plant capacity within the next few years already. CCS technology, however plays no part in the power plant projects currently being filed and authorized in Germany.

Future coal-fired power stations in Germany with and without CCS technology and their capacity in megawatt

Without CCS	MW	With CCS	MW
Hard coal-fired power stations (16 locations)	ca. 14,000	RWE (location not known as yet)	ca. 450
Lignite-fired power stations (3 locations)	ca. 3,500	Vattenfall "Schwarze Pumpe"	ca. 30
In total	**ca. 17,500**	**In total**	**ca. 480**

(Source: BUND/EUROSOLAR)

Should the technology for so-called "Carbon free" power stations be promoted further - instead of gradually replacing coal-fired power stations by Renewable Energies and energy conservation - large amounts of CO_2 would continue to be released into the atmosphere over the next decades and add to the existing atmospheric overload. The planned investment in "Carbon free" power stations should be redirected to speed up Renewable Energy expansion instead.

Conclusions

1. No "Carbon free" power stations exist.
2. CCS technology will be ready for commercial application too late to make a contribution to protect against climate change.
3. Germany has not enough storage capacity for CO_2, which is separated out.
4. CO_2 storage entails technological and ecological risks.
5. CO_2 capture would cause an increase in electricity prices.

Therefore: Let us avoid, but not "bury" CO_2.

Literature

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