Carbon dioxide capture and storage in geological formations as clean development mechanism project activities

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The UNFCC Art. 2 calls for the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The latest assessment report of the IPCC has shown that global emissions have to be reduced by 85% in 2050 (compared to 2000 levels) and stabilised at low levels to avoid a temperature increase above 2°C compared to pre-industrial levels.
To establish whether carbon dioxide capture and storage (CCS) could help in achieving this goal, further exploration is valid. However, the CDM is the wrong forum for this technology.

Under the CDM, Annex I countries (industrialised countries) can finance greenhouse gas (GHG) emission reduction projects in developing countries (non-Annex I countries) and count the resulting Certified Emission Reductions (CERs) towards their Kyoto emission targets.
The Marakesh Accords describe the objectives further: The CDM shall promote equitable geographic distribution of clean development mechanism project activities at regional and subregional levels, and activities should lead to the transfer of environmentally safe and sound technology. The CDM shall also provide cost-effective emission reductions and contribute to sustainable development.

Three key issues, relevant to the discussion of CCS and CDM are discussed below: safe and sound technology – sustainable development (and equitable distribution) - cost effectiveness.

- **CCS – not proven to be a safe and sound technology yet**

So far CCS projects (here meant as a coal fired power plants equipped with CO_2 capture technology, transport system and storage site) have not been tested on demonstration scale and thus proven to be environmentally "safe and sound", a requirement for inclusion in the CDM. No experiences with large-scale storage sites and the behaviour of large amounts of injected CO_2 in the underground exist today. Moreover, issues of site selection criteria, seepage/leakage, liability, monitoring and others are difficult to address and have still not been properly addressed in developed countries to date.

Transferring projects at this stage into developing countries would mean using developing countries as a testing ground for this technology. The European proposal put forward at SBSTA 28 in Bonn must also be discussed in this regard. The EU insists its proposal will improve knowledge of technical issues. However, such issues can be tested wherever a coal-fired power plant and a geological formation suitable for CO_2 storage exists. Europe as well as other industrialized countries have plenty of coal-fired power plants emitting hundreds of millions of tons of carbon dioxide year by year. There is therefore no need to use developing countries as „guinea pigs“ for this technology. Developed countries would reap the benefit, leaving developing countries to shoulder the long-term burden.

Long-term issues

The use of CO_2 capture and storage has long-term implications, which one needs to be aware of. The end of a CO_2 injection phase or the end of a project is not the end of costs, or responsibility. In contrast to time-limited CDM projects, CCS projects are long-term projects where the end-date can not be predicted ahaed of the project. Although the CO_2 injection stage is easy to define, the duration of the post-injection, post-closure stage can not be given precisely. The time frame can range from a many decades to hundreds of years depending on the storage site parameters (geological formation, amount of CO_2 stored, CO_2 behaviour underground etc). The host country will most likely become in charge, responsible and liable for the storage sites in the long-term. However, no guidelines exist so far on this issue. Monitoring areas could be large. A scenario example is given for a single 1000MW coal-fired power plant, producing 8.6 million tons of CO_2 per year that could generate an underground CO_2 plume of 18 km^2 in the first year of injection alone. Furthermore, the plume would be expected to grow further still after closure of injection ended, extending to 200 to 360 km^2, depending on the lifetime of the storage project, the amount of CO_2 stored, and the thickness of the storage formation[1].

- **CCS – no contribution to sustainable development and equitable distribution of projects**

Because of the high costs CCS will probably not be used in small scale projects. However, in large scale CCS projects, only few socio-economic benefits can be expected. Only a limited number of people will find employment indirectly and directly during the project construction, operation, and post-injection (monitoring) stage. Moreover, capture technology is energy-intensive and increases the energy demand of a coal- fired power plant by up 30%. Coal prices are likely to increase further because of increasing demand as do the environmental impacts related to coal mining activities. The costs of electricity will almost double, depending on the plant and capture type.
CCS projects will not be distributed equally. Only a limited number of developing countries and countries in transition will benefit from such projects, these are countries with a share of coal-fired power plants and oil and gas exporting countries. The already uneven distribution of projects will increase further.
Projects under the CDM should focus on renewable energy and energy efficiency.. This would help increase access to clean, reliable and affordable energy in developing countries on a regional as well as local scale. A CDM project should improve social, economic, and environmental well being. CCS projects do not deliver this.

- **CCS – Not a cost-effective mitigation technology**

No coal-fired power plant CCS demonstration project has started so far. One of the reasons is the high cost of such projects. A number of projects in developed countries have already been abandoned because of that[2]. Monitoring is also not a cheap exercise. In the case of leakage,

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[1] Benson S., Hoversten M., Gasperikova E., Haines M. (2005): Monitoring protocols and life-cycle costs for geologic storage of carbon dioxide.

[2] See for example: http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article3080952.ece

remediation will cost even more and may happen long after operation has ended. Estimated costs for monitoring geologic storage sites over the full life-cycle of a project (assumed to be 30 years operation and 50 years post-operation) can range from $0.05 to $0.10 per tonne of stored CO_2. This is small in comparison to the cost of capture, it nevertheless may represent up to $50 to $80 per tonne CO_2 over the life cycle of a typical project[1]. However, these costs increase if a longer post-closure timeframe is taken into account.

Cost estimates for CCS vary considerably depending on factors such as power station configuration, CCS technology, fuel costs, size of project and location. One thing is certain, CCS is expensive. It requires significant funds to construct the power stations and necessary infrastructure to transport and store carbon. The IPCC sets costs between US$15-75 per ton of captured CO_2. Other sources give ranges between 25 to 100$/t CO_2. This is well above the current price of CERs. CCS would not pay off as noone would buy such expensive CER's – except you have a longing interest to get CCS started. Starting CCS pilote projects under the CDM can only be understand as a hidden subsidy for the coal industry in industrialized countries.

Large amounts of money flowing into CCS pilots may mean funds are no longer available for clean solutions such as renewable energy projects. This concern does not come out of the blue. In recent years, the share of research and development budgets in some Annex I countries pursuing CCS has ballooned, with CCS often included as part of renewable energy packages. Australia for example has three cooperative Research Centres for fossil fuels, one particularly committed to CCS. There is not one for renewable energy technology.

Emission offset

The purchase of CERs by industrialized nations offsets their own emissions and helps them achieve their Kyoto commitments. Accumulating large amounts of CERs from CCS CDM projects lowers the share of domestic action needed to fulfill the reduction obligations. One crucial feature of the CDM is that it generates new certificates which are added to the overall GHG “budget” established by the Kyoto Protocol for industrialised countries. Or in other words, coal-fired power plants could run with business-as-usual, while capture and storage takes place in developing countries.

Assuming ongoing technology improvements and deployment, and large-scale CCS projects starting up some times past 2020, the estimated CO_2 avoidance costs will range between 35 to 50 €/tCO_2[3]. Whether this price estimate will be low enough to encourage CCS projects must remain open as it strongly depends on the market price of carbon and thus future reduction commitments by industrialzed countries.

To conclude, CCS does not fulfill the requirements for inclusion in the CDM.
Greenpeace therefore recommends to exclude CCS from the CDM.

[3] TAB-Bericht (2007): CO_2-Abscheidung und -Lagerung bei Kraftwerken. Bericht Nr. 120