

DAMMING THE CDM: Why Big Hydro Is Ruining the Clean Development Mechanism



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Seven large hydropower projects have been proposed for CDM credits. These account for 38% of proposed emissions reduction credits. New renewables make up only 27% of the claimed credits.

Hydro and the CDM at age one

The Clean Development Mechanism is intended to lower developed countries' costs of complying with the Kyoto Protocol. The Mechanism allows industrialized countries to meet their emissions reductions targets in part through "carbon credits" bought by subsidizing low-carbon projects in developing countries.

The CDM is based on the premises that the impact of greenhouse gases is the same wherever on the planet they are released, and that it is cheaper to slow down emissions growth in developing countries than to cut emissions in industrialized countries. CDM projects are also supposed to serve the interests of developing countries by helping them "in achieving sustainable development."

The general "rules and modalities" for the CDM were finalized in the Marrakesh Accords, adopted at the COP7 climate conference in October 2001. One year later, 30 projects are in the process of seeking validation or have received validation as eligible for CDM credits. A Dutch government carbon procurement agency called Senter Internationaal and the World Bank-administered Prototype Carbon Fund (PCF) are seeking to purchase credits from all but one of these 30 projects. A Japanese agency is seeking credits from the remaining project.

Environmental groups have warned that without adequate rules – in particular rules excluding large hydropower projects – the CDM would fund many projects that would have taken place anyway, without help from sales of carbon credits. These "free-rider" projects allow industrialized countries to fall

short of their Kyoto Protocol emission reduction targets, and fail to slow emissions growth in developing countries.

Unfortunately, a review of the projects proposed for potential credits under Senter and the PCF show that these free-rider fears were entirely justified. **The CDM, if allowed to continue in its present form, will undermine the effectiveness and public credibility of the Kyoto Protocol.**

Of the 30 projects proposed for credits, seven are large hydropower schemes (using the common definition of large hydro as having an installed generating capacity equal to or greater than 10 megawatts). These large hydros make up 38% of the potential emission reduction credits. New renewable projects, by comparison, make up only 27% of the claimed credits.

Most of these large hydros are clearly free-riders, either because they are already under construction or because they are projects which governments and developers had already committed to build. The main result of buying these carbon credits would not be to achieve economically efficient climate benefits. It would instead only be to increase the return to the project developers: in the case of the proposed large hydros, mainly the subsidiaries of large US energy and engineering corporations. And because the projects would have happened anyway, developing countries would receive no additional investment benefit.

Hydro project promoters also appear to be regularly claiming more credits than would be justified even if their projects were not free-riders. Hydro developers are inflating

their potential emission credits by using assumptions for without-project scenarios that are unrealistically carbon-intensive. They are also failing to account for likely emissions from their own projects and for the sizeable uncertainties in estimating the amount of power their projects will generate.

Hydro plants can have far greater generating capacities than renewable projects. Large hydro projects could capture most of the available credits, leaving few available to promote new renewable technologies. The Bujagali Dam in Uganda, for example, is claiming nearly four times more credits than the largest renewable energy project undergoing validation. In the future, hydro projects of an order of magnitude larger than the 200-megawatt Bujagali could be proposed for CDM credits.

Subsidies for new renewables such as solar, wind and efficient biomass can spur technology development and transfer, and help bring down future generating costs by scaling up production. Subsidies for large hydro achieve none of this – hydro is an established technology which has changed little since the 1950s and is in widespread use.

Subsidizing large hydro also runs counter to the CDM's mandate of promoting sustainable development. As the World Bank/IUCN-sponsored World Commission on Dams has shown, large hydro projects have seriously negative social and environmental impacts and have regularly underperformed. Promoting large hydro through the CDM means that the overconsumption of Northern countries is being subsidized at the cost of the rivers and riverine people of the South.

In order for the CDM to achieve its stated goals, the Executive Board must establish clear guidelines that prevent the generation of fictitious credits, and promote energy efficiency and new renewable technologies.

Additionality: Making nonsense of the CDM

The largest hydros proposed for CDM credits are business-as-usual projects. A project to expand the generating capacity of the Bayano Dam in Panama, being considered for credit purchases by the Dutch agency Senter, was already more than two-thirds complete when it was submitted for validation. Another Senter large hydro in Panama, Esti, was more than half complete when submitted. Both are scheduled to be completed with or without CDM funds. **If approved, these projects will bring no climate benefit while serving to reduce the Dutch Kyoto commitment by about 3.5 million tons of CO₂.**

The highly controversial Bujagali Dam in Uganda was submitted to Senter in August 2002. Yet the initial contract to build the dam was signed eight years ago and it was approved for World Bank funding in late 2001 with a financing plan which makes no mention of the need for carbon credits.

These three hydro projects are being implemented by subsidiaries of the US power developer AES Corp. AES appears to be proposing these projects to the CDM on a purely speculative basis, hoping that the credits will improve their rate of return on projects they are already committed to build. The same would appear to be true for the subsidiary of the US company Harza Engineering International, which is applying to sell credits to Senter for a dam in Peru.

Large and small hydropower projects currently in the CDM pipeline

Project	Country	Size (MW)	Funder
Chacabuquito	Chile	25	PCF
El Encanto	Costa Rica	7.5	Senter
Penas Blancas	Costa Rica	35.4	Senter
Fortuna	Panama	12*	Senter
Bayano	Panama	110**	Senter
Esti	Panama	120	Senter
Huanza	Peru	90.6	Senter
Bujagali	Uganda	200	Senter
West Nile	Uganda	6.6***	PCF

* Added to existing 300 MW plant

** Added to existing 150 MW plant

*** Project includes a 5.1 and a 1.5 MW hydro

The Marrakesh Accords state that to receive credits under the CDM, a project must be “additional.” This is defined as:

“A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.”

The debate over what this sentence means is crucial in determining whether the CDM will help reduce carbon emissions in an economically efficient manner, or become merely a carbon accounting loophole. For the former to happen, a project must not be considered additional if it would have gone ahead without CDM credits.

Unfortunately the companies validating

projects for CDM credits – the validators are known in CDM-speak as “Operational Entities” – are not using this common sense definition of “additional.” They are instead defining projects as “additional” if they would have less emissions than other projects that might be implemented if the project applying for credits were not built.

In response to comments from NGOs, one of the Operational Entities has recognized that the definition of additional they are using means they are approving free-rider projects. But the company says this will continue unless they receive clear instructions from the CDM Executive Board on how to interpret additionality.

Kyoto Protocol and Marrakech Accords negotiators left many of the difficult details of the CDM validation procedures to be decided by the Executive Board. The

Board has a clear mandate to create CDM rules and procedures that maintain the environmental integrity of the Mechanism.

According to a recent industry survey, approximately 1,700 large hydro projects with a total capacity exceeding 135,000 megawatts are proposed around the world. As

the World Commission on Dams has shown, there has frequently been strong political support for large hydropower projects, even when cheaper and less harmful options are available. Given this context it would be hard to justify the additionality under the CDM of any large hydro project.

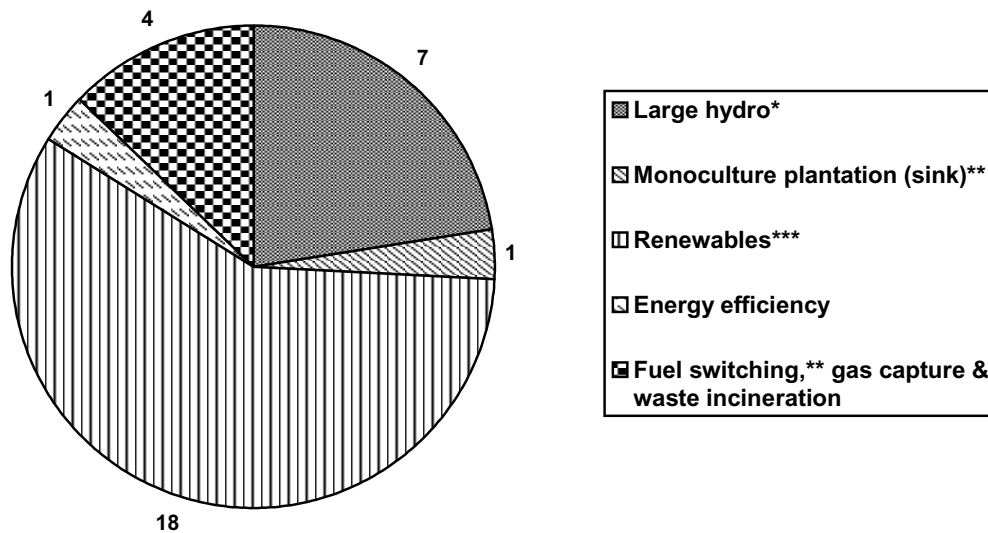
The CDM Executive Board must carry out its mandate and provide instructions to the Operational Entities that free-rider projects are non-additional and should not be validated.

World Commission on Dams recommendations

The WCD developed a set of criteria for water and energy planning to prevent the problems that have occurred with past dam projects. These recommendations include:

- comprehensive and participative assessments of water and energy needs and options for meeting these needs;
- developers held legally accountable to negotiated agreements with affected communities;
- prior and informed consent of indigenous peoples;
- full access to relevant project information;
- feasibility studies to include sensitivity analyses of potential cost and time overruns and shortfalls in production;
- agreement at the design stage of participative monitoring and adaptive management procedures to be followed through project lifetime.

Number of projects validated or undergoing CDM validation

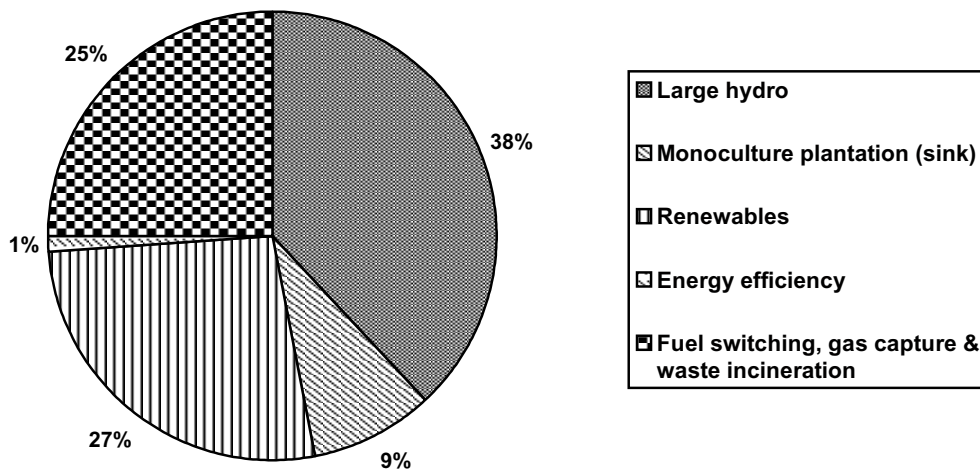


*Greater than or equal to 10 MW.

**The *monoculture plantation* and *fuel switching* activities are two components of the same project.

*** *Renewables* include hydropower projects less than 10 MW.

Percentages of proposed carbon credits for different project types



Inflated baselines

Proposals for CDM registration must include a calculation of the “baseline” – the counterfactual scenario of what would happen if the proposed project were not built. The baseline is then used to estimate how much carbon emissions would be reduced by the proposed project. A high carbon-emitting baseline will increase the amount of carbon credits that a project developer can sell.

A review of the proposals for hydro CDM projects shows that developers are submitting inflated baselines. The baselines assume that they will displace electricity production from fossil fuel combustion, often coal. Even the project proposals from Uganda and Peru – countries which generate almost all of their electricity from hydropower – used fossil fuels as their assumed baselines.

Numerous hydro projects are planned in Peru and Uganda. Registering a hydro project for CDM credits in one of these countries is likely to mean only that the registered hydro project is built instead of or sooner than another hydro plant, not that

a hydro is built in place of a fossil fuel plant. The baseline AES uses for Bujagali assumes that the dam is being built in place of gas-fired plants. Yet Ugandan and foreign power sector analysts (including the World Bank and its consultants) agree that the cheapest power options for Uganda apart from Bujagali are a (less controversial) dam and geothermal plants.

The baseline document for Huanza in Peru outlines two methodologies for determining project baselines. One is to assume that the project displaces marginal power production, that is, power from the plants that are most expensive to run and the last to be turned on at times of peak demand. The second method is to assume that the project defers construction of other new power plants.

The Huanza baseline study assumes that it will displace only marginal power from gas, coal, oil and diesel plants. Yet it is more valid to assume that the main impact of building a medium-sized project such as Huanza would be the deferring of the construction of other planned hydros - rather than the displacement of marginal power from fossil fuels.

The Executive Board must instruct validators to vet baselines carefully, and to insist that the most conservative scenario is used. Inflated baselines lead to spurious credits and undermine the effectiveness of the Kyoto Protocol.

Dam and reservoir emissions

Dams and reservoirs appear to be significant sources of carbon dioxide and the much more powerful greenhouse gas, methane. Scientists have recorded greenhouse gas emissions at all of the more than

30 reservoirs that have been sampled. Preliminary research suggests that emissions from dams and reservoirs worldwide may be equivalent to about one-fifth of estimated total human-caused methane emissions from other sources, and four percent of carbon dioxide emissions.

The Executive Board must ensure that developers give scientifically credible estimates of emissions from their projects.

An initial pulse of reservoir emissions results from the decomposition of leaves, twigs and other rapidly degradable biomass flooded when the reservoir is first filled. Over the lifetime of the reservoir, emissions result from slowly decaying woody biomass, organic matter washed into the reservoir from upstream, and the growth and decay of biomass in the reservoir. Reservoir emissions last for many decades at least, and presumably for the life of the reservoir.

The amount of gases released per unit area of reservoir depends on numerous factors, the most important of which is the climatic zone in which it is located. The highest emissions recorded have been from reservoirs in the lowland tropics. These can have a warming impact equivalent to or greater than that of thermal plants generating the same amount of power.

CDM documents for the AES project to increase generation from the Bayano Dam in Panama wrongly claim that:

“Hydropower is a clean energy source that is emissions free, and there will be no greenhouse gas emissions that are directly related to the use of hydropower for electricity production.”

The Bayano expansion may in fact lead to a considerable increase in methane emissions from the dam and reservoir. Methane emissions from the existing project have not been measured, but as this is a large tropical reservoir its contribution to global warming is likely to be significant. A credible scientific study is needed to quantify the emissions due to the Bayano expansion.

Comparison of average gross emissions from hydro and natural gas

	Hydro reservoir (temperate)	Hydro reservoir (tropical)	Combined cycle natural gas
Average gross emissions (CO₂-equivalent per kWh*)	10-200	200-3000	430-635

* Using GWP for methane of 21.

Sources:

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Exaggerating power production, underestimating costs

Developers of large hydroelectric plants have consistently overestimated future streamflows and thus the electricity production from their projects. More than half of 63 hydropower dams evaluated by the World Commission on Dams generated less power than projected. Developers have also consistently underestimated hydro project costs: World Bank analyses show hydropower cost overruns averaging 30%; the WCD found average overruns for dams to be 56%.

According to the World Bank, the average hydro project in a developing country has a “plant factor” of around 49%. This means that it generates 49% of what it could generate were it to run at full capacity all year round. Dams operate under their full capacity for a number of reasons, including that their power is not always needed (for example, at night), and that there is insufficient water to turn their turbines during droughts.

Extremely optimistic plant factors have been used in some CDM proposals. The Prototype Carbon Fund uses a plant factor of 90% for a project involving two small hydros in Uganda and one of 80% for the Chacabuquito hydro project in Chile. These rates of power production are highly unlikely to be reached.

Projections of hydropower production require reliable estimates of future streamflow. Even with good historic streamflow data, projecting future streamflows has always been prone to many uncertainties. Climate change now makes these uncertainties much higher.

The IPCC predicts that the frequency and severity of both floods and droughts are likely to increase. Droughts cut power production; increased rainfall may increase production but major floods threaten dam safety and increase sedimentation rates. The exact impact of climate change on any given river, however, is not possible to predict. The best that the hydrologist can do is to increase the range of uncertainty for power production estimates. Although developers applying for carbon credits must surely be aware of the issue of climate change, none of the hydro projects proposed for CDM registration mentions the increased hydrological uncertainties caused by global warming.

Carbon emission reduction credits will only be granted per kWh of electricity actually produced. Yet overestimations of power production and underestimations of costs will exaggerate the financial viability of hydroelectric plants. This can give hydro proposals an unmerited apparent advantage over new, renewable energy technologies and demand side management.

A range of expected emission reductions should be used when evaluating hydro projects. Sensitivity analyses should allow for climate change-enhanced hydrological risks and the likelihood of significant cost overruns.

Europe changes course on hydro in the CDM

During the negotiations on rules for the CDM, NGOs warned repeatedly that weak additionality provisions would lead to non-additional projects undermining the Mechanism's effectiveness. A study commissioned by WWF ahead of the 6th Conference of Parties (COP6) in The Hague, Netherlands, November 2000, specifically identified large hydro as one of the technologies which could flood the market with spurious carbon credits and open a massive loophole in the targets agreed by industrialized countries.

Approaching COP6 there was scattered support for designing the CDM in such a way that technologies like large hydro were excluded. The European Union was promoting a "positive list" of eligible technologies which would be restricted to renewable energy and energy efficiency improvements. Hydro was on the list, but only run-of-river plants (which have no or only small reservoirs) up to 10 MW.

Attempts to exclude technologies from the CDM ultimately failed, with the exception of nuclear power. Now, as the first potential CDM projects begin to seek validation the fears of NGOs are being borne out – large, mostly non-additional hydro projects are a prominent source of credits, generating more than any other single technology and dwarfing the volume of credits being claimed by renewable projects. Even the notorious Bujagali Dam in Uganda is being considered as a source of carbon credits by the Netherlands.

Ironically, these projects are being considered by the same European countries who at COP6 sought to exclude large hydro from the CDM. The projects are being developed through the Dutch agency Cerupt and the World Bank's Prototype Carbon Fund. European Union member states – Finland, Sweden and the Netherlands – make up three of the six governmental investors in the PCF. France is also an investor via the involvement of state-owned Gaz de France.

Negative social and ecosystem impacts

The large-scale promotion of hydropower for climate mitigation would have serious impacts on people and ecosystems. Dams and reservoirs have had enormous social costs, especially on indigenous and peasant communities. According to the WCD, 40-80 million people have been displaced by dams, and millions more have lost their access to resources such as floodplain fisheries or forests. Most of the displaced have been evicted without their consent, and without adequate provisions for resettlement and compensation. The results have often been community disintegration, impoverishment and disease.

Sixty percent of the length of the world's large river systems are highly or moderately fragmented by dams, inter-basin transfers and water withdrawals for irrigation. This massive alteration of the world's riverine habitats is a major reason for the rapid loss of freshwater biodiversity. An estimated 30-35% of freshwater fishes are extinct, endangered or vulnerable. A significant but unknown share of shellfish, amphibians, plants and birds that depend on freshwater habitats are also at risk.

The World Commission on Dams concluded that attempts to mitigate the ecosystem impacts of dams "have had only limited success." The reasons for this include inadequate study of possible impacts and a lack of mechanisms to ensure that mitigation measures are implemented. For some major impacts such as flooding of land or the changing of flow regimes, mitigation is often impossible.

The WCD also found that large dams have often performed poorly on economic and technical grounds, resulting in unnecessary burdens for taxpayers and national economies. Reservoir sedimentation renders most large hydro projects non-renewable.

Bujagali and Bayano both clearly fail to meet the sustainable development goal of the CDM. World Bank-funding for Bujagali Dam has been stalled because of corruption and an investigation by the Bank's watchdog Inspection Panel. The Panel's findings vindicated many of the project opponents' claims, including that alternatives to the dam were not fairly assessed and that it risks becoming an economic white elephant.

The Bayano Dam flooded 350 square kilometers of tropical forests and has been the subject of a 25-year fight by indigenous groups to receive adequate compensation for the loss of their lands and increased waterborne diseases. The documents for the Bayano expansion submitted to the CDM make no mention of any stakeholder consultations and fail to address adequately the impacts of expanding the project.

A group of 32 experts, mainly from European Union governments, met on the German island of Vilm in December 2001 to discuss possible conflicts and synergies between the UN conventions on climate and biodiversity. The group concluded that because of their negative biodiversity and climate impacts, large hydro projects should be excluded from the CDM and other climate mitigation measures. The participants also recommended that any small hydros built for climate mitigation purposes should comply with WCD recommendations.

IRN/CDM Watch recommendations

- No free-riders should be allowed under the CDM: business-as-usual projects must not be considered additional.
- Reliable and conservative baseline-setting procedures must be followed to avoid exaggerated baselines. Baselines for large projects must be based on deferring new capacity rather than marginal production.
- Large hydropower projects (those with an installed capacity of 10 MW or more) should not be eligible for CDM funds.
- All small hydro CDM projects should comply with the recommendations of the World Commission on Dams.
- Reservoir emissions must be quantified.
- Sensitivity analyses should be used which account for hydro developers' consistent exaggeration of power production and underestimation of costs. Hydrological uncertainties due to climate change should be reflected in power production estimates.

Conclusions

Seven large hydros have been submitted for CDM registration. These account for 38% of the carbon credits claimed by the current portfolio of proposed CDM projects. Most of these projects would clearly be built whether or not they receive carbon subsidies.

The Executive Board must establish clear guidance to project validators that non-additional, free-rider projects are ineligible for CDM credits. The Board must require that the additionality of all current and future proposed projects be tested based on clearly defined procedures prior to validation and registration. The Board must rule as soon as possible that the Bujagali, Bayano and Esti hydro projects blatantly breach additionality requirements and must not be validated.

Hydro projects with a generating capacity of 10 MW or more must be excluded from the CDM. Large hydro projects will almost always be non-additional, and lead to serious environmental and social impacts. The relatively large volume of cred-

its that large dams can generate could swamp the CDM, crowding out investment in the renewable energy and energy efficiency technologies that are the real solution to climate change.

While small hydro projects have the potential to be sustainable and renewable, they can also, if badly planned and implemented, create unacceptable social and environmental impacts. In order to meet the sustainable development goals of the CDM, **small hydro projects seeking CDM validation should comply with the recommendations of the World Commission on Dams.**

The CDM could lead to technology transfer and capacity building in developing countries and assist both industrialized and developing countries in controlling their greenhouse gas emissions. Or it could inject large quantities of false credits into the carbon market, subsidize harmful projects and undermine the integrity of the climate regime. The path the CDM takes rests in the hands of its Executive Board and the governments and agencies that influence its rules and operations.

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PCF: <http://www.prototypecarbonfund.org/>

CDM Watch: <http://www.cdmwatch.org/>

IRN's Rivers, Dams & Climate Change project: <http://www.irn.org/programs/greenhouse/>

A guide to some CDM jargon

Project validation – Before a project can generate emission reduction credits it must first be validated and registered. During the validation process each project is tested against certain eligibility requirements, including a review of its emission reductions estimates.

Project registration – The procedure by which the CDM Executive Board officially accepts a project as a CDM activity.

Executive Board – The main governing body of the CDM. The Board's ten members are chosen according to regional criteria from countries that have signed the Kyoto Protocol. The members are nominated by their respective geographical constituencies. The Board is charged with drafting the detailed rules for how the CDM will function and is responsible for accrediting Operational Entities and registering CDM projects.

Operational Entities – These are companies or other organizations that validate CDM projects. OEs verify that emissions have been reduced before emissions credits are granted.

Prototype Carbon Fund – A World Bank fund that purchases emission reduction credits from CDM projects and sells them to governments and private companies. As of mid-October 2002 the PCF had signed carbon credit purchasing agreements for seven projects.

Senter – A Dutch government fund which functions much like the PCF. As of mid-October 2002 Senter is considering proposals from 19 projects. The majority of proposed credits from these projects would be generated by large hydro projects.