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Future Energies

Guest contribution by **Dr Philip M. Fearnside**

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Why Hydropower is Not Clean Energy

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Hydropower is generally presented as “clean energy,” at least from the perspective of global warming. Of course, hydro impacts, such as displacing human populations, flooding terrestrial ecosystems and radically altering aquatic ones. Un significant additional impact of many dams, especially in the tropics. The hydropower industry has reacted strongly to c the results makes this resistance harder and harder to justify.

“It’s baloney!” was the initial response of the industry, as voiced by a spokesperson for the U.S. Hydropower Associatio was my calculation that Brazil’s Balbina Dam was worse than fossil fuels in terms of greenhouse-gas emissions (Fearn northern reservoirs can release greenhouse gases (Rudd et al., 1993). This was only the beginning of the long debate passing through the turbines of tropical dams have been have confirmed by direct measurements of methane release i (April et al., 2005) and the Balbina Dam in Brazil (Kemenes et al., 2006).

In 2002, I published a paper in the journal Water, Air and Soil Pollution calculating that in 1990, Brazil’s Tucuruí Dam (t than the city of São Paulo (Fearnside, 2002). Once again, shock waves were set off. The head of ELETROBRÁS (Braz dams) claimed that the study showed that those who say that dams have high emissions (that is to say, me) are subjec lobbies.” (Rosa et al., 2004; See reply: Fearnside, 2004). In a follow-up attack (Rosa et al., 2006; see reply: Fearnside, bubbles in a leisurely consumed bottle of guaraná (a Brazilian soft drink) would reveal the error in my use of Coca Cola principle that gases have higher solubility under increased pressure (see Giles, 2006; McCully, 2006). I had used the b opened to explain why so much methane (CH4) is released when water from the bottom of a reservoir emerges from th whether the gas bubbles all emerge immediately or whether the process continues for half an hour or more (as with a b the bottom of a reservoir is under high pressure and contains a high concentration of dissolved methane. When the pre the turbines, most of this methane is released.

Methane accumulates in the water near the bottom of the reservoir because the water column is thermally stratified (ge such that the colder deep water does not mix with the warmer surface water. Since the deep water (hypolimnion) has v than CO2. Organic matter undergoing decomposition comes both from what was originally present in the vegetation an that enters the reservoir each year, one example being from the soft vegetation that grows on the mudflats that are exp to be flooded again when the reservoir is refilled. Unlike a natural lake where an outlet stream draws water from near th one pulls the plug at the bottom—outflow is through turbines and spillways that are located at depths where the water i greatest in the first years after a reservoir is filled, the annual flooding of the drawdown zone can sustain an appreciabl one ton of methane is equivalent to 21 tons of CO2 in terms of impact on global warming, according to the conversions gives hydroelectric dams a significant contribution to the greenhouse effect.

Omissions of methane from the turbines and spillways is the main reason why my estimates of greenhouse-gas emissi times higher than the official estimates Brazil submitted to the Climate Convention in its national inventory (Brazil, MCT official responsible for Brazil’s national inventory confessed in a singularly public way that ELETROBRÁS had been inv hydroelectric emissions specifically because the agency would produce a politically convenient result that would avoid (Brazil, MCT, 2002; see Fearnside, 2004).

The dispute over greenhouse gases from hydroelectric dams, as in many scientific disputes, is likely to cause people n lie somewhere between the two sides, presumably at the midpoint. Unfortunately, while the central-limit theorem is a go same type, such as a series of measurements of gas concentrations in the water at a given place and time, the theorem omissions of important components of a problem, in this case the principal sources of methane release: the turbines an in the “Amazonian Controversies” section at http://philip.inpa.gov.br.

The issue of hydroelectric dam emissions has gained greater public attention following the colorful exchange of “editori
2004, 2006; Rosa et al., 2004, 2006). Outside experts invited to comment on the debate recognized the potential of da
and spillways and called for the Intergovernmental Panel on Climate Change (IPCC) to prepare a special report on the
Nations Educational and Scientific Organization (UNESCO) convened a meeting in December 2006 to promote an inte

The fact that hydroelectric dams have significant greenhouse-gas emissions has a variety of practical implications. One
power source (Bambace et al., 2006). Another is the need to reduce the net benefit attributable to dams when calculati
under the Kyoto Protocol. Most important is having a reasonably complete accounting of the impacts (as well as the be
choices can be made in the best interests of society.

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