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Climate Law in Developing Countries post-2012: North and South Perspectives

Climate Policy Energy Solutions for Developing Countries – Be Careful What You Wish For[1]

Key Words: EIA Imperatives; Renewables; Biofuels; Nuclear Energy; "Clean: Coal; Carbon Capture & Sequestration

In the rush to find energy solutions for greenhouse gas emissions and to relieve the economic burdens and energy security problems of dependence on imported oil, alternative technologies are being advocated and even implemented on large scale without adequate technological or environmental assessments. Some of the alternatives actually can result in far greater greenhouse gas emissions than burning traditional fossil fuels. These problems occur pronouncedly, for example, with the contemplated conversion of coal into liquid transportation fuels and use of oil from shale or tar sands, among the most polluting and carbon-intensive fossil fuels.

Perhaps most concerning, there has been a rush to develop and use carbon capture and storage technologies to make possible the burning of coal without contributing to greenhouse gas emissions. The coal industry has seized upon this still unproven technology to justify expansion of the use of coal, by far the most polluting of energy resources. Ignored has been inadequate research on the technical feasibility of secure and long-term sequestration of carbon dioxide, which like underground injection as a means of disposing of toxic wastes in several Southern states, could result in serious contamination of already scarce water supplies. Also ignored are the horrendous air, water and toxic pollution consequences from current coal mining techniques, processing and burning.

The nuclear industry has touted its energy as carbon-free and safe, ignoring an assessment of the greenhouse gas emissions and other environmental and safety problems from mining and processing uranium, the still unsolved problems of long term waste storage, protection against weapons proliferation, and the new vulnerabilities to sabotage in an age of hand-held missile launchers by terrorists.

Furthermore, many of these alternatives are inappropriate for developing countries with the possible exception in some cases for countries in transition. For example, nuclear energy clearly is beyond the economic reach and technical capabilities of most developing countries.

Even some environmentally attractive renewable energy resources being advanced for assisting developing countries to meet the energy needs for their economic development

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[1] Pace Law School interns Gabriella Carvalho of Brazil and Nana Safo of Ghana assisted in the research for this paper. The paper represents the views of the author and not necessarily those of Pace Law School or IUCN.

are beyond their economic reach. Thus, for example, solar photovoltaic and wind energy, while environmentally beneficial and economic for rural areas not serviced by electricity grids, are beyond the affordability of the very poor developing countries without large inputs of overseas development assistance or funding from private sponsors. One must consider not only the high equipment costs and the drain on hard currency resources, but the costs of education, training, maintenance, parts replacements, and other indirect costs of these energy resources.

Of the available renewable energy resources, biofuels could be potentially the most advantageous resource for developing countries because they can use locally grown crops growable in tropical climates, provide local jobs, enrich the soil, and may not require complex imported conversion equipment and expertise. But the rush to biofuels has ignored the environmental and social consequences of unsustainable biofuel feedstocks and processing practices that if not adequately regulated can increase fossil fuel use and promote deforestation resulting in increased greenhouse gas emissions, compete with food supplies, destroy biodiversity, introduce invasive species, contribute to air pollution by burning feedstock residues, deplete and pollute water supplies for drinking and agricultural production, and if grown as monocultures can ruin soil productivity and thus be unsustainable, If large biofuel plantations are inadequately regulated, they can result in removal of people from lands they have farmed for generations, exploit labor with inhumane working conditions and starvation wages, and siphon off biofuel revenues to large, often foreign landowners, resulting in a new form of colonialism.

These problems call for much more stringent environmental and social regulations of all energy resources, requirements for thorough environmental assessments and their enforcement, and requirements for remediation of attendant environmental hazards. International standards to protect against polluting, hazardous, environmentally harmful and unsustainable practices and socially unacceptable consequences are urgently needed, such as those being developed for biofuels by the Roundtable On Sustainable Biofuels being formulated in a uniquely participatory and open process by the Ecole Polytechnique Federale de Lausanne.[2]

COAL & CCS

Coal is by far the most polluting energy resource, not only in its greenhouse gas emissions, but also in pollution from its combustion to produce energy and in its mining and processing. For just one example, coal mines alone in China, the largest coal consumer, annually release about 395 cubic meters of toxic gasses including CO2 that contributes about 50% of greenhouse gasses; methane, an even more potent greenhouse gas contributing about 18% of greenhouse gasses; about 731,000 tons of SO2, the main contributor to acid rain, and soot, the principal cause of smog and particulate pollution that result in deadly lung diseases. The mines discharge billions of tons of wastewater every year most of which drains untreated into rivers, making the water unsuitable for

[2] See http://energycenter.epfl.ch/biofuels

drinking and causing massive fish kills.[3] And the mines can cause serious land subsidence. The head of the Energy Economics Institute of the reports that 294,000 hectares of land subsidence in Shanxi in 2004 and an additional 9,400 hectares in each subsequent year.[4] Acid mine drainage is another major problem. In Pennsylvania, for example, drainage from thousands of abandoned coal mines has contaminated more than 3,000 miles of streams, eliminating their fish populations, and causing Pennsylvania losses of an estimated $67 million annually in recreation revenues.[5]

And these are just the damages from mining. Even greater damages are caused by the burning of coal, with major emissions of greenhouse gasses, sulfuric and nitric acids, soot and particulates. It has been estimated that the externality costs of premature deaths, illnesses and environmental damages from unscrubbed coal combustion exceed the costs of operation of coal-burning power plants.[6]

CCS Background[7]

What is CCS: Geologic sequestration involves separating and capturing CO_2 from an industrial or energy-related source, transporting it to a storage location, and injecting it underground. It is based on the theory that the liquid will remain isolated in the subsurface. The technology to separate carbon dioxide from plant emissions and store it underground has not yet been proven on a commercial scale, and potential leakage of CO_2 into underground sources of drinking water could pose significant threats to human and environmental health.

Promoting CCS: The U.S. and other countries, however, are touting CCS as an essential mechanism for reducing CO_2 emissions. Since 2005, the U.S. Department of Energy (DOE) has earmarked $145 million to support seven regional partnerships that are testing the feasibility of sequestration. Preliminary pilot testing to determine the viability and safety of carbon sequestration will not be completed until 2009; further, large scale testing has not yet begun. Congress is also putting pressure on the DOE to expedite the use of CCS before technological and environmental challenges have been addressed and sufficient regulatory programs established. For example, Representatives Henry Waxman (D-Calif.) and Ed Markey (D-Mass.) have recently introduced legislation that would prevent the permitting of new coal-fired power plants that cannot capture and store most greenhouse-gas emissions. The European Union (E.U.) expects that all coal-fired

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[3] China Geological Environmental Infonet, *Mine Geological Environmental Problems in China*, www.cigem.gov.cn/englishver/files.net34.htm (visited September 4, 2008).
[4] China View, January 13, 2007, *Land subsidence plagues coal-rich N. China province*, http://news.xinhuanet.com/english/2007-01/13/content_5600761.htm (visited September 4, 2008).
[5] *Coal-Mine-Drainage Projects in Pennsylvania*, http://pa.water.usgs.gov/projects/amd/.
[6] *Environmental Costs of Electricity*, Pace University Center for Environmental Legal Studies, Oceana Publications, Inc. 1991 at p. 349 *et. seq*.
[7] The CCS material was written by Ms. Suzi Ruhl, founder of LEAF and an expert on underground injection of toxic wastes, with my edits.

power plants in Europe will be built with CCS capabilities by 2020.[8] In addition, the E.U. recently revised the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), a 15-year old treaty, to allow CO_2 to be stored on the ocean floor. Further, the recently-issued Synthesis Report from the UN Intergovernmental Panel on Climate Change included CCS as one of its major proposed climate change solutions. Finally, private philanthropy is seeking to expedite the implementation of CCS through public policy and financial channels. For example, several foundations have indicated an interest in fast-tracking CCS in the US.

Challenges Posed by CCS and the Current Approach: While it is recognized that CCS may provide important benefits for climate change response, many uncertainties remain that pose significant risks to natural resources and human health. A predominant risk of CCS is to underground sources of drinking water (USDW).[9] CCS is based on the expressed, but unsubstantiated theory, that CO_2 will be isolated in perpetuity by impermeable formations in the subsurface. Yet, decades of bad US state experience with underground injection of toxic wastes clearly reveals numerous pathways of contamination from both anthropogenic and natural causes. Violations of confinement integrity that could endanger USDW include:

- Upward movement of injected fluid through abandoned wells;
- Dissolution of the confining zones
- Leaching of potentially toxic substances (e.g. arsenic) caused by the injected fluid;
- Lateral displacement of injected and formation fluid (e.g. brine);
- Vertical movement of injected fluid due to faults and fractures;
- Vertical movement of injected fluid due to artificial penetrations in the confining zone (e.g. abandoned wells);
- Vertical movement of injected fluid due to mechanical integrity failures;
- Release of trace metals and toxic organic compounds; and
- Earthquake caused releases

Other threats which have been publicly acknowledged include ecosystem degradation, public health safety, and financial losses.

The risks associated with CCS will be exacerbated by a weak regulatory system that purports to prevent endangerment of USDW from sequestered CO_2 injected underground. These potential deficiencies include lack of sufficient funding for states to operate

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[8] Commission of the European Communities, *Sustainable Power Generation from Fossil Fuels: Aiming for Near-Zero Emissions from Coal after 2020, Communication from the Commission to the Council and the European Parliament* 6-7, *available at* http://ec.europa.eu/environment/climat/ccs/pdf/com2006_0843_en.pdf (January 2007).

[9] A USDW is defined as an aquifer or part of an aquifer that supplies drinking water for human consumption OR contains a total dissolved solids concentration of less than 10,000 milligrams per liter.

delegated Underground Injection Control (UIC) programs;[10] staffing challenges due to inadequate experience and expertise; limited oversight capacity by EPA of delegated state programs; political will to take necessary action regarding permitting and enforcement; lack or inadequate statutory authority to address siting controls, and possible federal/state jurisdictional problems.

Imminent Action: The U.S. Environmental Protection Agency (EPA) is in the process of developing regulations for CCS under the Safe Drinking Water Act, through the UIC programs. Although extensive research and analysis is underway to address construction and design, insufficient attention is directed to the fate of the CO_2 and related hazardous materials in the subsurface. A comparison of assumptions regarding CCS has not been evaluated under the lens of experience with underground injection failures throughout the country. For example, the implications of the Florida Class I municipal injection well history, where EPA ultimately revised its regulations to accommodate movement of fluid into USDWs, has not been adequately assessed. Drinking water utilities have also expressed concern about EPA's rapid development of a program which encourages the use of the untested approach of CCS which may have unintended consequences, including the potential for widespread groundwater contamination comparable to that seen after the use of MTBE auto fuel additives

While substantial efforts are under way to simultaneously promote and evaluate CCS, critical gaps remain. Left unaddressed, these gaps pose a substantial threat to drinking water supplies and the environment. To address these gaps, the Legal Environmental Assistance Foundation, Inc. (LEAF), in collaboration with the Pace Energy Project and the Environmental Integrity Project (EIP), among others, is launching a collaborative project, *Accounting for Risks of Carbon Sequestration as a Solution to Climate Change.*

Goals and Objectives

The primary goals of this project are to (1) prevent endangerment of underground sources of drinking water caused by CCS and (2) prevent disincentives to sustainable solutions to climate change posed by the inappropriate use of CCS. Specific objectives include:

- Increase public awareness of risks posed by the inadequate governance of CCS to drinking water and other natural resources;

- Ensure proper regulation of CCS through correction of deficiencies in the UIC program and other applicable authorities;

- Prevent the improper siting and operation of CCS facilities that would endanger USDWs;

[10] The Underground Injection Control (UIC) Program was established by the federal Safe Water Drinking Act. The program regulates the subsurface discharge of hazardous and non-hazardous pollutants through injection wells.

- Support increased research on the water resource impacts of CCS; and

- Increase support of diverse solutions to climate change challenges that are protective of all life-sustaining natural resources.

CCS Conclusion

Under the correct circumstances, CCS may be appropriate and a part of the climate change solution, but extensive reliance on this practice without responding to its limitations and risks will create additional challenges to the planet's sustainability. It is imperative that the full environmental, health and economic costs of CCS be considered, including the relevant history of underground injection in the U.S. Most importantly, the adverse impacts and measures to overcome them must be thoroughly addressed in all authorities governing CCS**.**

If CCS is applied to coal burning emissions, then the other grave environmental hazards of mining, processing and burning coal need be addressed.

NUCLEAR

Safety

Nuclear energy is the most high risk energy option for addressing climate change. It poses the risks of mining hazards and pollution, radiation exposure to workers and the public from leakage and accidents, proliferation of nuclear materials to make nuclear weapons, long-lived radioactive wastes, and most recently, serious risks of sabotage from terrorist activities in an era of suicide bombers, hand-held missiles, air attacks and attacks from the sea. Since nuclear plants generally are built next to large cities to minimize transmission costs, large populations are vulnerable to radiation from accidents or sabotage.

Amazingly, the Nuclear Regulatory Commission (NRC) has explicitly declined to take account of terrorism risks in its licensing and other regulatory procedures.[11] It is quite specific on this issue, NRC regulations provide that a licensee "is not required to provide for design features or other measures for the specific purpose of protection against the effects of…attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person…"[12] The NRC even refused to follow a 9th Circuit decision requiring it to consider terrorist attacks in licensing proceedings under the National Environmental Policy Act.[13]

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[11] Coplan, Karl S, *The Externalities of Nuclear Power: First Assume We have a Can Opener*, Ecology Law Quarterly at http://www.boalt.org/elq/C35.01_04_Coplan_2008.04.10.php at P.7.
[12] 10 C.F.R. Sec. 50.13 (2008).
[13] *Amergen Energy Co., LLC*, 65 N.R.C. 124 (2007).

Nuclear plants have an additional safety disadvantage because they must instantly shut down in a power failure but they can not be quickly restarted. During the August 2003 Northeast blackout, nine U.S. nuclear plants had to be shut down. Twelve days later, their average capacity loss had exceeded 50 percent. For the first three days, when they were most needed, their output was below three percent of normal.[14]

Nor is the nuclear fuel cycle entirely without its own contribution to greenhouse gas emissions since fossil fuel energy is used in the mining, transportation and highly energy intensive enrichment of nuclear power fuel.[15]

Cost

Nuclear energy also is the costliest option by far among all main energy competitors, indeed so costly that even with huge federal loan guarantees of up to $18.5 billion per plant, Wall Street has been unwilling to finance them.[16] Just the capital costs of new plant construction now have reached $6–9 billion per plant according to Florida Power & Light (FPL) projections for a two-unit project, translating into 11-17 cents/kWh over the life of the plants. First year costs are nearly twice these values.[17] And FPL reported that the 200 mile transmission lines required for the installation would cost $3 billion more, raising the total cost estimate to $7,700 per kW and said that even this figure was "nonbinding" and "subject to change."[18]

Lew Hay, chairman and CEO of FPL, was quoted as saying of the cost of the above 2-plant project: "That's bigger than the total market capitalization of many companies in the U.S. utility industry and 50 percent or more of the market capitalization of all companies in our industry with the exception of Exelon…This is a huge bet for any CEO to take to his or her board." [19]

And in January 2008, MidAmerican Nuclear Energy Co., owned by famed investor Warren Buffett, said that nuclear plant construction prices were so high it was ending its pursuit of a nuclear power plant project in Fayette County, Idaho after it had spent $13 million researching the plan's feasibility. Company President Bill Fehrman stated, "Consumers expect reasonably priced energy, and the company's due diligence process

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[14] Lovins, Amory B, I. Sheikh & a. Markevich, *Forget Nuclear,* Rocky Mountain Institute, Volume xxiv #1, Spring 1008. at pp. 24,25.
[15] Copan, *supra* note 7, at p. 9.
[16] Lovins *et al, supra* note 10 at pp. 1 & 25. This cost was confirmed as of 2007 by the Keystone Center's mid-2007 update, industry estimates and an MIT low 2003 cost assessment. *Id at p. 1.*
[17] Harding, J., *Myths of the Nuclear Renaissance*, Environmental Law Quarterly, Vol 15, #1, April 2008, at http://www/boalt.org/elq/C35.01_08_Hardibng_2006.04.10.php at p. 3. Moody's Global Credit Research estimate new power plant construction costs at $ 5,000-6,000/kW in an October 2007 study and report, *New Nuclear Generation in the United States.*
[18] *Nuclear Power, Part 2: The price is not right* at http://climateprogress.org/s008/06/13/nuclear-power-part-2-the-price-is-not-right/ at pp. 1, 2, stating the FP&L plants would cost $12-18 billion, from $5,500 to $8,100 per kW not including the power line costs. . .
[19] *Id*, at p. 1.

has led to the conclusion that it does not make economic sense to pursue the project at this time."[20]

Fuel Supply

Uranium fuel supplies are limited and fast depleting. Existing plants are fueled by extraction from abandoned Russian weapons, cancelled nuclear plants and government inventories, driving prices down and resulting in the closing down of mines and enrichment plants since the 1980s. Thus, as supplies from existing sources are drying up, there no longer exists the capacity to obtain and enrich new plant fuel supplies. As a result, the spot market prices for uranium are seven times higher today than five years ago.[21]

Reprocessing of spent nuclear fuel is the answer advanced by nuclear advocates, including the Bush Administration, to the supply problem. But the dangers of the plutonium by-product are unacceptable, with just nine pounds of plutonium required to produce a basic nuclear bomb, and the costs are prohibitive since current reactors can not use the reprocess fuel without substantial physical modification. The costs of using reprocessed fuel to run reactors are higher by 2.5-3 times (3.5 -4.5 cents/kWh).[22]

France's nuclear reprocessing is often used as a success example, but it has not found a means of recycling either the reprocessed uranium or the separated plutonium. As a result, France has an inventory of thousands of tons of reprocessed uranium and 50 tons of separated plutonium for which there is no commercial use.[23]

Thus, uranium supplies are a distinct limitation on a resort to nuclear power to address climate change, especially when you consider that simply keeping pace with planned retirements would require eight new plants per year in this decade and twenty-one new plants per year in the following decade.[24]

Nuclear Waste Disposal

The "spent" fuel remaining after use in nuclear power plants is highly toxic, consisting 97% of uranium and 3% of highly toxic isotopes such as Cesium 137, Iodine 120 and plutonium 239, some of which have half lives running tints millions of years. Currently there are 55,000 metric tons of spent nuclear fuel in the United States alone. The majority is stored in "pools" at reactor sites that, if breached, could result in melt-downs resulting in highly dangerous releases. Several plants now experience leaks from these spent fuel pools, resulting in dangerous tritium, cesium and strontium isotopes. As the pools, almost all well above their designed capacity, become full, utilities are resorting to

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[20] *Id*. at pp. 1,2.
[21] Harding, *suprs* note 12 at p. 5.
[22] *Id*. at p. 4.
[23] Coplan, supra note 7, at p. 5.
[24] Harding, *supra* note 12. at p. 4.

"dry cask" storage in concrete and steel containers the required life of which is only 20 years.[25]

While the nuclear power industry touts the concrete containment vessels designed to protect the power plants from accidents or attack as security for this spent fuel, it never mentions that the spent fuel pools are outside the containment vessels, as are the control rooms by which a plant can be shut down in the event of an accident or attack. Thus both are highly vulnerable.

Since nuclear power plants are almost always built near population centers to save having to fund long transmission lines and their attendant power losses, the vulnerability of spent fuel facilities poses large numbers of people to great danger.

The spent fuel facilities at power plants were designed only as temporary holding areas until a permanent geological repository could be constructed. Yucca Mountain in Nevada was selected by Congress as the first such repository. Yucca Mountain was designed to safeguard wastes for only 10,000 years, but the federal courts ruled that they had to offer protection for 1 million years – and since this challenge among others has not been able to be met, it is doubtful that the repository ever will be approved. But even if it is, the repository is barely adequate to accommodate currently accumulated wastes, and if the Bush plan to expand nuclear power is pursued, Deputy Energy Secretary Clay Sell has testified that the U.S. would require nine repositories the size of Yucca Mountain if nuclear generation were to be expanded six-fold as proposed by the Administration. Other countries have experienced the same difficulties. And, as discussed above, reprocessing of wastes is both too risky and costly to be feasible.[26]

Nuclear Conclusion

If nuclear power is to play a part in the solution to global warming, the above risks and costs need first to be addressed, to protect against accidents, leaks and sabotage, requiring plants to be protected from attacks by land, air and sea; to resolve the safe disposal of nuclear wastes; to protect against proliferation, particularly if reprocessing of plutonium-producing wastes are permitted, to make uranium mines and enrichment faculties safe for workers and affected populations, to prevent massive fish kills from cooling systems, and to assure adequate and safe uranium supplies, and to bring costs down to affordable levels..

BIOFUELS

[25] Coplan, *supra* note 7, at pp. 2 & 3.
[26] *Id. at pp. 2-5.*

Biofuels[27] have the exciting potential for mitigating the grave threats of global warming, reducing the world's dependence on imported oil from insecure sources and reducing the skyrocketing costs of oil that are threatening to undermine the world's economies and are devastating the people in non-oil producing developing countries.[28] For the people in these countries, biofuels offer a promising road to enhance economic development since they use local materials, can provide local jobs, and may not require the import of expensive equipment and expertise.

Brazil has been the pioneer in the use of biofuels, allowing it to eliminate its oil imports, becoming completely energy independent, and demonstrating to the world the potential benefits of substitution of biofuels for fossil fuels. Indeed, inspired by Brazil's example, the United States in recent years has developed a strong biofuels industry, albeit from the disadvantageous feedstock of corn. The United States has just created an alliance with Brazil to make major purchases of its biofuels. The European Union and countries around the world are rapidly developing their own biofuels programs.

But Brazil and its replicators have to exercise great care in designing and implementing biofuels programs. The environmental and social risks of biofuel development, also demonstrated in Brazil, are great and could well undermine all the potential advantages if not done right.

These concerns are particularly pertinent to Brazil if its biofuel program meets current projections of biofuels exports to the United States and other countries. Brazil ethanol-industry estimates that the extent of land devoted to sugarcane cultivation, 13.6 million acres in 2006-2007, will reach 20.5 million acres by the 2012-13 harvest, an area bigger than the very large U.S. State of Maine. Brazil produced 65% of world ethanol exports last year, shipping 898 million gallons, or 31% more than in 2005. Processors estimate the country's annual ethanol exports will more than double to reach 1.85 billion gallons by 2013. This vast and rapid expansion will put tremendous pressure on Brazil's pasture land, presently the primary source of its biofuel production, and on its invaluable forest lands and Amazon basin treasure chest of biodiversity.

Even if forest land and protected areas are declared legally to be off limits to biofuel production as has been legislated in Brazil, these vulnerable areas still

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[27] As used here, the term, "biofuels" includes only liquid and solid fuels derived from biological feedstocks. It includes ethanol and biodiesel, but does not include biogas. First generation currently commercially produced biofuels are derived primarily from agricultural feedstocks. Second generation biofuels are projected to be derived from cellulosic materials such as switchgrass and agricultural wastes.

[28] It is worth noting that: "Of the world's 50 poorest countries, 38 are net importers of petroleum and 25 import all their petroleum requirements. Recent oil price increases have had devastating effects on many of the world's poor countries, some of which now spend as much as six times as much on fuel as they do on health. Others spend twice the money on fuels as on poverty reduction. And in still others, the foreign exchange drain from higher oil prices is five times the gain from recent debt relief." *Sustainable Bioenergy: A Framework for Decision Makers*, UN-Energy (April 2007) at P. 39

may be affected by migration to them by ranch owners and others displaced by biofuel production. Also, there are serious problems of enforcement of such legislation due to corruption and inadequate numbers and qualifications of enforcement officers.

Ethanol, of course, is not the only biofuel product. Large investments have been made in

Major biofuels' risks that need addressing include:

Food Impacts

Selection of crops or use of lands for biofuels production that will jeopardize food supplies or increase their price should be avoided, particularly because of their dire impact on the people in poor developing countries. When farmers can obtain greater profits for use of their land for biofuels than for food, this risk becomes apparent. Price increases already have occurred in biofuel feedstock markets for sugar, corn, rapeseed oil, palm oil and soybeans.[29] There is great international concern that the expanded use of first generation biofuel feedstocks of crops and land used for food production will have serious adverse effects on food supplies as already is being experienced.[30]

Water Impacts

Depletion and contamination of water supplies can have profound effects on human and animal health. Many biofuel crops require large amounts of water for their cultivation, particularly harmful in areas where water is scarce. Experts cite the increased danger of spills of ethanol and vinhoto, a liquid byproduct of ethanol production used to fertilize and irrigate sugarcane plantations. Vinhoto spills have contaminated rivers, occasionally causing large fish kills. A Vinhoto spill in Sao Paulo state in 2003 killed off the fish population along a 95-mile stretch of the Rio Grande River.[31]

Forest Impacts

The cutting of forests in order to create land available for the growing of biofuel crops would have grave impacts on greenhouse gas reduction as well as biodiversity, land erosion, and the need for wood for housing and other local necessities.[32] In the sugarcane area of Pernambuco province only 2.5% of the original forest of the sugarcane region remains, although this occurred over a number of years as a result of sugar cane development both before and after the

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[29] *Sustainable Bioenergy: A framework for Decision Makers,* UN-Energy (April 2007), (hereinafter "UN-Energy") at p.34
[30] *Id.* at p. 31 *et .seq.*.
[31] See note 2, *supra*, at p. 1
[32] See UN-Energy note 3 at p. 43.

development of biofuels. In order to satisfy future global demand, Brazil will need to clear an additional 148 million acres of forest, according to Eric Holt-Gimenez of the NGO FoodFirst.[33]

Monoculture Impacts

Monoculture biofuel cultivation would degrade the productivity of affected land. The monoculture of sugarcane could lead to massive environmental destruction. To protect against such destruction, The State of Sao Paulo has adopted and enforced legislation for the conservation of native and riparian forests, together with crop rotation requiring that 20% of all biofuel growth areas be diverted from sugar production every year for the planting of other crops before returning to sugarcane – so crops like peanuts, beans and others would be used in 20% of the total area every year.[34] However, corruption often results in evasion of these laws.

Genetic & Invasive Species Impacts

Other environmental risks include the use of genetically altered crops to increase biofuels' production, with the danger that the genetic alterations will migrate to the detriment of other agricultural crops, and the introduction of invasive species through feedstock cultivation that also could harm existing agriculture.[35]

Impacts of Second Generation Biofuels

The introduction of second-generation biofuels that are derived from non-food feedstocks such as switchgrass and agricultural wastes have their own environmental problems. Switchgrass can be valuable for flood protection and prevention of erosion. Agricultural wastes removed from the land can result in deterioration of the productivity of the land. [36] Biofuel production also might create incentives to plow up rangelands and savannas to plant them with biofuel feedstocks and displace cereals and subsistence crops.[37]

Colonialization Threats

A serous socio-economic problem with the expansion of biofuels that needs addressing is the increasing concentration of sugarcane lands in the ownership of a few large landowners in Brazil and many other developing countries, combined with the takeover of land for biofuel cultivation by large international

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[33] Kenfield, Isabella, *Is Ethanol the Solution or the Problem?*, EnviroHealth, (March 12, 2007) at p. 5.
[34] UN-Energy, note 3 *supra*, at p. 44, 46
[35] McNeeley, Jeffrey, *Governing the risks and opportunities of Bioenergy: Risks and opportunities of significantly increasing the production of biomass energy*, International Risk Governing Council (Concept Note 24 May 2007) at p. 6.
[36] UN-Energy, note 3, *supra*, at p. 44.
[37] *Id* at p. 24, 33

agribusinesses. The uncertainty of individual land ownership eases these takeovers.[38] These large agribusinesses, local and international, having little respect for the environment, are removing small farmers from their lands, throwing them into poverty; are mechanizing the harvesting of sugarcane, thus throwing local labor out of their jobs and eliminating the prospect of local economic growth from biofuels cultivation; paying substandard wages; and siphoning off most of the profits from biofuel production and processing. They threaten to destroy the established way of life and livelihoods of many thousands of the local populations.[39]

A recent declaration from the Forum of Resistance to Agribusinesses, a consortium of non-governmental organizations (NGOS) through South America, states,"The implementation of the model of production and export of biofuels represents a grave threat to our region, our natural resources, and the sovereignty of our people."[40]

The Forum states that with respect to the intrusion of international agribusiness, "The era of biofuels will reproduce and legitimize the logic of the occupation of rural areas by multinational agribusinesses, and perpetuate colonialization processes to subvert ecosystems and people to the service of the production and maintenance of a lifestyle in other societies."[41] And the local consequences, it states, is that agro-export will generate vast amounts of wealth for a few Brazilians, and exploitation and poverty for many others. Brazil's high rate of income inequity is inseparable from the fact that it also has one of the most unequal rates of land distribution. The sugar industry is stated to be a classic example of Brazil's land and income inequality.[42]

According to Mari Aperecido de Morães Silva at the State University of Sao Paulo, "Brazil has the lowest cost of production in the world because of the industry's dependence on labor exploitation, including massive slave labor, and its refusal to implement environmental regulations."[43]

According to Marluce Melo of the Pastoral Land Commission (CPT) in the northern Brazilian city of Recife, Pernambuco, "In the last two decades, practically all of the small properties in the region have disappeared, with ...the expulsion of the workers…In this same period, about 150,000 jobs were lost when 18 companies closed and lands and sugarcane processing was concentrated in the 25 sugar mills and distilleries that remain…This has

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[38] UN-Energy, *supra* note 3 at p. 4, 7, 8

[39] UN-Energy, *supra* note 3 at p. 4, 24 "The transition to liquid biofuels can be especially harmful to farmers who do not own their own lands. At their best liquid biofuel programs can enrich farmers by helping to add value to their products. But at their worst biofuel programs can result in concentration of ownership that could drive the world's poorest framers off their land and into desperate poverty." *Id* p. 24

[40] Kenfield, *supra* note 7 at p. 2

[41] *Id*

[42] *Id* at p. 3

[43] *Id.*

provoked a generalized 'slumming' of the workers, which has aggravated hunger."[44]

These domestic inequities and foreign agribusiness threats require redress. Certainly the foreign agribusinesses should be taxed sufficiently so that local communities and their people will benefit from the exploitation of their resources.

To address some of these concerns, Brazil recently introduced a "social seal" program focused on small rural cooperatives that are targeted specifically at poverty reduction.[45]

Other Risks

The United States and Europe in particular have accompanied domestic subsidies for production of biofuels with tariffs on biofuel imports to protect local farmers. These tariff barriers impede the development of biofuels in developing countries.[46]

Financing of biofuel production, processing, marketing, the training of personnel and the education of farmers and the public on the costs and benefits of biofuels in developing countries is a major challenge. Temporary subsidies are required to make biofuels affordable to poor populations, as well as micro-financing, cooperative purchasing and other market interventions.

Electric utilities and oil company-owned fueling stations often resist the marketing of biofuels, requiring regulatory provisions.[47]

The failure to perform life-cycle assessments of the costs and benefits of biofuels projects with full public disclosure and public participation in biofuels planning and implementation decisions jeopardizes the success of biofuels projects.[48]

Solutions

The feasibility of legally binding, enforceable standards should be considered for the cultivation and processing of biofuels with respect to the risks listed above – e.g. protection of food and water supplies; access to land; biodiversity conservation; treatment of labor; technology transfer;

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[44] Kenfield, note 7 at p. 4. This phenomenon was only partly attributable to the introduction of biofuels, however.
[45] UN Energy, *supra* note 3 at p. 35 (largely quoted)
[46] *Id* at p. 40. It is ironic that there is free international trade in oil while trade in biofuels is severely restricted.
[47] *Id* at p. 18
[48] "…one thing is clear: the more involved farmers are in the production, processing, and use of biofuels, the more likely they are to share in the benefits." *Id* at p. 24

etc. This should include consideration of the potential to incorporate such standards in international law.[49]

Meanwhile, voluntary guidelines, best practice standards and credible certification/labeling schemes for different biofuel feedstocks and production practices should be quickly developed and promoted[50], such as those being formulated by the Roundtable for Sustainable Biofuels sponsored by the Ecole Polytechnique Federale de Lausanne, the Dutch Government and its Cramer Commission, the UK, and FAO, UN-Energy, UNEP, UNIDO, UNCTAD and the WTO, among others.[51] Importers should require that imported biofuels meet these standards.

Biofuel production should not be permitted that jeopardizes the price and supply of food and crops essential for animal feed and local construction materials for the people of developing countries..[52]

Exporters and Importers of biofuels should be informed about and required to respect all environmental and labor laws and relevant local, national and international biofuels' standards, guidelines and/or certifications. Tariffs restricting purchase of biofuels from developing countries should be eliminated.

The introduction of foreign agribusinesses in developing countries should be accompanied by measures to assure their observation of national and local environmental and labor protections, and where these do not exist, of international requirements. They should be required to pay taxes sufficient to compensate developing country governments and communities for the exploitation of their resources.

Provision should be made for mandatory social and environmental assessments of biofuel development projects, with thorough studies of all the life-cycle costs including externalities, impacts and risks enumerated above, full public disclosure, public hearings, and community involvement at all stages of development.[53] Such provisions should account for the relative magnitude of anticipated impacts and adequacy of regulatory

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[49] "International standards and certification/assurance systems are critical to ensure that bioenergy is produced using the most sustainable methods possible." *Id* at p. 46

[50] *Id* at p. 49

[51] *Id* at p. 47, 49, 55

[52] The importance of such a requirement is illustrated by the fact that: "According to FAO data for 2001-02, there are approximately 854 million undernourished people in the world…Hunger claims up to 25,00 lives every day, two thirds of them children under the age of five, and it is currently the leading threat to global heath, killing more people than AIDS, malaria, and tuberculosis combined." *Id* at p. 32 "Price increases have already occurred in major biofuel feedstock markets, for example, sugar, maize, rapeseed oil, palm oil and soybean." *Id*

[53] "Thus the entire bioenergy chain needs to be analyzed in order to identify and overcome actual and/or potential barriers and inefficiencies." *Id* at p. 25

capacity. Comparison should be made of the experiences with introduction of biofuels in other countries, both of their successes and failures.

Provision of education and training to biomass producers, managers, policy-makers, farmers and the public is essential. Agricultural extension services can play an important role.

Measures should be adopted to prevent deterioration of land used for biofuels through monoculture utilization. "A variety of management practices, such as the use of bio-char, intercropping, crop rotation, double cropping and conservation tillage can reduce soil erosion, improve soil quality, reduce water consumption, and reduce susceptibility of crops to pests and disease – thereby reducing the need for chemical fertilizers and pesticides. It is important to note that…these benefits are gained only if sufficient soil cover, mostly from crop residues, is left on the ground."[54]

It is essential that forests, protected conservation areas, and other habitats essential for biodiversity be protected.

Measures should be adopted to protect the land rights and way of life of existing farmers and ranchers.

Regulations must be adopted to protect water supplies and protect against water and air pollution from the growing and processing of biofuel feedstocks. Feedstocks such as jatropha and sweet sorghum that require minimum water, fertilizers and pesticides should be promoted.

Electric utilities should be required to remove barriers to use of biofuels and oil companies should be prohibited from banning sale of biofuels at their company-owned and leased service stations.

Further research should be pursued urgently on second generation biofuel technologies and feedstocks that do not compete with food production and on regulatory provisions to prevent degradation of the land from their utilization.[55] Investment should be promoted on those technologies that already are established. Particular attention should be paid to "cascading"

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[54] *Id* at p. 44. "Ultimately the problems associated with bioenergy land use (particularly of virgin lands), including deforestation, biodiversity loss, soil erosion and nutrient leaching, will be the most vexing and deserve the most attention. *Id*

[55] Much research remains to be done to determine which crop and crop species are most suitable for different liquid biofuel applications, soil types, farming systems, and cultivation contexts. Key factors to be considered when electing feedstock include economic viability, suitability for different biofuel applications, yield per hectare, input requirements, yield increase potential, crop versatility, drought and pest resistance potential, competing uses, price volatility, and opportunity costs." *Id*

biomass using biomass materials for various uses and recycling the wastes for energy that are not needed for soil replenishment.[56]

Combined heat and power (cogeneration) should be considered to facilitate maximum fuel utilization and minimization of costs.[57]

In rural areas, consideration should be made of use of cooperatives and other forms of collaboration to permit projects of viable scale. Microfinancing methods should be considered.

Temporary and strictly targeted subsidies to promote the introduction of biofuels that meet established standards, guidelines or certification should be promoted, along with the possibility of funding of them through redirecting existing subsidies for fossil fuels. All subsidies should be transparent and linked to the economic development they are designed to promote.

Availability of financial and technical assistance from international agencies and the private sector should be explored. Assistance on sustainability of biofuels is obtainable from The International Bioenergy Partnership (IBEP), The Global Bioenergy Partnership (GBEP), The Biofuels initiative of UNCTAD, and The Global Village Energy Partnership (GVEP) that also provides financial support, capacity building and technical assistance to small bioenergy projects.

Biofuels Conclusion

The potential is great for the use of biofuels to relieve world dependence on scarce and uncertain supplies of oil[58] and to reduce emissions of greenhouse gasses. Particularly in developing countries where national and individual resources are too low for the introduction of modern energy resources essential for their development, biofuels have potential for providing energy from local crops, creating jobs and alleviating poverty.[59]

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[56] "In the future, cascading biomass over time … will maximize the CO2 mitigation potential of biomass resources… Studies of the climate and economic impacts of cascading biomass have concluded that this practice could provide CO2 benefits of up to a factor of five compared to biomass used for energy alone." *Id.* And, of course, there would be concomitant energy and cost savings.

[57] "Current research concludes that using biomass for combined heat and power (CHP) rather than for transport fuels or other uses, is the best option for reducing GHG emissions in the next decade – and also one of the cheapest." *Id* at p. 49

[58] "Diversifying global fuel supplies could have beneficial effects on the global oil market. By some estimates, rising production of biofuels could meet most and perhaps all of the growth in liquid fuel demand in the next few decades…" *Id* at p. 39

[59] "Excellent examples of energy self-sufficiency and even selling power to the grid come from the sugar industries of Australia, Brazil, Cuba, Guatemala, India, Mauritius and several other countries." *Id* at p. 15

None of these potentials will be realized, however, if standards are not adopted to provide against substitution of fuel for food crops, endangerment of clean water supplies, deterioration of the land and inequitable distribution of the profits from biofuel production. Introduction of biofuels is proceeding so rapidly, however, that the environmental and social risks of biofuel production are too often being ignored. Without careful and thorough assessment and regulation, the promise of biofuels may well be lost.

CONCLUSION

Rather than massive promotion of high risk and high cost CCS and nuclear energy to reduce greenhouse gas emissions and provide energy security, a massive international effort should be devoted to the commercialization of safe, environmentally sound measures such as energy efficiency, cogeneration and renewable energy resources -- solar photovoltaics, solar thermal, wind, geothermal, small hydro, wave, tidal and bioenergy resources -- all with appropriate standards to protect human health, wellbeing and the environment.

Black carbon recently has been identified as a major cause of climate change in a major study by the International Network for Environmental Complaince and Enforcement (INECE) and its secretariat organization, the Institute for Governance and Sustainable Development (IGSD). The study concluded as its title indicates that *Reducing Black Carbon May Be [the] Fastest Strategy for Slowing Climate Change*.[60] Scientists at the International Panel on Climate Change (IPCC) estimated, in a follow up to its 2007 report on black carbon, that concludes, "emissions from black carbon are the second largest contributor to global warming after carbon dioxide emissions, and that reducing these emissions may be the fastest strategy for slowing climate change."[61]

A realistic price must be placed on greenhouse gas emissions either through pollution tax or cap and trade regimes. The huge multi-billion dollar government subsidies to coal, oil and nuclear energy should be eliminated and substituted for clean energy research and financing.

Since many of the threats from global warming already are in evidence and it will take time to implement adequate mitigation measures, substantial funds from developed countries must be devote to assist developing countries with adaptation measures.

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[60] IGS/INECE Climate Briefing Note 6 July 2008, www.igsd.org/BC%20Summary%206July 08.pdf., updated 20 August 2008..

[61] IPCC, Technical Summary, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 21 (2007) available at http://www.ipcc.ch/ipccreports/ar4-wg1.htm.

The threats to human health and the environment from climate change are so great, however, that some high-risk solutions may need to be considered. This is why many international and environmental organizations are seriously considering CCS, nuclear energy and, among other reasons, biofuels measures. But this urgency does not justify rushing into widespread use of these measures without adequate prior research and regulation.

Thorough research prior to implementation must be given to these high-risk measures to assure that the risks and potential benefits are known with reasonable certainty, that the benefits are real and justify the costs, and that greenhouse gas emissions are reduced through the measures at a cost that does not enormously exceed alternative emission reduction measures. International standards and certification should be adopted to assure that environmental and social risks are minimized and, where possible, avoided.

High risk measures that do not reduce greenhouse gas emissions, but are advanced solely to increase energy security, should be rejected. Thus, exploitation of oil in environmentally valuable coastal and protected areas and exploitation of oil shale and tar sand oil should be absolutely rejected. They increase dependence on oil, add to greenhouse gas emissions and in the case of shale and tar sand oil, are highly polluting and a serious threat to human health.

The use of coal as an energy resource should be gradually eliminated and replaced with energy efficiency, cogeneration and environmentally sound renewable resources, the latter with standards to minimize or eliminate environmental and social damages. The world is so dependent on coal, particularly for electric power production, that this transition will take considerable time and investment resources. But this process should be instituted now.

During this transition, international standards should be adopted to require environmentally sound coal mining and waste disposal practices, pre-burning coal washing, and scrubbing of exhausts from coal combustion. Research should be accelerated on improving the environmental and economic characteristics of coal gasification. Research also should be continued on CCS, but it should not be deployed until safe sequestration can be assured through stringent international regulation.

Currently operating nuclear power plants are mostly economic since their huge capital construction costs have been amortized. But regulations and relicensing proceedings should provide, as they do not now, for protection against terrorist attacks from the land, sea and air. Reprocessing of nuclear power plant wastes producing plutonium should be prohibited. Regulations also should require closed system cooling to protect against the massive fish kills attendant on most nuclear plant operations today.

New nuclear power plants are so horrendously expensive that their costs, mining threats to workers and the environment, threats to proliferation of weapons and security threats from terrorists simply are not worth the costs. Efficiency and renewable resource alternatives at today's costs are far more advantageous from every standpoint.

Biofuels, particularly second generation biofuels that do not compete with food supplies, seem the best, maybe the only, immediate alternative for energy to fuel economic development in poor countries and rural areas of countries in transition not served by modern energy resources.

Respectfully submitted:

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