Energy security and ecosystems: creating a virtuous relationship

Background Paper for the German British Forum 12th annual conference
11-12 October 2007
London, UK

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DRAFT 4 September 2007

Energy security – what does it mean? Fundamentally it means maintaining access to supplies of energy (United Nations, 2005). To those of us living in Europe or North America it is a matter of having light when we flick a switch or having heat when we turn on the radiator. To an African villager energy security means having fuel-wood supplies close at hand to cook and boil water. To the Latin American family it means having kerosene to fuel generators for light and electricity.

World energy markets are ripe for change and security is one of the driving forces. But it is not the only one. In the developed world gas cuts, aging infrastructure, fuel price hikes and ever growing demand are creating the conditions for public acceptance of and political will for energy investments. In the developing world energy is recognised as a necessary, but not sufficient condition for development (International Bank for Reconstruction and Development, etc. 2005; UNDP, 2005) and concerns about indoor air pollution and environmental degradation are creating interest in modern energy services (FEMA, 2007).

For both developed and developing countries climate change looms large as a game changing factor. If it is not addressed, climate change threatens to alter the landscape into which investments are placed (turning forests into deserts, exposing coastal zones and offshore instalments to more severe weather events, and changing growing seasons). On the other hand, if the political will is found to deal with climate change the likely result is a changed investment landscape for energy systems where carbon dioxide and other greenhouse gasses come with a price.

The mix of factors driving change in the energy markets is diverse. When considered individually these drivers can each lead to outcomes which undermine other, equally important objectives. Taking security as an example, striving for energy security by increasing energy from locally produced sources is likely to lead to increased investments in coal which performs poorly on greenhouse gas emissions (unless paired with costly carbon sequestration technologies). Efforts to increase access to modern energy services in Africa through hydroelectric schemes may further expose people to drought brought about by climate change (FEMA, 2007).

Further factors need to be taken into account when considering issues outside of the traditional energy agenda. Ecosystems and the goods and services they provide are critical to energy systems. Take the case of water. Water flows are needed for hydropower dams and there is growing evidence in many parts of the world that flows are being affected by climate change. The Akosombo Dam on the Volta River in Ghana has recently suffered from water rationing due to drought, resulting in rolling blackouts for cities throughout the country (Niasse, et.al., 2004 and Watkins, 2007). Likewise, the flows of the Colorado River have dropped from 13.5 million acre-feet per year to just over 6.7 million over the last five years, resulting in a 35% reduction in Glen Canyon Dam's hydropower generation (Living Rivers, 2004). There is increasing recognition of the importance of investing in upstream ecosystems to maintain hydropower productivity. Some

dam operators invest in soil conservation activities such as reforestation and contour plowing in areas upstream of the reservoir to reduce sediment inflow thereby increasing the lifetime of the reservoir and reducing damage to the turbines.

There are further links between water and energy. Water is a critical part of processing ores for the mining industry – including energy feedstocks such as coal, tar sands and uranium. A survey at the 2007 members meeting of the World Business Council for Sustainable Development (WBCSD) in Montreux, Switzerland revealed the provision of water as the ecosystem service of greatest concern to company executives. And there is justification for this concern. The Millennium Ecosystem Assessment (MA) concurred that "More than 50% of specific types of wetlands in parts of North America, Europe, Australia, and New Zealand were destroyed during the twentieth century, and many others in many parts of the world degraded". And "the degradation and loss of wetlands is more rapid than that of other ecosystems." The MA scientists recommend cross-sectoral ecosystem based approaches to wetland management on a basin scale to understand and address trade-offs between different wetland ecosystem services (Millennium Ecosystem Assessment, 2005).

Another example of ecosystems underpinning energy services is that of biomass production. Producing fuel crops such as rapeseed, soy, sunflower seeds, coconut oil, and oil palm for biodiesel and biogas or sugar beets and cane, corn, and cassava for ethanol requires a number of ecosystem services including the regulation of erosion, climate, water, pests, and pollination. Nearly all of these services aside from water regulation are in decline (see table below) meaning that the capacity of ecosystems to produce sufficient amounts of fuel to make a significant impact on greenhouse gas reductions. Furthermore, competition with agricultural land for food production may mean that biofuel feedstocks will be produced in "marginal lands" which serve ecological functions, further degrading the capacities of ecosystems to deliver important regulating services.

Balance sheet: Ecosystem services

Provisioning services		
Food	crops	↑
	livestock	↑
	capture fisheries	↓
	aquaculture	↑
	wild foods	↓
Fiber	timber	+/-
	cotton, silk	+/-
	wood fuel	↓
Genetic resources		↓
Biochemicals, medicines		↓
Water	freshwater	↓

Regulating services	
Air quality regulation	↓
Climate regulation – global	↑
Climate regulation – regional and local	↓
Water regulation	+/-
Erosion regulation	↓
Water purification and waste treatment	↓
Disease regulation	+/-
Pest regulation	↓
Pollination	↓
Natural hazard regulation	↓
Cultural services	
Spiritual and religious values	↓
Aesthetic values	↓
Recreation and ecotourism	+/-

↑ globally enhanced
↓ globally degraded

Source: Millennium Ecosystem Assessment, 2005.

The MA evaluated the global status of provisioning, regulating and cultural services. An upwards arrow indicates that the condition of the service globally has been enhanced and a downwards arrow that it has been degraded in the recent past.

Finally, if one considers the needs of those with the least access to energy options – the 2 billion or so people who depend on biomass fuels for cooking and heating (UNDP, 2005), and the women and children who have to travel for hours by foot to salvage fuelwood for cooking and heating their homes – the productivity of the surrounding ecosystem is a matter of life or death. Well planned and executed ecosystem restoration such as the regeneration of woodlands in Tanzania's Shinyanga region (see Box 1) can secure livelihoods of local communities and

provide villagers with reliable and accessible supplies of fuelwood as well as a range of non-timber forest products.

Box 1. Regenerating Woodlands in the Shinyanga Region of Tanzania

The Shinyanga region of Tanzania was once an abundant woodland which had been stripped away over decades, first to eradicate the tsetse fly and then to make way for cropland for a growing population. Through a series of ecosystem restoration project which revived traditional land management techniques over 350,000 hectares of forest enclosures in over 800 villages have returned the forest to over 2.8 million people. As a result villagers now spend 2-6 hours less *each day* collecting fuelwood (WRI, 2005).

The changes in energy systems which will occur over the next five years will have significant and lasting implications for ecosystems and livelihoods for decades to come. Likewise, the way ecosystems are managed and cared for today will have bearing on the availability of energy services in the future. The relationships between energy systems and ecosystems have traditionally been characterised by conflict and constraint, but this need not be the case. Tools such as biodiversity offsets (Forest Trends, 2007) and payments for ecosystem services (Ravnborg, Helle Munk, et al 2007) are being developed by the conservation community to provide incentives for delivering ecosystem services through better management of natural systems. Likewise, energy decision makers are increasingly interested in investing in ecosystem services which are critically important to the future viability of energy options. For example, approaches to promote local climate change resilience strategies and energy planning are being developed in Africa (HELIO, 2007). Such approaches can help transform the relationship between energy systems and ecosystems into a virtuous cycle.

References

EarthWatch Institute, World Resources Institute, WBCSD and World conservation Union, November 2006. *Business and Ecosystems: issues brief; ecosystem challenges and business implications*.

FEMA (Forum for Energy Ministers of Africa), 2007. *Energy Security and Sustainability in Africa*. Nairobi, Kenya.

Forest Trends, 2007. *Business and Biodiversity Offsets Programme*. http://www.forest-trends.org/biodiversityoffsetprogram/.

International Bank for Reconstruction and Development, the World Bank, and the United Nations Development Programme, 2005. *Energy Services for the Millennium Development Goals*. Washington DC, USA.

HELIO International, 2007. *A preliminary assessment of energy and ecosystem resilience in ten African countries*. Paris, France.

Living Rivers, 2004. *Climate Change: the end of Glen Canyon Dam?* www.livingrivers.org

Millennium Ecosystem Assessment, 2005.*Ecosystems and Human Well-Being: wetlands and water synthesis*. World Resources Institute, Washington, DC.

Niasse, Madiodio, Afouda, Abel and Amani, Abou (Eds.), 2004. *Reducing West Africa's Vulnerability to Climate Impacts on Water Resources, Wetlands and Desertification: Elements for a Regional Strategy for Preparedness and Adaptation*. IUCN, Gland Switzerland and Cambridge UK. Xviii-66pp.

Ravnborg, Helle Munk, Mette Gervin Damsgaard, and Kim Raben, 2007. *Payments for Ecosystem Services: issues and pro-poor opportunities for development assistance*. Danish Institue for International Studies, DIIS. Copenhagen, Denmark.

UNDP (2005) Energizing the Millennium Development Goals. UNDP, New York USA.

United Nations Department of Economic and Social Affairs Division for Sustainable Development (2005). *Milti Dimensional Issues in International Electric Power Grid Interconnections* http://www.terrawatts.com/interconnection_final.pdf

Watkins, T. 2007. The Volta River Project in Ghana, West Africa.

WRI. 2005. The Wealth of the Poor. http://multimedia.wri.org/wr2005/048.htm.