Future Energies

Guest contribution by **Dr Johannes Lehmann**

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Climate change has featured prominently in the news and both adaptation as well as mitigation of the anthropogenic greenhouse effect is an increasingly debated agenda item in both the media and policy arena. Emission reductions from fossil fuels are a top priority and more efficient use of energy as well as reductions in energy use are the most effective way to achieve the massive reductions required to mitigate climate change. But also alternative energies have to be explored to meet the challenge.

Bioenergy is one of these alternatives that are currently pursued by industry and supported by subsidies in many countries. Possible environmental impacts of bioenergy, however, shed valid concerns on this otherwise valuable approach to substitute fossil fuels. Maximizing biomass yields from bioenergy crops will inevitably lead to the depletion of soil organic matter contents, which is the foundation of healthy soils and a healthy environment. If bioenergy crops are grown that require high amounts of fertilizers, the applied nitrates or phosphates as well as herbicides or pesticides may find their way into our drinking water reserves. The soil degradation will then not only lead to a deterioration of the production base of the bioenergy itself, but also lead to unwanted offsite effects such as greater water pollution especially under scenarios where high-value crops such as corn are produced.Here is a new approach that tackles these types of issues of environmental degradation head-on:

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the thermal degradation of biomass by a process called low-temperature pyrolysis generates a by-product that retains 50% of the carbon contained in the original biomass,- biochar. This biochar can be returned to soil and not only make this type of bioenergy carbon-negative but also avoid soil degradation on bioenergy plantations. Biochar has a range of properties that make it a very efficient soil improver. Biochar is able to retain nutrients, keep them available for plants and reduces their losses into rivers and groundwaters. It is also very resistant to microbial decomposition and therefore stays in soil for very long periods of time,- much longer than any compost, manure or crop residue would.

But what will it cost and who is going to pay for this environmental service? Burning the biochar would create revenues that have to be covered in a different way if biochar were to be returned to soil. The opinions about this aspect diverge among experts, and for a very good reason. The prices of for example electricity differ widely between countries and so will the revenues for the bioenergy produced by pyrolysis. The costs of feedstock drive to a significant extent the rentability and transportation charges have typically the largest share in this cost. If clean wastes can be used such as forest thinnings or animal manures, tipping fees may create revenues. On the other hand, dedicated bioenergy crops will always come at a price and short transportation distances as well as inexpensive and low-input production systems are key to the financial success. In some cases, the return of biochar to soil for the purpose of either emission trading or yield increases may provide the main financial incentive.

Bioenergy in general adds value to products grown on land which brings urgently needed income streams to farming communities. This has recently even led to rising prices achieved of for example corn due to proliferation of ethanol production from corn grain. By the same token, bioenergy approaches may compete for land with the land-based production of food and make food production more costly. Here again may be an opportunity for pyrolysis bioenergy to be complementary to food production. Biomass for the use of pyrolysis ideally has a “low quality”. This means that grasses or woody plants can be used that can also be grown on marginal lands, and do not rely on prime agricultural land that is used for food production. In contrast, for example corn or sugar cane ethanol production requires prime agricultural land.

This example shows in the first place that we have not exhausted our options in developing energy alternatives that are complementary to more established approaches in their environmental impact and resource use. Broad thinking is required to explore all options.

Reference:

Lehmann J 2007 A handful of carbon. Nature **447**, 143-144.

Lehmann J 2007 Bio-energy in the black. Frontiers in Ecology and the Environment, in press.

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