

Science for Environment Policy

Agriculture can be powered by renewable energy sources

Some agricultural activities, such as irrigation, could be powered by renewable sources, a new study indicates. Farm machinery could also be renewably-powered, but the machinery would need to be adapted to use renewable electricity, instead of liquid fuel.

Agriculture is a major contributor to global warming through greenhouse gases (GHG) from activities such as deforestation, soil treatment and methane emissions from livestock. It is also one of the main users of fossil fuels in Western countries, thus also contributing further to GHG emissions. The cost of agricultural products is highly dependent on, and vulnerable to, fuel prices. It is therefore appropriate to assess alternative sources of energy for the future of agriculture.

The study examined the possibility of substituting the use of fossil fuels in farming with energy produced from renewable sources, such as wind, photovoltaics, hydroelectricity and biomass. Power from wind and photovoltaics has reached a level of efficiency that can compete with fossil fuels. Globally, agriculture currently consumes about 27.7 EJ (27.7×10^{18} joules) per year; of this, 8.2 EJ is provided by renewable energy. It is possible to provide about 30 EJ, using mainly photovoltaics and wind, the study suggests, and the land needed to expand these two renewable sources should be minimal (about 30,000 km²) compared to requirements of agriculture. However, biofuels would not be feasible in this respect because they require large amounts of land for cultivation and, above all, they are not energy efficient. While renewable sources could produce enough energy for farm machinery, it is in the form of electricity and not a liquid fuel. Agricultural processes would therefore need to be adapted to use renewable electricity directly.

The study considered four fundamental agricultural processes that would need to be adapted in order to be more sustainable:

- 1) **Mechanical operation.** The study drew on results from the EU funded RAMSES¹ project that developed an electrically-powered multi-functional vehicle with some of the functions of a conventional tractor. This vehicle could also be used as a source of power for agricultural applications, such as watering and spraying, either by electrical coupling or by using the vehicle's batteries. It was shown to be reliable and functional, but its development for global use would have to be subsidised.
- 2) **Irrigation** is relatively easy to power with certain forms of renewable energy, such as wind pumps which can directly power the extraction of water from the ground. However, water management must be improved as scarcity becomes an issue.
- 3) **Use of artificial fertilisers.** The two main ingredients of fertilisers are nitrogen and phosphorus. The process used to extract nitrogen (Haber-Bosch) and mining of phosphorus could both be powered by renewable sources. However, phosphorus is a finite resource and the use of renewable energy would not overcome issues of its depletion which require shifts in fertiliser use and improvements in recycling of phosphorus from sewage sludge.
- 4) **Use of pesticides.** Although renewable energy could substitute the fossil fuel energy needed to produce pesticides, there are currently no substitutes for petrochemicals (chemical products derived from petroleum, such as kerosene) needed for the synthesis of the pesticides. Agriculture will have to adapt its practices and move towards less use of chemicals.

In conclusion, 'weaning' farms from fossil fuels is possible, but in order for agriculture to become truly sustainable, more efficient use of energy and resources is needed, and soil and water must be better preserved. Although the high cost of fossil fuels will offer some incentive to adopt renewable technologies, such as electrically-powered farm machinery, they may need subsidising in the near future to be affordable.



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1. See: <http://www.ec-ramses.net>