RES4LIVE
ENERGY SMART LIVESTOCK FARMING
TOWARDS ZERO FOSSIL FUEL CONSUMPTION

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Environmental and Economic Assessment of Renewable Energy Systems in an Experimental Dairy Cattle Farm

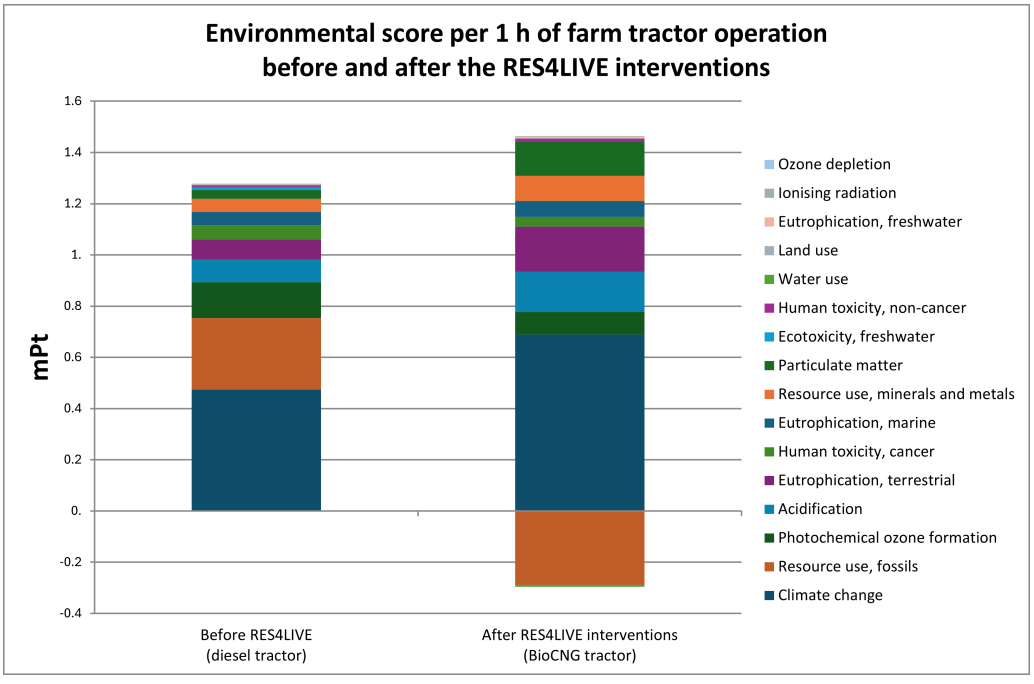
Integrating renewable energy sources (RES) systems into farming practices can greatly enhance operational efficiency and sustainability. This assessment examines the environmental and economic impacts of two innovative systems implemented on an experimental dairy cattle farm in Germany. The results suggest that cattle farmers can leverage these benefits and take advantage of available funding opportunities to support implementation.

The two systems evaluated are:

- A biogas-to-biomethane upgrading plant, equipped with a BioCNG filling station
- An adapted farm tractor for BioCNG use

The operation of the biogas-to-biomethane upgrading plant leads to remarkable diesel savings, causing a beneficial environmental effect equivalent to 4.6 times the total environmental burden of the biomethane supply chain system, only from the on-farm biomethane use in the retrofitted tractor. If all diesel savings are considered, including a potential sale of surplus BioCNG, the corresponding beneficial environmental effect could be increased up to 13 times.

The adapted tractor running on BioCNG offers additional environmental benefits compared to a conventional diesel tractor, reducing overall environmental burden by 9%, and the overall environmental burden caused by non-renewable fossil fuels and water consumption by 2 and 3 times, respectively.



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From an economic standpoint, considering both the sale of BioCNG and fuel savings, the discounted payback period (DPBP) for the biogas-to-biomethane upgrading plant is 10 years. With subsidies covering 20% to 40% of the total investment costs, aimed at promoting decarbonization at the EU level, the DPBP could be shortened to around 8 to 5 years, respectively. After that, the DPBP for the adapted tractor would be around 2 years.

Incorporating similar interventions could improve the environmental and economic sustainability of cattle farms producing biogas in Germany.

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