

2. Studienarbeit

„Der Einfluss von Windrädern auf Moorböden bezüglich der energetischen Amortisationszeit am Beispiel der Beinn Ghrideag Wind Farm auf der Isle of Lewis“

Zusammenfassung

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Summary

Peatland is a significant terrestrial carbon storehouse which is protected from decomposition into gaseous carbon dioxide by the wet and acidic conditions that excludes oxygen and inhibits the action of microorganisms. Wind power is expected to grow fastest by 2035 compared to all other renewable energy sources. At 11.2 %, wind energy already has the largest share of all renewables in the European grid mix.

Installing wind turbine on peatland has the disadvantage of exposing carbon that was trapped in the ground to decomposition, and some estimates suggest the turbine can take several years of operation to compensate for the associated carbon dioxide emissions. One of the main reasons for these high payback times is the assumption that the construction not only causes drainage within the construction area, but can extend up to 400 m. However, for a windmill on the Isle of Lewis, Scotland, the calculated payback time is only 44 days. The calculation was predicted on extensive investigations and measurements in a potential area of the Beinn Ghrideag Wind Farm in Stornoway, Scotland. This included the determination of the peat depth, the peat volume and the mass of peat. Based on this, the content of CO₂ could be calculated, which would be released by the construction of the wind turbine. The calculation of the energy yield of the wind turbine and the resulting CO₂ gains were necessary to determine the payback time. To calculate the CO₂ gains, the emission factor was used for all fossil fuels used in the United Kingdom in 2016.

On the one hand, it was possible to determine the dry mass of peat in the study area using the water content of different peat samples. On the other hand, it could be shown that even in a peat-cutting area the peat body interior shows no signs of dehydration and thus it can be assumed that peat has the property to bind water effectively for longer periods of time. Based on this assumption and a positive assessment of the bog vegetation in Beinn Ghrideag Wind Farm, it was hypothesized that the impact of a wind turbine on hydrology in a bog could be much lower than previously thought. It is important that each area is assessed individually and no standard values for the calculation of the payback period are accepted. Entering crude estimates of the impact on the surrounding peat into a generic CO₂ calculator can lead to a dramatic overestimation of the impact and undermine the potential of wind energy.

The payback time could be significantly reduced if wind farm developers were obliged to sequester extracted peat to prevent oxidation, and it may even be beneficial to actively encourage surface water retention in the peatland around the turbines to encourage peat regeneration and growth. With this study it could be determined that the construction of wind turbines could exert a much smaller influence on the hydrology of the peat soil. However, to obtain precise and realistic payback periods of wind turbines on peat soils, extensive hydrological investigations must be the basic prerequisite for calculation methods. Arbitrary and vague assumptions regarding the range of possible drainage undermine the potential of wind power and create mistrust of the importance of renewable energy for a sustainable and environmentally friendly energy supply.