Wind energy and agriculture

Agricultural systems in most parts of the world, including our own, are subject to many risks and uncertainties. These include weather-related risks (droughts, floods, hail), which have historically been responsible for a wide range of problems (poverty, hunger, migration).

Climate risks aggravated by climate change are expected to further exacerbate[1] the significant problems facing our country in the future. To mitigate these impacts and minimise the risks, **the integration of renewable energy systems into agriculture can reduce the economic risks of the sector, indirectly help the in-situ conservation of protected agricultural livestock and crops, and support soil protection**. However, its realisation depends on a number of factors, such as the cost of energy, the availability of adequate grid coverage, and any incentives/support provided by governments for the introduction of renewable energy.

Our main proposals are as follows:

Rules applicable to other uses of land should be extended to wind energy, thereby creating a regulatory basis for the dual use of wind energy and agricultural activity.

Renewable resources have huge potential for agriculture.
Farmers should be encouraged through subsidies to use wind energy technologies.

The concept of sustainable agriculture is based on a delicate balance between maximising yields and maintaining economic stability, while minimising the use of natural resources and environmental damage. The increased use of wind energy could contribute to it and therefore should be promoted in the Hungarian energy mix.

Schemes should be developed for farmers to allow them to get to know relevant professional and market actors, the different technologies that use wind energy, and to learn good practices on how to integrate wind energy into their farming activities.

It would also be necessary to launch a national wind energy R&D&I programme, which would promote and ensure the application of state-of-the-art technologies in our country, taking into account the natural and agricultural conditions, situation and potential of our country.

1 E.g. Report on the scientific assessment of the potential impacts of climate change on the Carpathian Basin; ITM, 2020.

Achieving renewable energy targets requires coordination between many market players. Research by Liao et al.[2] shows that **countries that adopt more renewable energy policies produce more renewable energy products.** Among policy instruments in this area, incentives/subsidies for production are common and dominant. Recently, the primary renewable energy policy objective of governments has been to promote renewable energy products by removing various barriers. However, the energy market needs to be broadened to ensure that renewable energy products are ubiquitous and able to compete with fossil products - making them economically indispensable in the agricultural sector.

Wind farms in agricultural areas

Wind energy and agriculture are a good match. A single wind turbine can occupy less than 500m^2 of land, which in total can be orders of magnitude less than what is needed for a solar power plant[3]. Farmers can plant crops and graze livestock close to the base of the turbines, making use of up to 95% of the land in the immediate vicinity of the turbine. The advantage of wind farm production is that the additional income generated by the turbines can be reinvested in the farm or even compensate for any loss of income from agricultural production. Enabling farmers to use wind energy technology on their land will help our country meet its food and energy needs in a safe and sustainable way.

Farmers can reduce their costs by using the electricity generated by the turbines. This allows them to save money that they can use to produce more food. They can increase production, buy more equipment and at the same time increase their profits and be more likely to stay in the sector.

Pretty et al.[4] have identified three mechanisms[5] through which farmers can take positive action towards ecologically and economically sustainable and climate-neutral agriculture:

- increasing carbon sinks in soil organic matter and above-ground biomass;
- avoid carbon dioxide or other GHG emissions from farms by reducing direct and indirect energy use; and
- increasing renewable energy production to replace fossil fuel consumption and thus reduce carbon emissions.

It is also important to highlight the problems of soil erosion and dependence on fossil fuels. The success of efforts to achieve food and energy security for a growing world population can be greatly enhanced by the wider use of dual use. In Hungary, the dual use of wind energy and agricultural activities is the quickest and easiest way to achieve this dual objective and to support the effectiveness of soil conservation and biodiversity conservation programmes (e.g. EU Biodiversity Strategy for 2030).

Hungary is primarily an agricultural country, with 45% of its land area used for arable crops and 8% for grassland (Hungarian Statistical Office, HCSO, 2021 data). In our country, many people[6] make their living from farming, but this means an increasingly unpredictable income every year due to the effects of climate change. Dual use of agricultural land (energy and agro-industry) can provide farmers with a predictable extra income.

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[2] https://journals.sagepub.com/doi/full/10.1177/0036850419832696

[3] see more in "Land Use for Solar and Wind Energy" (Energiaklub, 2022.) https://energiaklub.hu/files/study/Energiaklub%20tanulma%CC%81ny%20-%20Fo%CC%88ldhaszna%CC%81lat%20nap-%20e%CC%81s%20sze%CC%81lenergia%20esete%CC%81n.pdf

[4] https://www.researchgate.net/profile/Jules-Pretty/publication/7121921_The_role_of_sustainable_agriculture_and_renewable-resource_management_in_reducing_greenhouse-gas_emissions_and_increasing_sinks_in_China_and_India/links/00b4952399333c83ec000000/The-role-of-sustainable-agriculture-and-renewable-resource-management-in-reducing-greenhouse-gas-emissions-and-increasing-sinks-in-China-and-India.pdf

[5] https://royalsocietypublishing.org/doi/abs/10.1098/rsta.2002.1029

[6] In Q3 2022, 4.33% of all employed persons worked in agriculture, forestry and fishing (HCSO)

However, in Hungary, dual use is currently only allowed[7] and feasible for certain technologies (agro-photovoltaic) and subject to other limiting factors.

If a favourable regulatory environment is created for wind farms and the permitting process is simplified, 95% of a 1 hectare of agricultural land on which a wind farm is built can continue to be farmed, unlike solar farms where such activity can be more limited and cumbersome. Wind farms also have a small demand for land during their construction and operation. They are capable of stable operation for 25-35 years, while requiring only 0.01-0.05 hectares of land to be taken out of cultivation. An important advantage is that agricultural roads can also be used to access wind farms in general, so that maintenance does not necessarily require significant additional infrastructure development. Moreover, if the wind farm is being installed by an external investor (and not the farmer), these roads are usually upgraded as part of the investment, thus supporting farmers.

An average wind power plant that could potentially be installed in Hungary today would be capable of generating roughly 6 million kWh of electricity per year[8], which could provide an annual income of about 100-200 million HUF[9] just by selling the electricity generated.

Wind and solar energy can also be used to power greenhouses to provide fresh water, heat or run other equipment without using fossil fuel energy sources. Renewable energy in greenhouses is an economical way to maintain the optimum temperature needed to grow plants and vegetables.

Economic aspects of landowners

Whether through crop production, grazing or other agricultural activities, many rural landowners are accustomed to using their property for income generation. Wind energy can provide landowners with an additional form of income that can diversify farm incomes, which can be strongly affected by volatile commercial markets and weather conditions. An advantage can be that such revenues are often received annually, which can provide a more predictable source of income. The land surrounding the wind turbine can still be used for grazing, crops or other agricultural purposes.

In addition, local income growth can allow the economy of a region to boom. If the wind farm investment is not carried out by the landowners themselves but by independent investors, the former will also be compensated in line with national practice. Main issues and possibilities for compensation of landowners are the following:

1. Option (individual) agreements: a pre-construction land ownership agreement that allows project developers to acquire short-term rights to assess the wind resource prior to investment.

An option agreement allows the viability of a project to be established in a short timeframe, giving the developer time to carry out activities such as wind resource assessment, permit approval and project design before signing a long-term wind development contract. By signing an option agreement, landowners typically receive compensation from the developer in exchange for the opportunity to build the wind project if it is deemed viable.

The payment arrangements in the option contract may vary depending on the terms of the agreement between the landowner and the wind developer: variables may include the duration of the contract, the total amount per hectare and whether this amount is fixed or

[7] https://nak.hu/tajekoztatasi-szolgaltatas/mezogazdasagi-termeles/103433-modosult-a-termofold-vedelmerol-szolo-torveny-is
[8] 3 MWp capacity and 23% capacity factor
[9] at 15-30 HUF/kWh

increases over the duration of the contract. The option agreement can last for several years and typically sets out the terms on which the developer will or will not implement the project.

2. The agreement on compensation payments between landowners is concluded between the property owners (including state or local authorities if the land is in public ownership) and the project developer. These long-term contracts are often complex and cover the lease or easement of the property, contractual term, liability issues, payment details, tax considerations, land impact considerations, and decommissioning. Many landowners choose to negotiate with the developer on their own, but there are many examples of landowners forming associations to pool their resources during negotiations.

Types of landowners in wind power investment

The number of participating landowners will depend largely on the size of the project, the land available, the local wind resource and other factors that project developers use to determine the location of the project, the suitable locations for the installation of each turbine that will make up the project. Although wind turbine owners will receive the largest share of landowner compensation, compensation paid by landowners may also be used to compensate those hosting the project infrastructure. Types of landowners:

a. Participating landowners (wind turbine): property owners who have land suitable for the installation of a wind turbine and who have a lease or easement agreement with the developer. The participating landowner will receive payments as specified in the agreement for each wind turbine installed on their land.

b. Participating landowners (project infrastructure): landowners with sufficient land to accommodate infrastructure such as transmission lines, substations, roads, facilities and other installations. Participating landowners may receive payments as specified in the agreement for the type of infrastructure installed on their land.

c. Other participating landowners: property owners who do not have a wind turbine on their property have to be agreed with to provide access to wind farms, e.g. roads, so that there are no barriers to accessing wind farms. Adjacent property owners may receive compensation, but typically less than participating property owners.

d. Non-participating landowners: landowners who do not have a wind turbine or other ancillary project infrastructure on their land. These landowners will not be compensated.

e. Corporate landowners: wind energy projects can be located on land owned by companies: corporations, investors, foreign companies, land trusts, or owned by the actual investor/operator, rather than by an individual or family in the community. These companies may also receive land rental compensation from the project, but this revenue is less likely to provide rural and community benefits.

f. Public landowners: project developers should negotiate with state agencies to secure land use rights for any wind energy projects developed on public lands.