STRATEGIES AND TECHNOLOGIES TO ACHIEVE A EUROPEAN FOSSIL-ENERGY-FREE AGRICULTURE: THE AGROFOSSILFREE PROJECT

Dominik Rutz[1], Veronika Hofmeier[1], Chuan Ma[1], Rainer Janssen[1], Athanasios Balafoutis[2] (project coordinator), Konstantinos Vaiopoulos[2], Claus Aage Grøn Sørensen [3], Dimitris Manolakos[4], Alex Koutsouris[4], George Papadakis[4], Magdalena Borzecka[5], Vanja Bisevac[6], Daan Creupelandt[7], Julio Román[8], Frank Oudshoorn[9], Daniele Rossi[10], Martyna Próchniak[11], Zisis Tsiropoulos[12], Harm Brinks[13], Barry Caslin[14], Jorge Sneij[15], Mirentxu Asín[16]

[1]WIP – Renewable Energies, Sylvensteinstr. 2, D - 81369 Munich, Germany
Tel. +49 89 720 12743, Fax +49 89 720 12791
E-Mail: dominik.rutz@wip-munich.de
Internet: www.wip-munich.de, www.agrofossilfree.eu

[2]Centre for Research and Technology Hellas (coordinator), [3]Aarhus University, [4]Agricultural University of Athens, [5]Institute of Soil Science and Plant Cultivation, [6]European Agricultural Machinery Association, [7]REScoop, [8]European Conservation Agriculture Federation, [9]Landbrug & Fodevarer, [10]Confagricoltura, [11]Lublin Agricultural Advisory Center in Konskowola, [12]AGENSO, [13]DELPHY BV, [14]TEAGASC, [15]Trama TecnoAmbiental, [16]Iniciativas Innovadoras

ABSTRACT: The AgroFossilFree project is supporting Fossil-Energy-Free Technologies and Strategies (FEFTS) in agriculture by coordinating several stakeholder actions and by providing information on FEFTS in agriculture. Thereby, special emphasis is placed on applications of photovoltaics (PV) in agriculture. The core objective of the project is to set-up an online platform for farmers, advisors, researchers, industrial partners and other actors on which they can find useful information on FEFTS in agriculture. The AgroFossilFree project contributes to the High Level EU Strategies (i.e. EU Green Deal and Farm to Fork strategy) as it aims to decrease the use of fossil energy in any farming process. It also contributes to close the gap between the available FEFTS and the everyday EU agricultural practices by promoting effective exchange of novel ideas and by exchanging information between research, industry, extension services and the farming community. If this gap closes, European agriculture could become more sustainable with minimum energy, environmental and socioeconomic impacts. With the knowledge that is collected, classified and presented to actors in the agricultural field, the European agricultural sector is able to promote and comply with the fossil energy use reduction policies, the related legal and regulatory frameworks and sustainable food production practices. This paper presents the current status of the AgroFossilFree project which is funded by the Horizon 2020 Programme of the European Commission.

Keywords: Photovoltaic, Dissemination, Agriculture, Strategy, Agri-PV, Defossilisation

1 INTRODUCTION

Emissions from global agriculture are, among emissions from other sectors, a significant driver for climate change. The agricultural sector was responsible for about 10% of the EU's total GHG emissions in 2015, excluding land use, land use change, and net forestry removals [1]. These emissions are dominantly associated with livestock production (both enteric fermentation and manure management) and the application of fertilisers to agricultural soils. A recent study [2] found that the emissions related to the production of energy in agriculture (except for the horticultural crop type) were found to be of minor importance compared to other emission sources.

Nevertheless, in absolute numbers, large amounts of fossil energy are used in agriculture for fertilizer and pesticide production as well as for heating, cooling, transport and electricity. The AgroFossilFree project aims to support any fossil fuel saving measures and replacements by renewable energies, also named as Fossil-Energy-Free Technologies and Strategies (FEFTS).

FEFTS refer to the tools that are required to address cleaner and more efficient energy production and use in agriculture. FEFTS are categorised based on the associated agricultural technology application. The two main categories are about Clean Energy Production and Energy Efficiency Improvement, while an auxiliary category refers to Carbon Sequestration.

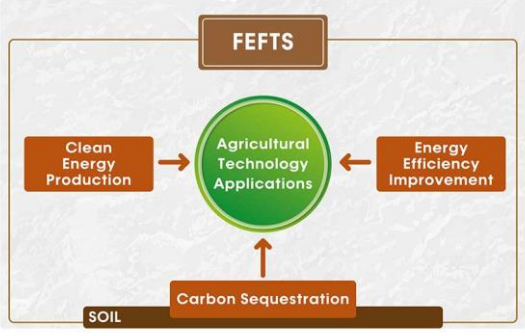

Figure 1: Overview on Fossil-Energy-Free Technologies and Strategies (FEFTS)

2 THE AGROFOSSILFREE PROJECT

The AgroFossilFree project (Figure 1) is supporting integration of FEFTS in agriculture by coordinating several stakeholder actions and by providing information on FEFTS in agriculture. Thereby, special emphasis is placed on applications of photovoltaics (PV) in

agriculture.

Figure 2: Logo of the AgroFossilFree project

The core objective of the project is to set-up an online platform (AgEnergy Platform) for farmers, advisors, researchers, industrial partners and other actors on which they can find useful information on FEFTS in agriculture.

The AgroFossilFree project contributes to the High Level EU Strategies (i.e. EU Green Deal and Farm to Fork strategy) as it aims to decrease the use of fossil energy in any farming process. It also contributes to close the gap between the available FEFTS and the everyday EU agricultural practices by promoting effective exchange of novel ideas and by exchanging information between research, industry, extension services and the farming community. If this gap closes, European agriculture could become more sustainable with minimum energy, environmental and socioeconomic impacts. With the knowledge that is collected, classified and presented to actors in the agricultural field, the European agricultural sector is able to promote and comply with the fossil energy use reduction policies, the related legal and regulatory frameworks and sustainable food production practices.

The expected results of the project are:

- Assessment and evaluation of the current energy use status in EU agriculture and the requirements to achieve a European fossil-energy-free agriculture.
- Identification and presentation of available and directly applicable FEFTS from applied research results to market solutions and explore existing financing tools for de-fossilising activities.
- Collaboration with all relevant stakeholders in thematic groups using interactive physical and online methodologies to produce community-based ideas for FEFTS integration in agricultural systems at regional and EU levels.
- Creation of an online platform with all available FEFTS for stakeholders and a Decision Support Toolkit to propose interventions and financing tools.
- Creation of policy guidelines on EU, regional and national levels to be communicated and to promote FEFTS in real agricultural activities in the near future.

The AgroFossilFree project is funded by the Horizon 2020 Programme of the European Commission (Grant Agreement Number 101000496), started in October 2020 and has a duration of 3 years. An overview on the status of the project is presented in the following chapters.

3 RESULTS

3.1 Current energy use status in EU agriculture

The current energy status in EU agriculture has been evaluated and the main findings indicate that energy use throughout EU agriculture is significant and fossil fuel dependent. According to Eurostat [3], agriculture accounts for 3.2% of total energy consumption, 56% which is derived directly from crude oil and petroleum products, 17% from electricity, 14% from gas and 9% from renewables and biofuels. However, AgroFossileFree results suggest that if indirect energy use associated with the production and transport of fertilizers and pesticides is included, the proportion of energy use in the EU-27 would be 62% higher overall.

The results also show that energy use, its concentrations and breakdown, vary significantly per production system (open-field, livestock, greenhouses). According to AgroFossilFree estimates of the crops and production systems, the annual energy inputs for arable agriculture are 1227 PJ, for orchards and vineyards 208 PJ, for meat production systems 501 PJ, and for dairy production systems 543 PJ.

For open-field agriculture, it is found that the use of fertilizer is the largest energy consuming activity in EU agriculture, accounting for around 50% of all energy inputs. On-farm diesel use accounts for 30%, while other uses are mainly dedicated to irrigation, storage and drying which accounts for 8%. Pesticides and seeds each account for 5% of total energy inputs. In all livestock systems, except for beef production systems, animal feed is the main energy input accounting for around three quarters of all energy requirements. The production of animal feed consumes around 60% of the cereal production in the EU and requires significant high-protein imports. On-farm electricity use, which currently mainly comes from fossil sources, is also significant but varies considerably depending on the production system. In high yielding and high-energy intensive greenhouses energy demand is dominated for heating and cooling. By contrast, lower yielding and less energy-intensive systems use little to no heating/cooling and instead energy use is mainly associated with fertilizers, diesel use for machinery, irrigation and other activities.

The above illustrate that for the EU to achieve the goals outlined in the Green Deal and Farm to Fork strategy, it is likely that the adoption of new technologies, and improvements in energy efficiency and the further development and adoption of non-fossil energy sources for agriculture is required. In addition to this, a transition to more sustainable agricultural practices and farming systems is required. For instance, conservation agriculture can significantly reduce on farm energy use and carbon emissions as well as sequester considerable amounts of carbon (up to 190M tonnes per year) and improve the overall climate resilience of the agricultural sector.

Providing an overview of energy use in EU agriculture is a challenging topic due to the plethora of the available, and in most cases inconsistent data. However, there are multiple areas that would benefit from further research. The understanding and estimates of energy use in EU agriculture would benefit from additional studies on energy use in all three main production systems, especially for greenhouse agriculture. In addition, further research into the energy use of non-conventional systems and crops that are cultivated on a minor scale is required as well as further research into the correlations between farm indicators (size, location, specialization) and energy use.

3.2 Overview on farmers' needs, innovative ideas and

interests

In the AgroFossilFree project farmers' needs, innovative ideas and interests were assessed by social research methods. 50-60 interviews with farmers were conducted in each of the 8 target countries of the AgroFossilFree project.

In addition, 4-5 interviews with experts in the field of energy in agriculture were conducted in each target country. Currently, the data are being processed and analysed and results will be available in autumn 2021.

Finally, a series of online and physical workshops will be organized to collect input from stakeholders. The preparation of the workshops has already started and the events will be implemented in winter 2021/22.

3.3 Inventories of FEFTS

In order to feed the AgroFossilFree online information platform, which will be launched in autumn 2021, a methodology for an inventory for data collection was elaborated. The methodology includes various categories which will facilitate the search function on the online platform. The project consortium is currently including information on FEFTS, to be fed into the online platform:

- Scientific papers
- Research projects
- Commercial technologies
- Training and advising material
- Financial support mechanisms

A database was created and in total more than 400 entries already registered. Once, the AgroFossilFree online information platform will be published, also external users will have the opportunity to register new entries.

3.4 AgEnergy Platform

AgroFossilFree will create the AgEnergy Platform to be its main online tool of promoting FEFTS worldwide. The first step of developing the website of the project (www.agrofossilfree.eu) that will interconnect interested stakeholders to the Platform has been made. The website is very informative and explains the objectives of the project in detail. The AgEnergy Platform is under construction and the wireframes of its contents are already in place. It is expected that the Platform will be launched in autumn 2021.

4 CONCLUSION

Agriculture, besides other important sectors, has to actively take various measures to mitigate climate change and thus to contribute to the target of climate neutrality in Europe as fast as possible.

These measures include innovations on livestock production, the application of fertilisers to agricultural soils, the application of pesticides, and the energy consumption in agriculture. The AgroFossilFree project contributes, with the creation of the AgEnergy platform, to knowledge transfer and easy access to information on fossil free technologies in agriculture.

4 REFERENCES

[1] European Parliament (2020) Briefing: EU agricultural policy and climate change. - https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651922/EPRS_BRI(2020)651922_EN.pdf

[2] Gołasa P. et al. (2021) Sources of Greenhouse Gas Emissions in Agriculture, with Particular Emphasis on Emissions from Energy Used. - Energies 2021, 14, 3784. https://doi.org/10.3390/en14133784 file:///C:/Users/rutz/AppData/Local/Temp/energies-14-03784-v2.pdf

[3] Eurostat (2021) Agri-environmental indicator - energy use. - https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_energy_use [06.09.2021]

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