



Training and Advising FEFTS Material

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Abstract

The study and promotion of currently available FEETS is critical for reducing agriculture's reliance on fossil energy. As one of AgroFossilFree's main goals FEETS will be collected, screened, and assessed in order to be included in AgroFossilFree's training materials inventories, which will serve to enhance stakeholder knowledge and provide incentives to minimize fossil fuel consumption.

The acquisition of FEETS training materials was divided into three phases. Phase one defined the specific FEETS categories. During phase 2, the consortium conducted research with the aim of collecting and cataloging relevant training materials under FEETS categories. This was followed by an initial screening of the uploaded FEETS by the task leader. In phase 3 the registered training materials will be reviewed and incorrect, duplicate, and incomplete entries will be removed thereby ensuring data integrity and supporting effective analysis in AgroFossilFree's subsequent phases.

The analysis found that the majority of training materials collected have multiple technical applications and that they have a relatively equal distribution between the three main FEETS categories (improvements in energy efficiency, renewable energy production, and soil carbon sequestration). More specifically, regarding renewably energy production, all training materials referred to production systems with the largest categories being solar (photovoltaics) and biomass (biogas/biomethane production). Regarding improvements in energy efficiency, the training materials mostly refer to the category 'efficient tool' while regarding soil carbon sequestration, the training materials are mainly focused on tillage systems.

Overall, the collection and incorporation of FEETS training materials into AgroFossilFree was successfully completed within the expected timeframe. This achievement will contribute to the effective operation of the AgroFossilFree platform and support the overall transition away from fossil fuel dependence in EU agriculture.

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1. Introduction

1.1 Background Information

The instruments needed to address cleaner and more efficient energy production and usage in agriculture are referred to as Fossil-Energy-Free Technologies and Strategies (FEFTS). To categorize FEFTS, the energy user/consumer within farming processes must first be identified, this indicates the agricultural technology application for which the specific FEFTS is used and relates to the energy-related uses of agricultural technology. Then, FEFTS are classified based on whether they provide (i) Clean Energy that replaces fossil energy which is concerned with the sources, types, methods, and storage of energy utilized in agriculture; (ii) an Energy Efficiency Improvement in comparison to conventional technologies/practices which refers to the methods and tools used to improve energy efficiency in farming activities; (iii) Soil Carbon Sequestration, which is concerned with agricultural methods that can reduce the impact of fossil energy and associated GHG emissions by supporting improvements in the amount of carbon stored in soil. This is an auxiliary category as it is mainly a GHG compensation strategy rather than a fossil fuel reduction strategy. Table 1 lists all of the FEFTS categories and subcategories.

Table 1. FEFTS categories and level 1 and level 2 subcategories.

FEFTS category	Level 1 sub-category	Level 2 sub-category
Energy User/Consumer	Agricultural technology applications	heating and cooling of buildings
		process heat/cold
		lighting
		agricultural field practices
		vehicles
		tools
		energy sales to external consumers
Clean Energy Supply	Renewable Energy Sources	solar
		wind
		hydro
		geothermal
		bioenergy
		free energy
	Energy types	heating
		cooling
		electricity
		mechanical energy
		chemical energy
	Energy Technologies	photovoltaics
		solar thermal
		wind mills
		hydropower
		heat pumps
		geothermal
		solid biomass conversion
		biogas / biomethane production
		liquid biofuels production
	Energy Storages	heat storage
		electricity storage

Energy Efficiency Improvement	Energy savings	cold storage
		intermediate bioenergy carriers
		efficient buildings
		efficient vehicles
		efficient tools
		precision agriculture
		precision livestock farming
Carbon sequestration	Carbon sequestration	conservation agriculture
		soil organic cover
		tillage (Conservation Agriculture + CTF)
		nutrient management
		crop diversification
		soil and water conservation techniques
		fire management
		grassland management

Practical procedures are addressed in the FEFTS level 2 sub-category (for details, see FEFTS level 3 sub-category from Deliverable 2.1, Table 4 to Table 10).

The primary goal of this deliverable is to present FEFTS training content that the task leader and external partners have registered according to the FEFTS categories listed above, as well as to provide an early analysis based on the current collection status.

1.2 Methodology

WIP and other partners followed three phases to register FEFTS training materials in order to construct a user-friendly AgroFossilFree (AFF) database.

All AFF partners conducted desk research (internet search) during Phase 1 (Initial Identification) to locate relevant and applicable FEFTS training materials. The overall goal of this phase was to identify a wide variety of publicly available materials and techniques (complete solutions, hardware, software, methodologies, components, and procedures) that reduces EU agriculture's reliance on fossil fuels. This research was based on the three-level classification (and, in particular, the keywords/terms of level 3) provided in Deliverable 2.1. In terms of targeted sources, all training materials are primarily provided by the FEFTS organization and institute and are beneficial to a variety of stakeholders (individual farmers, producers associations, energy generators, contractors, advisory services, companies, industry and even policy makers).

In phase 2 the consortium gathered and uploaded all relevant FEFTS training materials through an online survey (Google Forms) creating a training material repository. This repository is used for the FEFTS analysis in Chapter 3 of this report.

Finally, the survey results and acquired metadata from earlier phases are scheduled to be reviewed during Phase 3 with the goal of removing incorrect, duplicate, and incomplete entries (Data Aggregation) thereby ensuring data integrity and supporting effective analysis in AFF's subsequent phases.

As stated in all of WP2's deliverables (D2.2, D2.5, D2.8, D2.14), this screening process will begin prior to the platform's launch once the first internal milestone of submitted FEFTS training materials (37 materials) in the inventory has been reached (until the end of September 2021). This will ensure that the AgEnergy platform will contain high-quality and relevant FEFTS training materials. This screening process builds upon a preliminary step whereby the task leader reviewed all uploaded records, in each FEFTS category, for duplicate, incorrect, and incomplete entries. "Incomplete entries" are defined as those that lacked a thorough description and information, which renders evaluation difficult. When

incomplete entries were located, additional information was requested from partners in order to successfully complete the registration process. In cases that entries were not sufficiently updated these were removed from the inventory entirely.

Certain criteria Acceptance and exclusion criteria were established in order for all Task Leaders to complete this screening process. To accomplish this, Task Leaders held regular meetings (using the Microsoft Teams platform) to discuss the issue and agree on the screening approach for each FEFTS type. During these discussions, it was resolved to form a FEFTS Quality Committee made up of WP2 Task Leaders. This Committee's main responsibility is to screen all FEFTS submitted to the platform. It should be noted that, based on the approach used by each Task, the FEFTS supplied by each Task Leader were already verified for appropriateness before being included in the inventory. As the database is publicly accessible interested and relevant parties are allowed to continually submit new information. These submissions will be kept private until they are approved by the FEFTS Committee, this continual screening process ensures that the information publicly available on the platform is accurate, reliable and relevant to AFF's objectives.

2. Survey

A detailed description of the structure of the survey is available in Deliverable 2.1. The survey's form contains four basic groups of questions (see Annex). The first component contains general information about the recognized FEFTS training material, such as the name and category of the FEFTS, as well as basic information about the individual registering the FEFTS, his or her contact email, and affiliated organization. The second section contains more specific details on the FEFTS training resources, such as the title of the material and other information about the organization. The FEFTS specification (such as the most relevant agricultural domains and keywords) and the application field are discussed in the third part. The fourth component, which contains precise information on the type of FEFTS being submitted, is the most important. The three relevant categories, from which users have to choose, for this component are clean energy supply, energy efficiency improvement, and soil carbon sequestration, each with sub-categories. The final component of the form is a review process of the FEFTS training materials where the user must answer several questions on the socioeconomic, environmental, and general status of the relevant FEFTS training materials. It is important to note that the survey's structure, as well as the FEFTS analysis described in Chapter 3, are both dependent on the framework developed in D2.1. (see Table 3 in D2.1).

2.1 Data Collection – Partner's Role

By the end of September 2021, a considerable number of training materials had been registered by the consortium. The consortium worked in a unified manner with all beneficiaries contributing and by September 30th, 2021, 37 (target 36) scientific papers had been successfully registered on the platform, covering more than half of the targeted 1700 FEFTS (of any type) to be registered by the end of the project had already been registered to the repository.

Table 2. Overview of collection status

FEFTS TYPE	Partner	Target set	Collected
Scientific Papers	CERTH	493 (approx. 500)	490
	All other partners		
Research Projects	IUNG-PIB	100	107
	All other partners		
Commercial Technologies	WIP	200	178
	All other partners		
Training Material	WIP	36 (approx. 40)	37
	All other partners		
Financing Mechanisms	AU	48 (approx. 50)	46
	CERTH		
	All other partners		
Total		877 (approx. 900)	858

The entire identification and registration process was supported by an online thread in Microsoft Teams platform which served as a helpdesk for questions about FEFTS training materials registration.

2.2 Acceptance and exclusion criteria

For the case of FEFTS training material, each individual registration had to have clear agricultural application potential, represent innovative energy saving techniques or represent clean energy supply (production or storage) technologies. In general, the most appropriate training materials have strong educational features supporting FEFTS adoption. In terms of the exclusion criteria, entries that did not support reductions in fossil fuel use in agriculture were ruled invalid.

2.3 General information about the collected commercial FEFTS

In this section, general information about the organization of the collected FEFTS training material will be presented. The types of training material are shown in Figure 1, and the languages of them are presented in Figure 2.

As shown in Figure 1, most of the training material refers to manuals accounting for 13 out of 37 entries. Training materials related to e-learning, websites and presentation types account for the second largest number of entries (each accounting for around 6 entries). Training materials in the form of a leaflet/brochure, a video/photograph, and a webinar account for 4, 4, and 3 entries, respectively. The number of entries for serious game and application types were 1 each and no entries were made for the drawing/diagram type of training material.

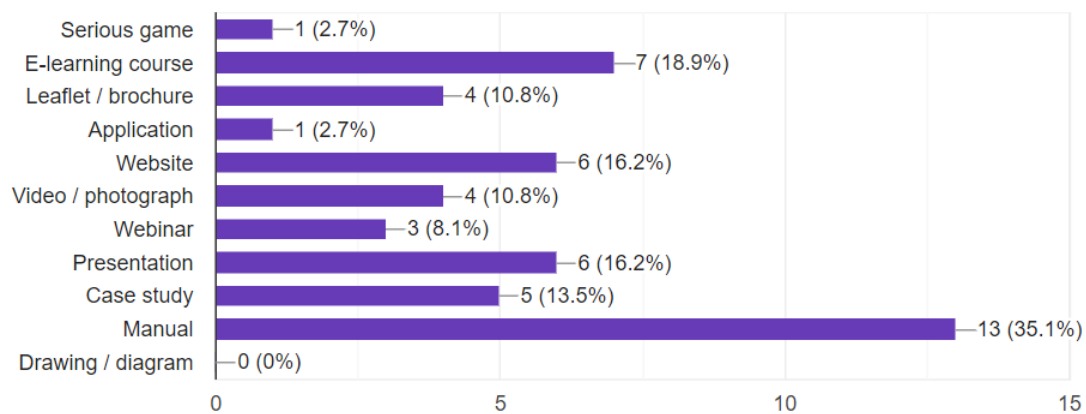


Figure 1. Percentages of different types of training material

Regarding the language distribution of the training materials, 38% are in English, 28% are in German, 13% in Polish, 10% in Greek, 8% Danish and 3% for Castellano (Figure 2).

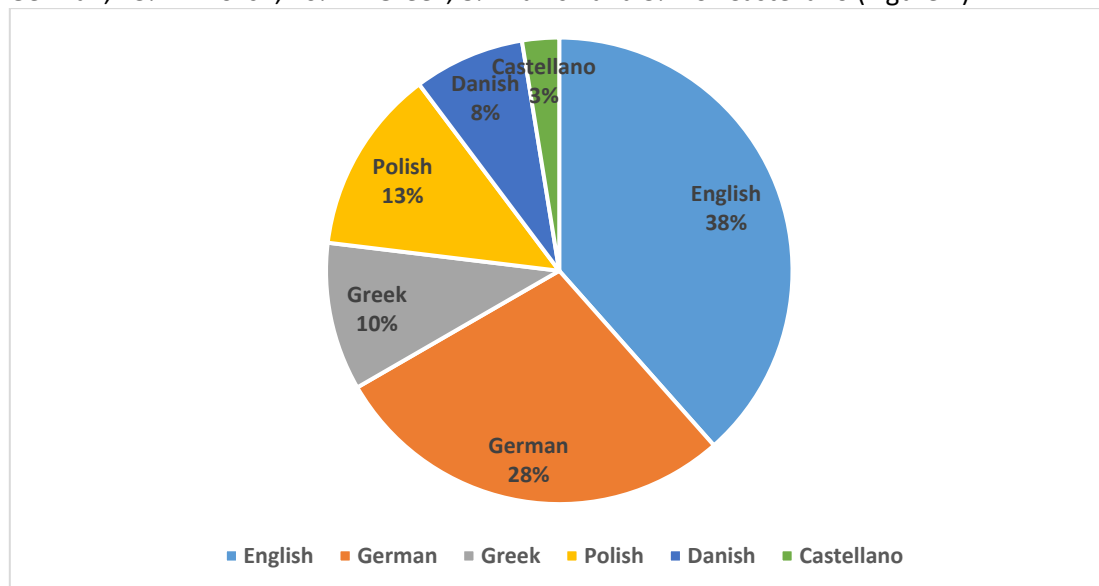


Figure 2. Percentages of different languages of training material

3. FEFTS Analysis

3.1 FEFTS specifications and applied sector

The vast majority of the training materials registered are relevant to multiple user groups, with only 2 training materials only for farmers. Overall, the most important user group for the collected training materials are farmers with 36 out of 37 training materials directly intended for them (Figure 3). This is followed by advisory services with 25, producer associations with 23, companies with 18, policy makers with 16, energy producers and industry both with 12, and contractors with 10 relevant training materials. Other users, such as teaching facilities and agronomists are also included in this analysis.

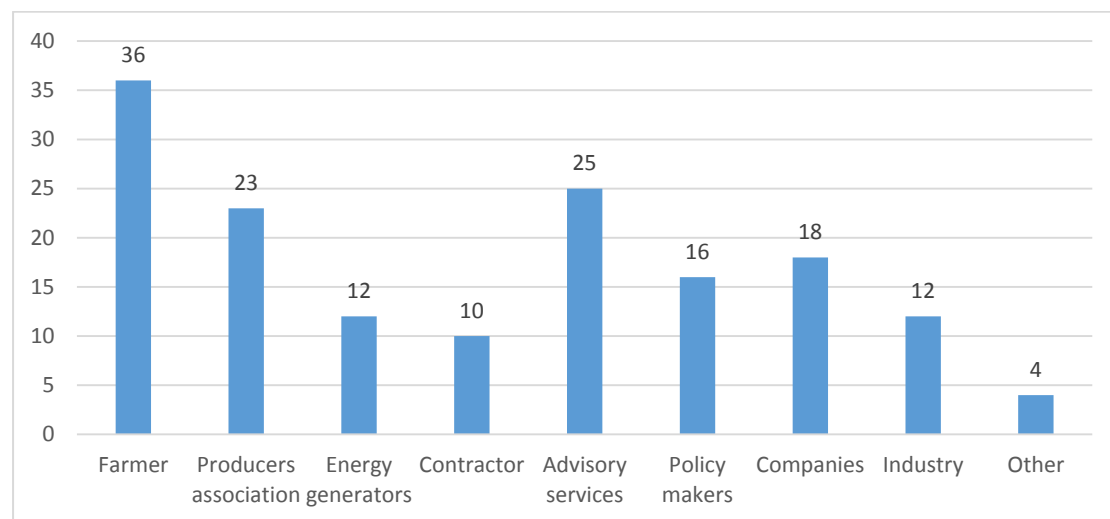


Figure 3. User groups for which the training materials are intended

Figures 1, 2, and 3 illustrate that the collected training material is mostly aimed at farmers, with the goal of improving and assisting farmers in reducing their reliance on fossil fuels primarily through the distribution of manuals and the provision of online courses. This is particularly important as it is crucial that reductions in fossil fuel dependence are adopted and driven by farmers themselves. The languages of these training materials are mostly in English and German, which are relevant to a large proportion of the EU's population. It is important to note that language should not be a hurdle in the adoption of FEFTS and that the use of online translators and other services can improve accessibility further. It is also significant that producer associations and advisory services are the second largest user groups for these training materials as they are important connectors between industrial FEFTS technologies and therefore deal with and combine information from a plethora of training resources.

Figure 4 demonstrates the registered FEFTS training materials' solution type. This figure illustrates that the largest number of FEFTS training materials referred to methodology (11), followed by procedure (10), software (6), complete solution (6) and hardware (4). 7 training materials were labelled as 'other' which refers to handbooks, guidelines, and advice.

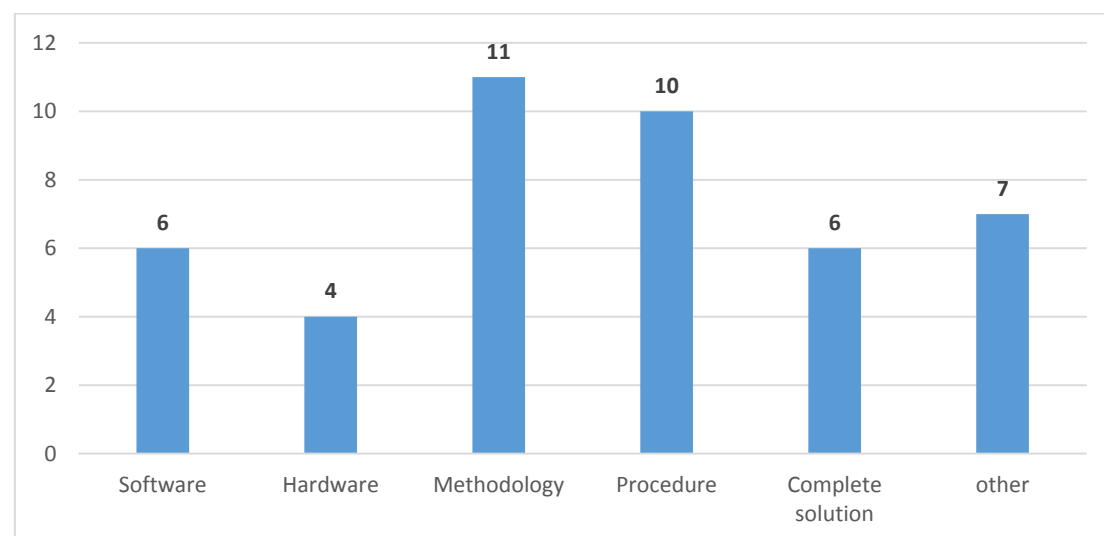


Figure 4. The type of collected FEFTS training material

Regarding the categorization of these training materials according to agricultural domains (open field agriculture, livestock and greenhouse). Our analysis indicates that 34 are relevant to open-field agriculture, 25 to livestock, and 20 to greenhouses. This finding is particularly relevant as open-field agriculture is the largest agricultural domain in the EU, followed by the livestock and greenhouse sectors. These training materials are often also applicable to multiple domains simultaneously with 19 out of 37 relevant to all three domains (Figure 5).

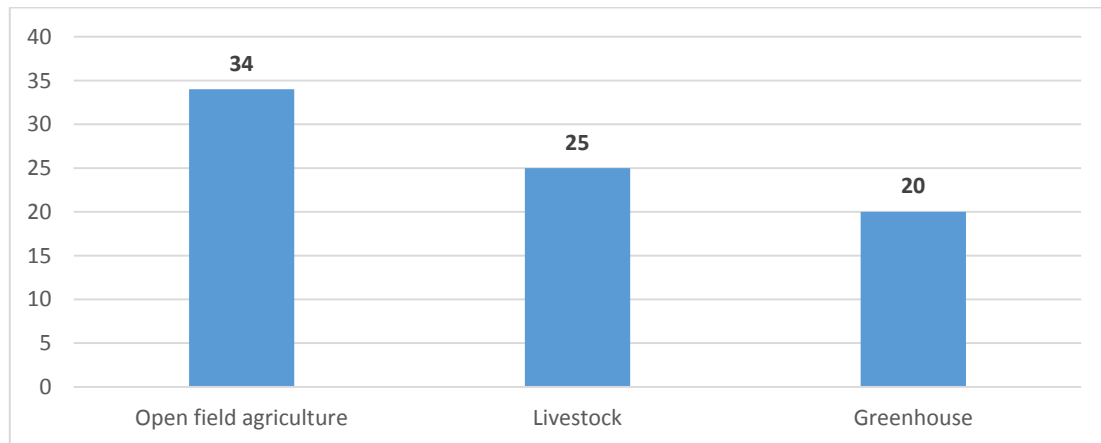


Figure 5. The agricultural domain of the collected FEFTS training materials

3.2 FEFTS application field

In Figure 6 the types of agricultural application of the collected training materials are presented. This figure shows that most of the training materials (23) have multiple technology applications, followed by agricultural field practices (9), energy sales to external consumers (2), heat sales to district heating (1), energy provision (1), and tools (1).

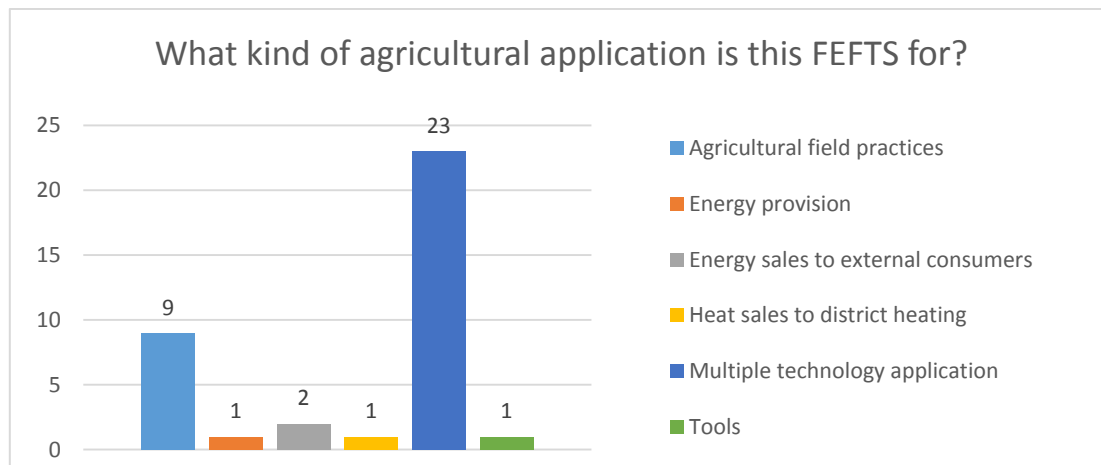


Figure 6. Types of agricultural application of collected FEFTS training materials

As already mentioned and illustrated in Figure 6, FEFTS training materials tend to belong (in terms of where they can be applied) to multiple sectors. It is important to note however, that during the first months of the FEFTS registration process, if the user chose 'multiple technology applications' then the survey would skip the categorization in 'relevant application fields.' This was found to be problematic, as it caused part of the commercial FEFTS (Task 2.4) not to be categorized adequately. To address this issue and provide the best possible categorization, the Google Forms survey was modified such that if multiple

technological applications were selected, the user would be requested to select the most applicable type for this FEFTS (clean energy supply or energy efficiency improvement or soil carbon sequestration). As a result of this modification entries that were categorized prior to this modification are not included in section 3.3. Once the AgEnergy Platform is complete, these items will be fully categorized and included in the following analysis in the updated version of this deliverable (D2.11 on M24, September 2022).

Figure 7 shows the distribution of the collected training material per FEFTS category: 12 for energy efficiency, 10 for clean energy production and 8 for soil carbon sequestration.

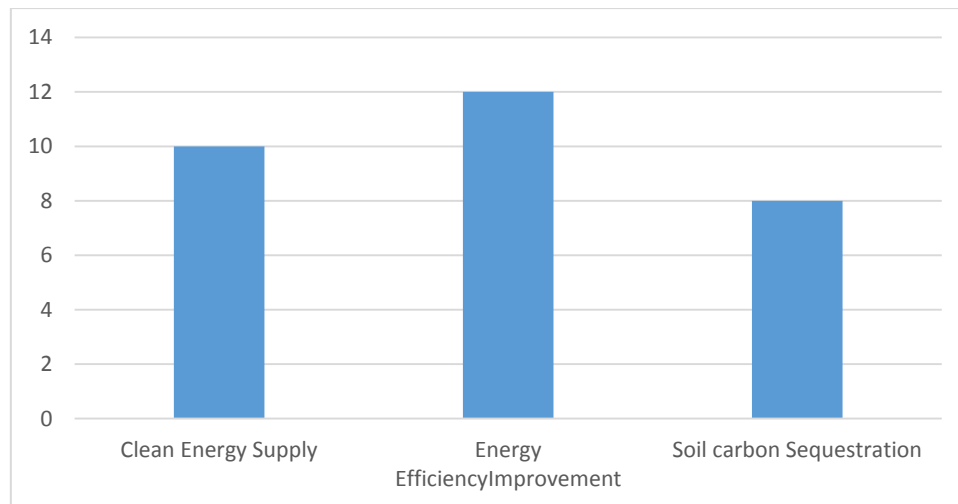


Figure 7. Type of the training material per FEFTS category

3.2.1 Clean Energy supply

All 10 clean energy supply training materials are registered as energy production systems. As energy production system is the predominant type of technology, it is important to analyze the renewable energy sources that they refer to. Figure 8 shows that most of the training materials refer to solar and biomass systems while 1 training material refers to sewage treatment plant and biogases, 1 to wind and 1 to other.

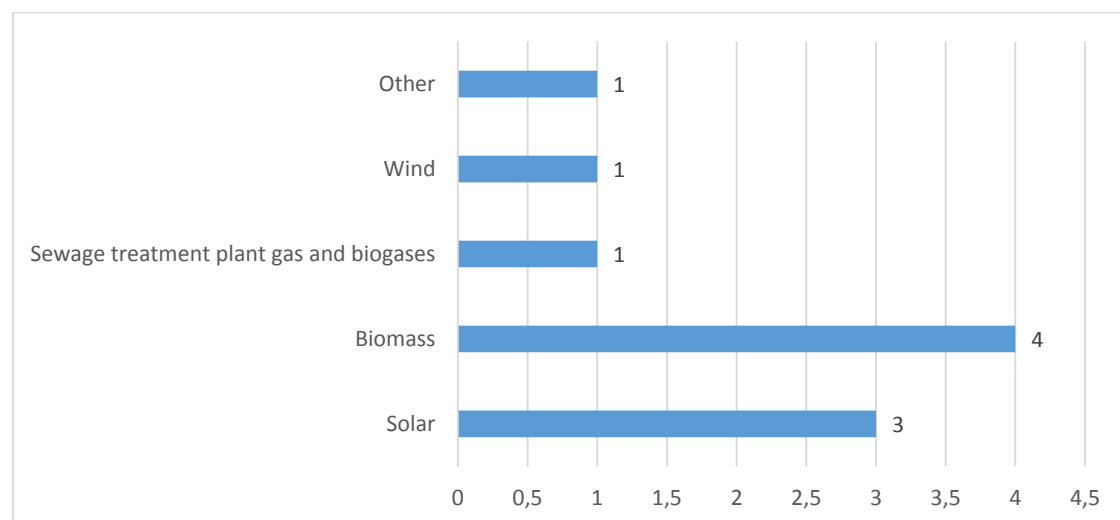


Figure 8. The renewable energy sources of Energy production system

Regarding the specific technologies (Figure 9) for energy production system, related to Figure 9, most of the training materials are relevant to biogas/biomethane production (4) and photovoltaic (3) systems. Training materials relevant to small wind turbines with the power range 1-50KW solid biomass conversion and other technology were also submitted.

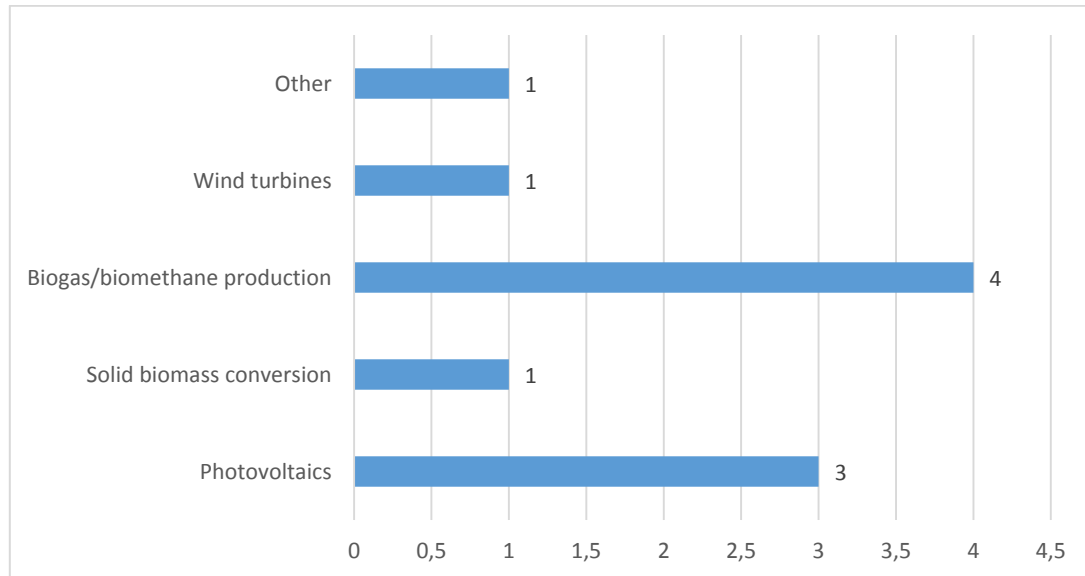


Figure 9. Specific technologies for Energy production systems

Among the 3 photovoltaic training materials registered, 2 of them refer to agri-PV systems and 1 to PV-arrays (Figure 10).

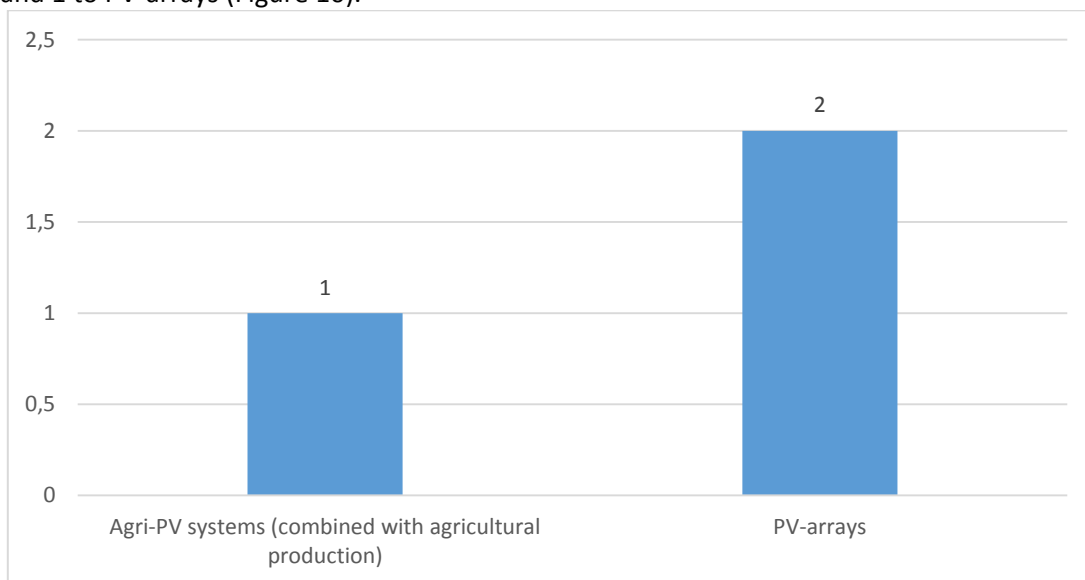


Figure 10. The submitted training material of the photovoltaic technology type

Regarding training materials related to biogas/biomethane production technologies, agricultural residues are registered the most; followed by energy crops; and wood chips, pellets and wood logs (Figure 11).

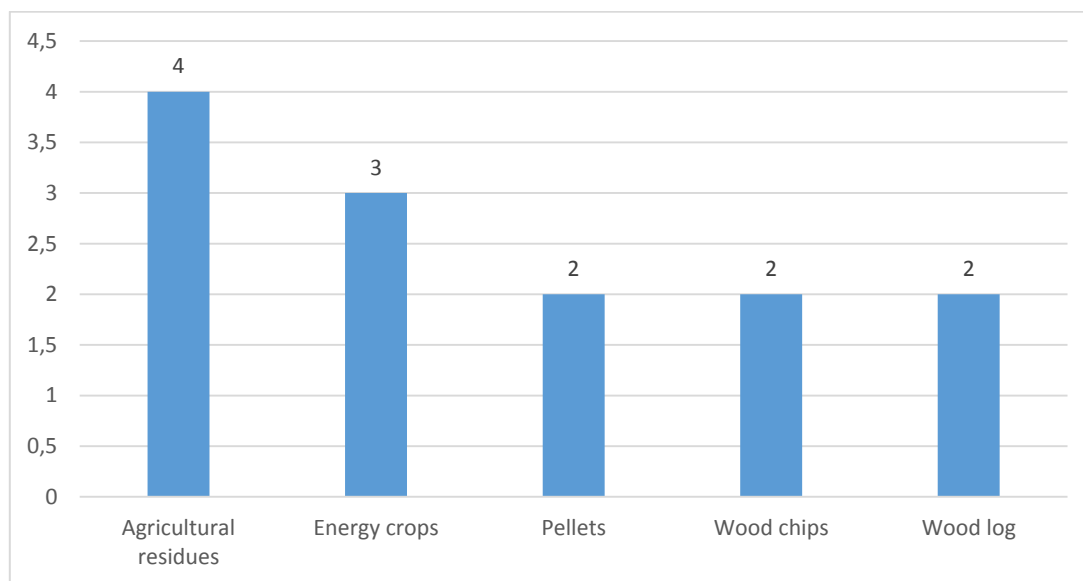


Figure 11. The submitted training materials of the biomass technology

3.2.2 Energy Efficiency Improvement

Figure 12 illustrates the type of energy improvement efficiency each training material refers to. This figure shows that most training materials refer to efficient tool, followed by efficient buildings, precision agriculture, precision livestock farming and conservation agriculture.

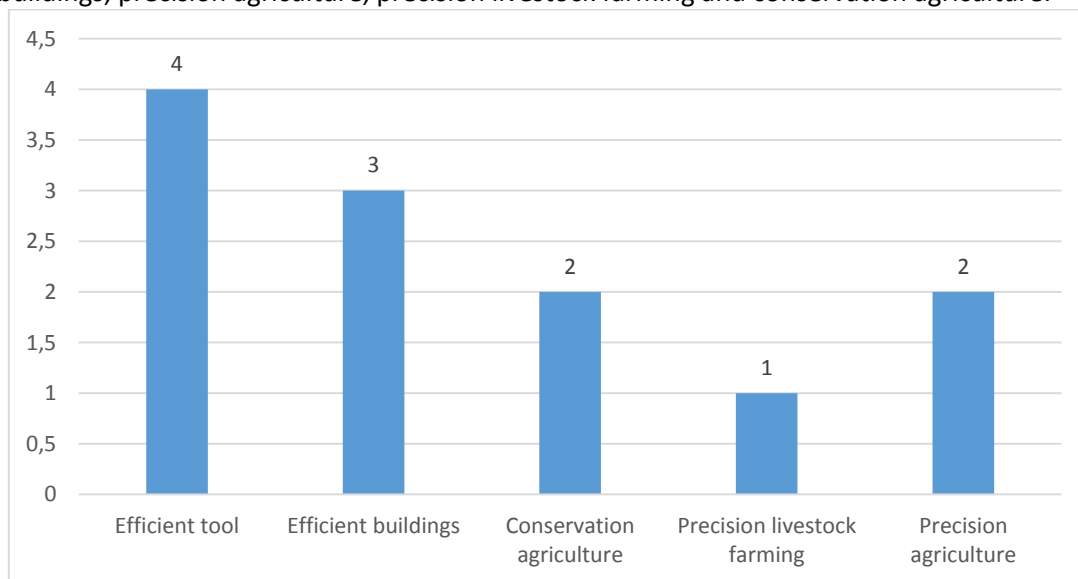


Figure 12. The submitted training materials of the energy improvement type

Regarding the efficient tools category amongst the results are 1 training material on milking machines and 2 providing e-learning platforms about multiple learning on energy efficiency and technologies. In addition, we have a training material about efficient insulation strategies for agricultural constructions. 2 training material are dedicated to pesticide reduction and plant production (precision agriculture), 2 material about soil organic matter (conservation agriculture) and 1 for precision livestock farming (medicine reduction).

3.2.3 Soil carbon sequestration

Regarding soil carbon sequestration, Figure 13 illustrates that most of the training materials refer to tillage (5, 63%), other technologies such as crop diversification, soil organic matter and soil and water conservation techniques each have one relevant training material.

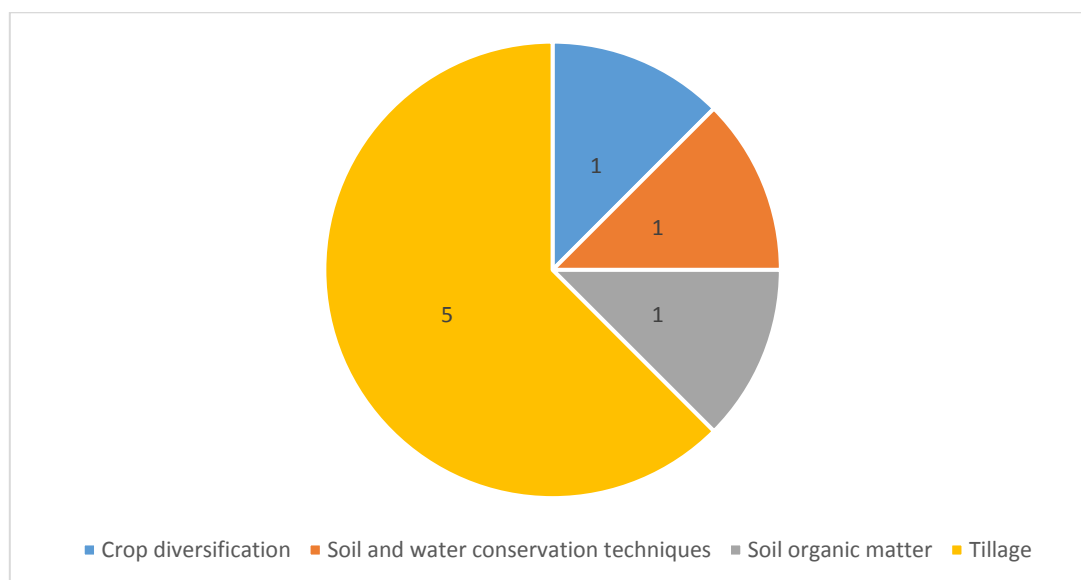


Figure 13. The materials collected based on carbon sequestration method

4. Conclusion and Reflection

In conclusion, this deliverable has shown how FEFTS are collected, screened, assessed and included in AFF's inventory on training materials inventories. This process and these training materials are important as they will serve to enhance stakeholder knowledge and incentives to minimize fossil fuel consumption.

The acquisition of FEFTS training materials was divided into three phases. The first step defined the FEFTS categories. During phase 2, the consortium conducted research with the aim of collecting and cataloging relevant training materials under FEFTS categories. This was followed by an initial screening of the uploaded FEFTS by the task leader. In phase 3 the registered training materials will be reviewed and incorrect, duplicate, and incomplete entries will be removed thereby ensuring data integrity and supporting effective analysis in AgroFossilFree's subsequent phases.

The consortium as a whole successfully registered 37 relevant training materials against a target of 36. The majority of the training resources are in English or German and are offered as manuals or online courses primarily for farmers, advisory services, and producer associations. The majority of the FEFTS training materials collected are Methodologies or Procedures with the most relevance for open-field agriculture, but also include a considerable focus on the livestock and greenhouse sectors.

The analysis found that the majority of training materials collected have multiple technical applications and that they have a relatively equal distribution between the three main FEFTS categories (improvements in energy efficiency, renewable energy production, and soil carbon sequestration). More specifically, regarding renewably energy production, all training materials referred to production systems with the largest categories being solar (photovoltaics) and biomass (biogas/biomethane production). Regarding improvements in energy efficiency, the training materials mostly refer to the category 'efficient tool' while

regarding soil carbon sequestration, the training materials are mainly focused on tillage systems.

Overall, the collection and incorporation of FEFTS training materials into AgroFossilFree was successfully completed within the expected timeframe. This achievement will contribute to the effective operation of the AgroFossilFree platform and support the overall transition away from fossil fuel dependence in EU agriculture.

Annex

Annex 1: Training Material retrieved from survey

Training materials retrieved from the Survey (from the extracted excel from Google Forms)

Title of Training Material
NEW TRENDS IN THE TECHNOLOGY OF CULTIVATION AND SOWING AND THEIR MULTIPLE-ASSESSMENT
Improvement of the environmental behaviour of latxo sheep farms, through energy efficiency, power generation and reduction of the environmental footprint
AGRIVOLTAICS: OPPORTUNITIES FOR AGRICULTURE AND THE ENERGY TRANSITION
Sustainable Heat Use of Biogas Plants - A Handbook
Energy efficiency in agriculture
Fundamentals of Solar Photovoltaic Systems
Project Tilos
Handbook on Small Modular Renewable District Heating and Cooling Grids
Agrivoltovoltaics: Opportunities for agriculture and the energy transition - A guideline for Germany
Further education in agriculture
Free online course bioenergy
COMPILE Toolkit: Stakeholder Engagement Guide
We the Power - a movie about the citizen-led community energy movement in Europe
The LICHT approach
The RegAgri4Europe Course
Conservation Agriculture leaflet
Conservation Agriculture: Making Climate Change Mitigation and Adaptation Real in Europe
FAO's database on Conservation Agriculture Technology
Grain cylinder
variety advice NRW
Minimisation of agricultural inputs of veterinary medicinal products into the environment
Renewable Energies in Agriculture
Biogas Knowledge
monitoring and signalling system for diseases and pests in plant crops
Bioenergy Online Course
AgriCT- Training for Precision Agriculture
National Agricultural Energy Optimisation Tool
SEAI Energy Academy
Teagasc Research Insights Webinar - Increasing energy use efficiency on Irish farms
Development of Innovative Technologies for Renewable Energy Sources in Rural Areas
OPPORTUNITIES FOR DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN RURAL AREAS IN THE LIGHT OF REVISED LEGAL PROVISIONS
Agricultural biogas plants - benefits for municipalities
Energy in Agriculture

Enhancing agronomists' renewable energy knowledge through alternative competence development models
SEAI Energy Academy
Healthy soil- From ploughing free to conservation agriculture
Conservation Agriculture in practice

The following link is the online spreadsheet which contains all the training materials retrieved from the survey until the 24th of September.

https://docs.google.com/spreadsheets/d/12QdJ9odzbcXzNKPxoZWLo4Bz_Hln3P_cbyqyzg9TYUw/edit#gid=577148393

Annex 2: Training Material Survey

The following link is the online survey that was used to submit all the categories of identified FEFTS.

[FEFTS Queries CERTH - Google Sheets](#)