



RESFARM ONLINE DATABASE SYSTEM DESIGN



RESFARM Deliverable D.3.2

BIOMASS RESEARCH REPORT 1602



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BIOMASS RESEARCH REPORT

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PREFACE

The RESFARM project, funded under the Horizon2020 research framework (Proposal number: SEP-210165646, Grant No.) aims at developing an investment tool for renewable energy hardware that can be used by European farmers and investors. To define the most suitable investment tool for farmers in Spain, Italy and Greece, a large number of farmers (phase 1: 2,000) will be interviewed using a survey which presents a range of questions on farm size, farmers' attitude and economic key figures. All data entered need to be stored and be made available for further analyses and implementation.

Biomass Research has been asked to develop a database structure plus data entry system under Work Package 3 (Data collection and analysis) which can be used by other project partners. The main aim of the database is to collect farm data in the three countries covered by the project, facilitating a uniform and efficient analysis (to be done at Universidade da Coruña). A mobile data entry module was developed to allow quick and efficient entry of answers that were given by the farmers in the specific countries and regions.

The database and data entry module have been fit on the farm survey developed in the project. In the design process, the following trends and basic principles have been implemented:

- Cloud based collaboration (online collaboration and project management)
- Managing data through a central database
- Optimization of system to make use of Big Data

It is important to pay attention to security and privacy of the submitted data and user friendliness of the system. This report explains how these issues have been dealt with and how data management for RESFARM has been organized.

I would like to express my appreciation to project partners that have played a role in the development of the survey and provided useful feedback on the database structure and data entry system.

Wageningen,

Hans Langeveld

Director Biomass Research

SUMMARY

The starting point for the data management system is the farmers' survey as designed by the "Universidade da Coruña" (UDC). The structure of this survey defined the technical characteristics of the web based application. This report explains how the different type of questions are translated into a web based form. Special attention is given to the security of the system of data storage and privacy of the submitted data.

This report describes the complete process of data submission, data storage, securing data, data export and data analyses. This report will be updated when the system is updated.

Table of contents

PREFACE.....	2
SUMMARY	4
ABBREVIATIONS.....	7
1. INTRODUCTION	8
2. DATABASE SYSTEM DESIGN	13
2.1 Survey.....	13
2.2 Database structure.....	14
2.3 Technical environment.....	16
3. DATA SUBMISSION	17
3.1 Technical environment.....	17
3.2 Submission forms.....	17
3.3 Data submission.....	19
3.4 Data review and editing.....	19
4. DATA MANAGEMENT	20
4.1 Viewing and Filtering of data.....	20
4.2 Data export.....	21
4.3 Analysis.....	23
5. DATA SECURITY AND BACKUPS	28
5.1 Updating of the system.....	28
5.2 Securing the system	28
5.3 System back ups.....	29
5.4 Privacy.....	29
5.5 Further actions to provide in security and privacy.....	29
5. DISCUSSION AND CONCLUSION	31
REFERENCES.....	32
ANNEX I FARMERS SURVEY.....	33

ABBREVIATIONS

CSV	Comma-Separated Values format
RAM	Random-Access Memory
RE	Renewable Energy
RES	Renewable Energy Systems
SSD	Solid State Drive
UDC	Universidade da Coruña
XLS	Excel Binary File Format

1. INTRODUCTION

Rural economies in Southern Europe are suffering as the prices received for agrarian products are falling, their production costs are rising and the politics that support their income are fading. Agricultural income per worker fell by 17% between 2007 and 2009¹. The same report indicates that on the other hand, input prices, largely driven by energy prices, have either been stable or have tended to increase (by 15 % between 2000 and 2008). There is a need, consequently, to diversify the farm income in order to maintain the existence of rural communities and livelihoods in rural areas of the European Union.

The European Union is committed to significantly reducing greenhouse gas (GHG) emissions while at the same time ensuring security of supply and competitiveness. A focus on the development of low-carbon energy technologies is crucial and should focus on low-carbon heat, power, and fuel as well as biobased products (ERKC, 2014).

Energy demand and prices are rising at a global level, eroding the competitiveness and quality standards of a Europe with a vastly deficient position in energy production. To tackle this deficit and the environmental consequences of relying on fossil-based energy, the EU has implemented a series of initiatives set out in the Agenda 2020. The initiatives being carried out have significantly increased the number of renewable energy systems (RES) through the financial and legal support of new facilities like wind farms and photovoltaic plants.

While farmers play only a limited role in renewable energy policies that have been formulated for the EU so far (Beurskens and Hekkenberg, 2011), there is considerable scope for on-farm renewable energy production including solar, wind and bioenergy. An overview of national RE action plans submitted to the European Union suggested the production potential in 2020 to be at least at 63 Mtoe, up from 12 Mtoe in 2008. Most of this is electricity generated with wind or solar energy installations, plus agricultural waste (Langeveld et al., 2014).

Large differences exist in the way in which RES are developed. Developments in the USA and China have been mostly large scale but development of wind, solar and bioenergy in northern Europe began with decentralized investments. In countries like Denmark and Germany, with thousands of installations developed on farms (Flavin et al., 2014). A survey including 800 farmers in Spain, Poland, Germany and Austria suggested nearly half of the farmers had invested in some kind of renewable energy. Total investments amounted to 125 million Euro, representing an average amount of 350,000 Euro invested by farmer (Langeveld et al., 2014).

¹ Directorate-General for Agriculture and Rural Development “Developments in the income situation of the EU agriculture sector”

These figures did not include investments done by external parties on farms. External financial sources will be needed as the level of investments needed for decarbonising the energy system will a huge increase of existing investment levels. The amount of capital required to fund low carbon infrastructure in the EU, China, USA, India, Canada and Australia up to 2020 has been estimated at 2.2 trillion Euro (Kaminker and Stewart, 2012). The role of sources such as external private and institutional investors will be essential.

While an important amount of RE investment has been attracted from the private sector, a number of barriers prevented such investments by many farmers and rural communities in the EU, despite the high potential for renewable energy (RE) production on their sites. Main barriers include (Back and Martinot, 2004; Langeveld et al., 2010; Kaminker and Stewart, 2012; Langeveld et al., 2014) economic issues such as subsidies for competing (fossil) fuels, high initial capital costs, high transaction costs, as well as legal issues such as restrictions for siting and construction of installations, lack of legal frameworks for independent energy producers, utility interconnection and liability insurance. Policy issues – lack of long-term political commitment, fragmentation among government level, regulatory instability – and market issues – related to access to credit, perceived technology risks and lack of information – may play a role as well.

In the targeted countries, agrarian land represents 55% of the Spanish territory, 47% of Italian territory and 63% of Greek territory, with plenty of RE resource (e.g. more than 2,000 yearly equivalent peak solar hours in most regions, representing from 1,300 kWh in the north up to more than 2,000 kWh per m² in the south; SolarGis, 2011). The farmers associations (FAs) that lead this proposal have analysed the barriers that are limiting our members to take advantage of this potential source of income. The main conclusion achieved is that most of the problems that farmers are facing are related to financing RES investments. From the farmers' point of view, renewable energy projects are still characterized by high up-front capital costs and a complex and fast changing regulatory framework. As consequence, cash squeezed farmers are reluctant to invest in these "high risk – low return options", or only under very favourable subsidies.

The ultimate objective of the RESFARM project is to help develop tools that can improve this situation. This is done by fostering RE production in the agrarian sector by scaling up investments in on-farm RES. As a major step in that direction, RESFARM will initiate a process to support the transition of on-farm RES from direct project-level promotion and finance to become an object for capital market investments. Main activities in the project include:

- Create a consortium of agrarian and financial sector actors, experts and other key stakeholders to collect analyse and share all the information and expertise needed to develop an investment instrument with the capacity of channelling capital market resources into investment projects in on-farm RES.
- Facilitate the launch of a flagship investment instrument. Institutional investors, to whom the development of this instrument is addressed, are very reluctant to allocate funds in projects that have not already proven their feasibility.



- Create a national sustainable energy financing platform in Spain orientated to on-farm RES to organise dialogue between the agrarian and financial sectors, public authorities and RES experts.

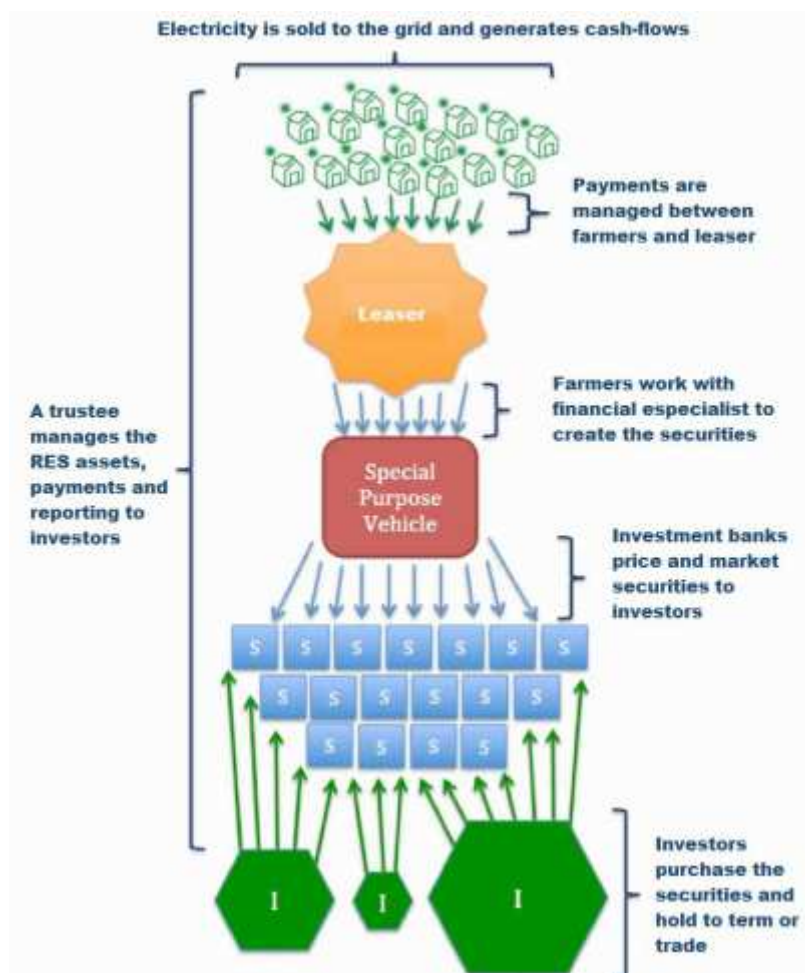


Figure 1.1 Generalized renewable energy securitization transaction

Biomass Research will be involved in several elements of the project, including:

- Inventory of data that have to be stored
- Information required to serve the farmers
- Information flow analysis
- Development of a knowledge base for development of advanced farmer advice

It is proposed to use online systems for data submission and storage in the RESFARM project. Recent technological advances paved the way for developing and offering advanced services for stakeholder interaction in the agricultural sector as well as elsewhere. A shift is developing away from proprietary and monolithic tools to internet-based, cloud hosted, open systems that will enable more effective stakeholder interaction (Kaloxylos et al.,

2013). For this reason, it was decided to develop a cloud-based application for data-submission and data-storage.

Special attention should however be given to security and privacy of the data submitted, especially regarding content protection, account protection, device protection, application protection and transparency (Box, 2014) to ensure the security and success of cloud computing (Cloud Standards Customer Council, 2015).

This report explains how the data management system for RESFARM has been organized. It is organized as follows: Chapter 2 presents an overview of the database design. Data submission procedures are described in Chapter 3. A description of data management procedures is listed in Chapter 4. Data security and backups are presented in Chapter 5. This is followed by a discussion and conclusion section (Chapter 6).

2. DATABASE SYSTEM DESIGN

2.1 Survey

A survey addressed to farmers has been designed in order to obtain quantitative and qualitative information about key aspects that will define the appropriate investment instrument regarding the use of Renewable Energy Sources (RES). The questionnaire for which this data management system is developed, will target farmers in Spain, Italy and Greece and will focus on level performance data, incentives, and attitudes in order to link capital market investors and farmers in exploiting RES.

A general questionnaire for farmers in Spain, Italy and Greece has been developed by UDC. It consists of four sections: description of the farm and the farmer (1), willingness to invest, innovate and communication channels (2), attitude towards securitizable contracts (3) and interest and preferences regarding alternative financing schemes for on-farm RES (4). A total of 41 questions are included; some of which have multiple sub-questions. Part 1 consists of eight chapters; part 2, 3 and 4 consists of only one chapter.

Including sub-questions, the survey consists of 91 questions. Three types of questions are included:

- Multiple choice questions
- Ratings
- Open questions (text and numbers)

An example of the questionnaire is presented in Annex 1. Table 2.1 presents an overview of question types in the different sections.

Table 2.1 Questions in the farmers' survey¹.

	Section 1 (incl sub ques- tions)	Section 2 (incl sub ques- tions)	Section 3 (total sub ques- tions)	Section 4 (total sub ques- tions)	Total (total sub ques- tions)
Open ques- tions	4 (17)	0	0	0	4 (17)
Multiple choice	11 (26)	2 (9)	6 (6)	1 (4)	20 (45)
Ratings	0	9 (9)	5 (13)	3 (7)	17 (30)
Total	15 (43)	11 (18)	11 (19)	4 (11)	41 (92)

¹X (xx): total questions (total including sub questions) i.e.: 11 (26) means 11 questions but 26 questions including sub questions

2.2 Database structure

A MySQL database system has been used. The database consists of multiple tables. There are four separated databases with four different database users. One for Resfarm Spain, one for Resfarm Italy, one for Resfarm Greece and one for the English test and demo application. All four have exactly the same structure. The databases differentiate between tables used for the system and tables used for data storage. The system itself uses 108 database tables. Total database consists of 109 tables, of which only one to store actual data. The remainder of the tables serve in system administration (user management, security, backup system, etc.). The separation of the table for storing the data gathered by the survey makes it possible to do a separate export of data and an import of these data in other systems or software.



Figure 2.1: Example overview of database tables

One table (the table 'farmers'_survey') stores all data that have been submitted. Each submitted questionnaire here is presented as a separate row with a unique ID. Questions are depicted as columns. The questionnaire consists of 92 questions which means that every row of the table "farmers'_survey" has 92 columns plus some extra columns for the date of submission, the unique ID and for storing the titles of the chapters, which makes a total of 115 columns.

This structure allows efficient storage of survey results. For example, in theory, a million questionnaires would require only about 400 Mb of database capacity.

Administration and management of the MySQL database can be done in php-myadmin.

2.3 *Technical environment*

Data are stored on an independent server based in Amsterdam, the Netherlands². We have reserved 100 Gb of disc capacity making use of SSD technology to ensure sufficient speed of data submission, analysis and export. Used RAM is 1 Gb. If needed, more RAM and disc capacity can be acquired but the system should be sufficient for the scope of this project and for a few hundred or thousand submissions a day.

² IP adress 185.10.231.177

3. DATA SUBMISSION

3.1 *Technical environment*

The application for data submission is written in PHP; the forms are presented as html forms to make them for use in internet browsers. The application for submitting the data is web-based, in order to allow users to communicate with the database without knowledge of PHP. The web-based system is a form that can be assessed from every location via the internet. All browser-types are supported; however, full functionality has only been tested for the following browsers: Chrome, Firefox and Edge providing about 90% of all browsers worldwide.

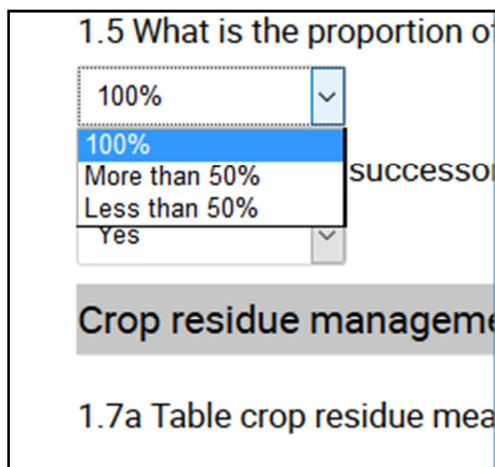
3.2 *Submission forms*

The online, web based questionnaires, consist of five different field types. Every question is one field which should be filled in. Types of fields are:

1. Dropdown with select option (18)
2. Text fields (22)
3. Radio buttons to choose for yes or no (8)
4. Check buttons to choose for options (14)
5. Rating fields (30)

This makes a total of 92 fields corresponding with 92 questions as described (*).

Examples of field types are presented in Figures 3-1, 3-2, 3-3, 3-4 and 3-5.



1.5 What is the proportion of

100% ▼

100%
More than 50%
Less than 50%
Yes ▼

successor

Crop residue management

1.7a Table crop residue mea

Figure 3-1: Example of a dropdown field



1.3 Table farm size

1. Area of arable land: Land used to grow crops (ha)

Figure 3-2: Example of a text field

1.11. Did you receive any Rural Development Payment?

☐ Yes ☐ No

Figure 3-3: Example of a radiobuttons field

Information about the farm

1.4 What is the legal status of

☒ Individual/family farm (A farm that is owned by inheritance)

☐ Limited company (A company where the owner is responsible for what they have invested or guaranteed)

☐ Cooperative farm/ group holding (A farm where the owner is responsible for purchasing and using of machinery, staff, etc. through its own institutions - farmers' cooperative)

Figure 3-4: Example of a check buttons field

2.1. Answer the following questions on a scale of 1 to 5 (1 It will decrease a lot, 2 It will decrease, 3 It will be stable, 4 It will increase, 5 It will increase a lot)

How do you intend to modify your farming activities?

★★★★☆

Rate your agreement with the following sentences on a scale of 1 to 5 (1 I agree a lot, 2 I agree, 3 I am neutral, 4 I disagree, 5 I disagree a lot)

Figure 3-5: Example of a rating fields

3.3 Data submission

A system has been developed for online use with an internet connection. Live data entry is the only option at the moment and a live online internet connection is needed while submitting. The system allows importing of data using CSV or XLS formats so in theory it is possible to submit data in an excel spreadsheet using a computer with no internet connection, after which the data can be entered in the system using the import option while activating the internet connection. Testing shows that this is not a reliable option and this option had not been further developed.

A central computer has been used for data storage as this can avoid potential problems with data synchronisation. Data submission is multiple-user functionality. Data submission requires registration with the website, after which a unique user's account is allocated to each user. Admission of new users requires approval of project staff. Final agreement has to be given by UDC. Submission of data is done from different locations and it is not a problem when data is submitted simultaneously from different locations at the same time. It is not possible for data to interfere during the submission process because every participant and submitter can only submit data using the unique account ID which means: through a user specific portal.

3.4 Data review and editing

All users have the capacity to review data after these have been submitted. If needed, errors can be corrected. But users are only permitted to edit data they submitted themselves through their unique account ID and they have technically no option to edit data which was submitted by other users.

The viewing of the data is country specific as users from Spain will have only access to the system which has been setup for Resfarm Spain. The same is true for Italy and Greece. Only the appointed project coordinators will have access to the three systems and through this to the data entered in these systems.

4. DATA MANAGEMENT

4.1 *Viewing and Filtering of data*

The submitted data is shown to all authorized users through the same webbased application as through which the data is entered via a separate menu-tab "Results Farmers Survey". The data is presented as a list and inbuilt are some filtering options. More filtering options can be implemented if requested. Figure 4-1 shows an example filter filtering on ratings for the question "The farmer is a good candidate for RESFARM". For all 92 questions a filter on results can be applied. Figure 4-2 shows a second type of filtering which can be described as "sorting". The submitted data is sorted and grouped based on one of the 92 questions.



Figure 4-1: Filtering options

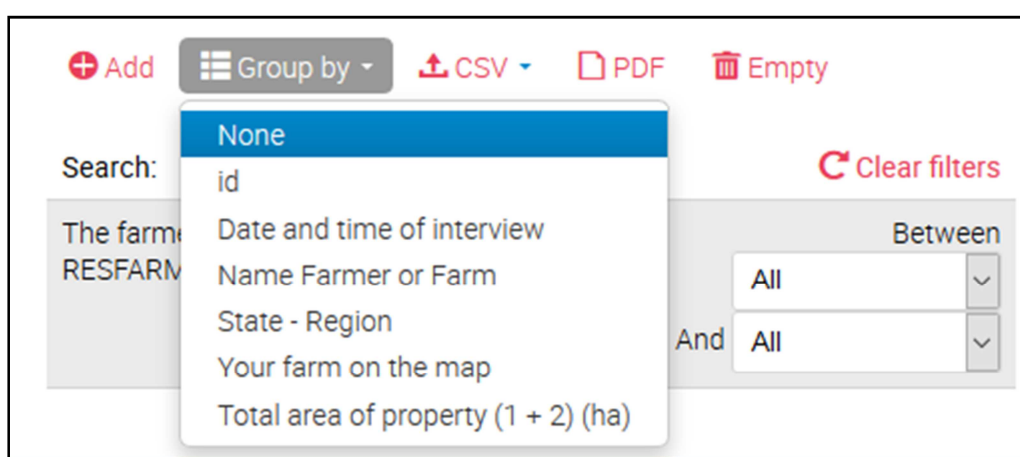


Figure 4-2: Filtering by group

An example of an extra filtering and sorting option is shown in the Figure 4-3. The list as published within the web based application does not show all elements or fields. Just a few are shown because there is no space to show all fields of all interviews all together. The other fields are shown after clicking on the magnifier next to a specific row which represents a specific interview. Every column represents a questions and the given answers. The project manager decides which column (which answers) are shown on the frontend of the web based application. The title of every column (the question) can be made clickable and through this a sorting option implemented. Figure 4-3 shows the sorting of the answers given in column "The Farmer is a good candidate for Resfarm". The sorting is applied after clicking on the column title and after implementing the filtering option.

Search:
↻ Clear filters

The farmer is a good candidate for RESFARM
Between

3

▼

And

5

▼

Go

id	Name Farmer or Farm	State - Region	Your farm on the map	⬆ The farmer is a good candidate for RESFARM
10	Mysql in Excel		40.463667 -3.7492200000000366	★★★★☆
19	Geldo Geri	Gelderland	51.96227442888501 5.649473932788055	★★★★☆
24	Giulio Goedi	Italy	44.48743289999999 11.822144999999978	★★★★☆
12	Foluke		51.96006999999999 5.754319300000002	★★★★☆
17	Ediso Frambisio		40.463667 -3.7492200000000366	★★★★☆
20	Myor Sql		40.463667 -3.7492200000000366	★★★★☆
22	Folke Bolke		51.96006999999999 5.754319300000002	★★★★☆
4	Hans Langeveld		40.463667 -3.7492200000000366	★★★★★

Display #

20 ▼

Figure 4-3: Sorting and filtering

4.2 Data export

Once submitted, data can be exported using the same web based application as used for data submission. Data export can be preceded by filtering but this is not mandatory. As indicated by the export button “CSV”, the exported data is formatted in a CSV document. This CSV is formatted for direct use in Excel for further analysing of data. Figure 4-4 shows the “Export to CSV” option together with the filtering option while Figure 4-5 shows the download button which is generated right after clicking on the “Export to CSV” option.

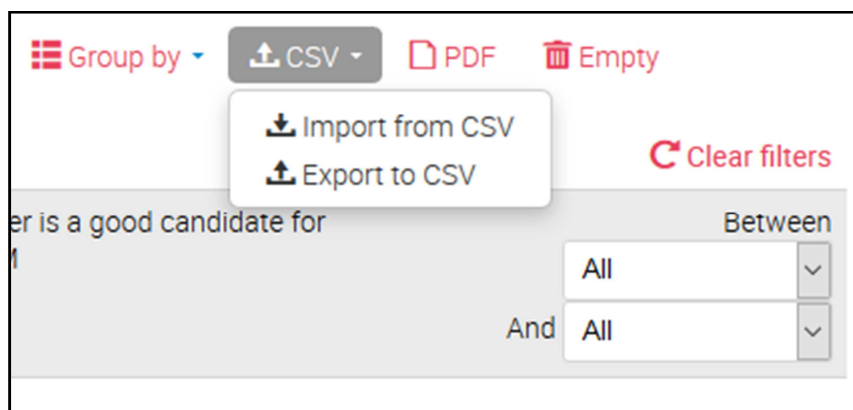


Figure 4-4: Data export options

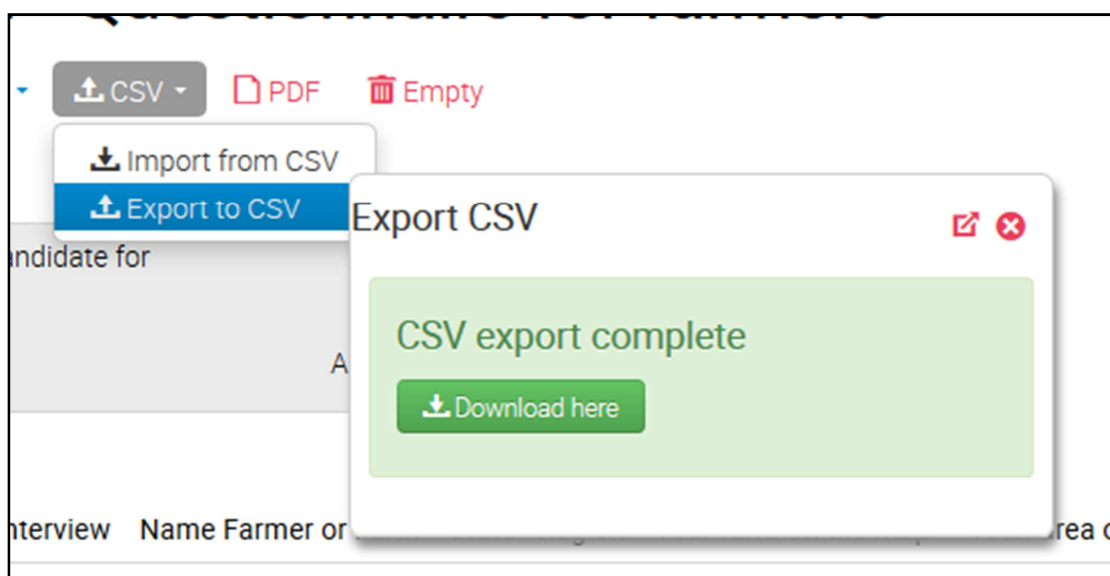


Figure 4-5: Data export download option

User rights determine who has the authority to export data. For each country, one coordinator has been appointed. For the project only one or two persons will be appointed with access to all three data systems (Spanish, Italian and Greek) and with access to the export options of the systems.

4.3 Analysis

Analysis can be done external after export of the data using commonly applied statistical packages such as SPSS, etc. However, an additional analytical element can be added to existing database management functionalities within the webbased application. The sorting and filtering options are the first analytical tools available.

Another useful option is the mapping of results. Example: using the filter on “The farmer is a good candidate for Resfarm”, the outcomes for a filtered value can be shown on a map. Figure 4-6 shows location of all the farmers within a certain region while Figure 4-7 shows the same region and farmers after applying a filter which results in less markers. Figure 4-8 show how multiple results (farmers locations) can be bundled. Using the zoom option the bundled and grouped results will get “ungrouped” to show the farmers as individuals (and not as a group).

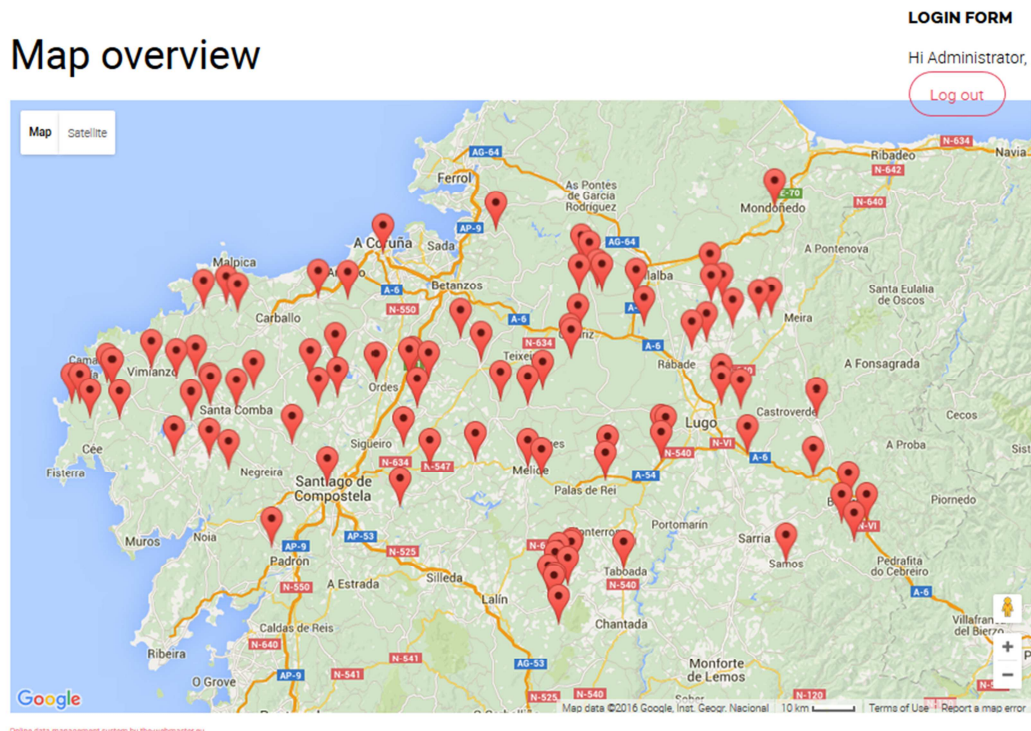


Figure 4-6: Results on a map (Spain – region Santiago de Compostela)



RESFARM - Cuestionario para agricultores/ganaderos

Clear filters

Log out

El agricultor/ganadero es un buen candidato para RESFARM

Between 5

And 5

Go

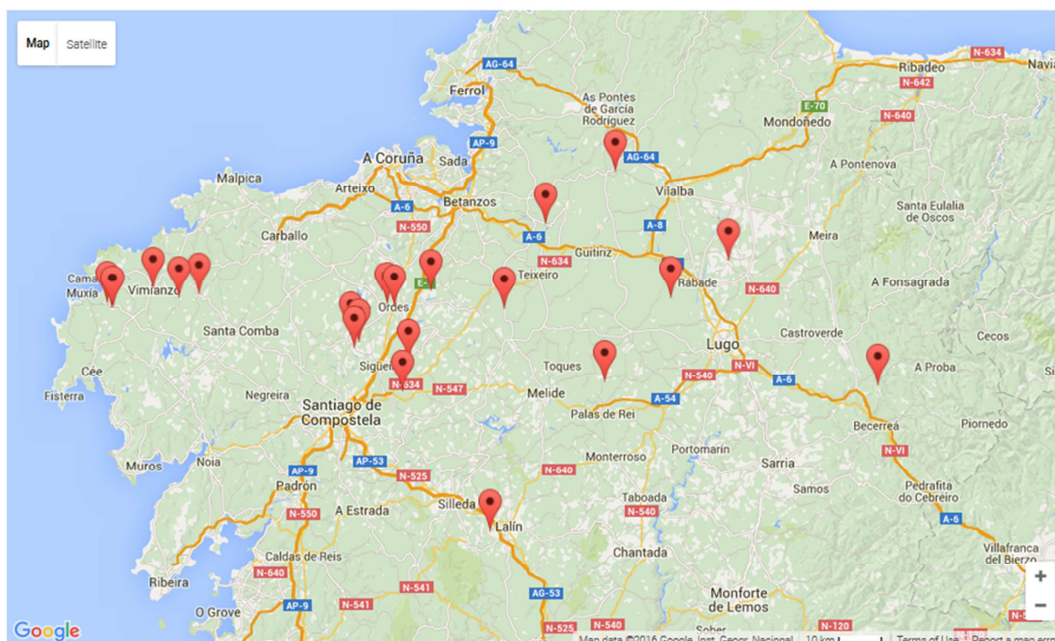


Figure 4-7: Results on a map after applying filter

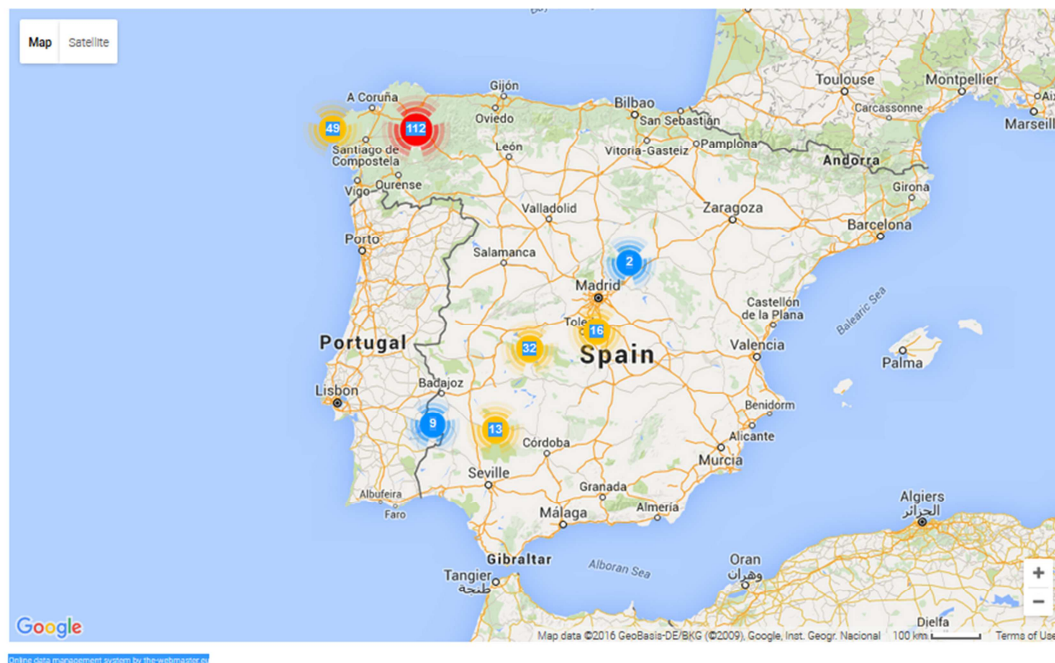


Figure 4-8: Clustering of information and showing of clusters in a map

Options for online and dynamic analysing include also all sorts of graphics and charts. For example: using the same data as used for the map view (ratings for “The farmer is a good candidate for Resfarm”), these outcomes can be shown in a Pie Chart. See Figure 4-9.

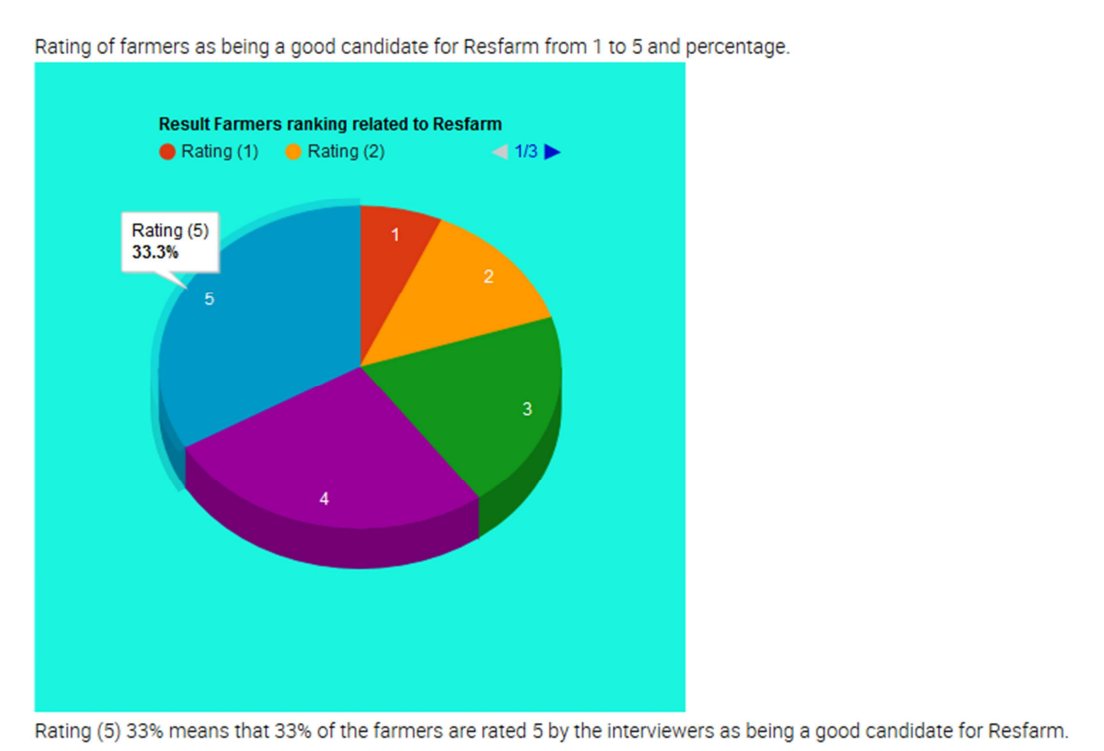


Figure 4-9: Analysis in Pie Chart

All data entered in the web based application can be analysed dynamically (in real time) and the analysis can be set up for automated processing and rendering of different kinds of graphics and charts including the graphics and charts as shown in Figure 4-10.

Filtering, sorting, clustering, maps, graphs and charts can also be used to compare outcomes. The outcomes of the survey in Spain can be compared to the outcomes of the survey in Italy or Greece and be made visible (dynamically, in real time) through these graphs, charts and maps.



Figure 4-10: Examples of dynamic generated charts based on submitted data.

These are dynamic functionalities with the option to show in real time the results based on a predefined analysis. These dynamic charts can be used for benchmarking, comparison, and all other analysis as requested. Other options include: the import of the data (through CSV import) from a partner country and present these outcomes together with the outcomes of another country.

5. DATA SECURITY AND BACKUPS

5.1 *Updating of the system*

Software is used for generating forms allowing (1) data submission into the database, (2) reading the database, (3) data export, (4) user management and for (5) data system management. The software should be updated on a regular base (preferably several times per month). Updates are provided whenever a possible security risk is found. Testing is done on a daily basis and updating on a weekly basis.

5.2 *Securing the system*

Securing the system consists of the following elements:

- Firewall
- Automatic IP banning when suspicious actions are registered such as filling in wrong login credentials multiple times.
- IP block based on Geodata which will block all users from other continents as Europe and blocking of users from Russia, Poland and Ukraine as most registered hackers and spammers are active from these countries.
- Blacklisting and whitelisting of IP's.
- Protection against file including and file injections.

Security checks are implemented each month, according to the following the following checklist:

- Software updates available
- Firewall updates available
- Passwords test
- Username check (certain usernames as "admin" should not be used)
- Integrity check of configuration file
- Checking session life time
- Files left in temporary folder
- Htaccess check (entrance file or first file accessed entering the webbased application)
- Session handler
- Server configuration
- Complete scan of the integrity of CMS (Content Management System) files
- Folder permission check
- Files permission check
- Complete scan of files for common malware

- Review of Firewall system log
- Review of blacklist and whitelist (IP based)

5.3 System backup

For all four systems (the Spanish, Greek, Italian and English test system) a backup is generated on a daily basis. This is done through a Cron job which means this is an automated system. For all systems there is a daily backup of the complete system (files and database) as well as a separate backup of the database. The backups of the complete system are about 80MB and are stored on the server in Amsterdam and can be easily restored if needed. For all backups, 30 versions of backup packages are kept which is about 2.4 Gb of storage for every system and 10Gb of data for all four systems.

5.4 Privacy

Data privacy is guaranteed using the following techniques:

- Data encryption. A SSL certificate is installed (SHA256 encryption) in the web based application which secures encryption of all data submitted through this application including passwords but also all other common information which is submitted through the forms.
- A user account management system is applied; this means only users that have been registered and approved can use the application and view data.
- The user account management system is setup in such a way that users can only edit data which they submitted themselves.

5.5 Further actions to provide in security and privacy

During the Resfarm meeting in Rome, the techniques as described in 5.2, 5.3, 5.4 and 5.5 has been presented and discussed. Attention is given to the fact that privacy can only be secured in making agreements regarding privacy and cannot be guaranteed only by the techniques of the system. Data as entered is protected as long as available in the system but can be exported and through this be send to and used by others in systems for which we cannot guarantee security and privacy.

The infographic used during the presentation in Rome:



SECURING YOUR DATA

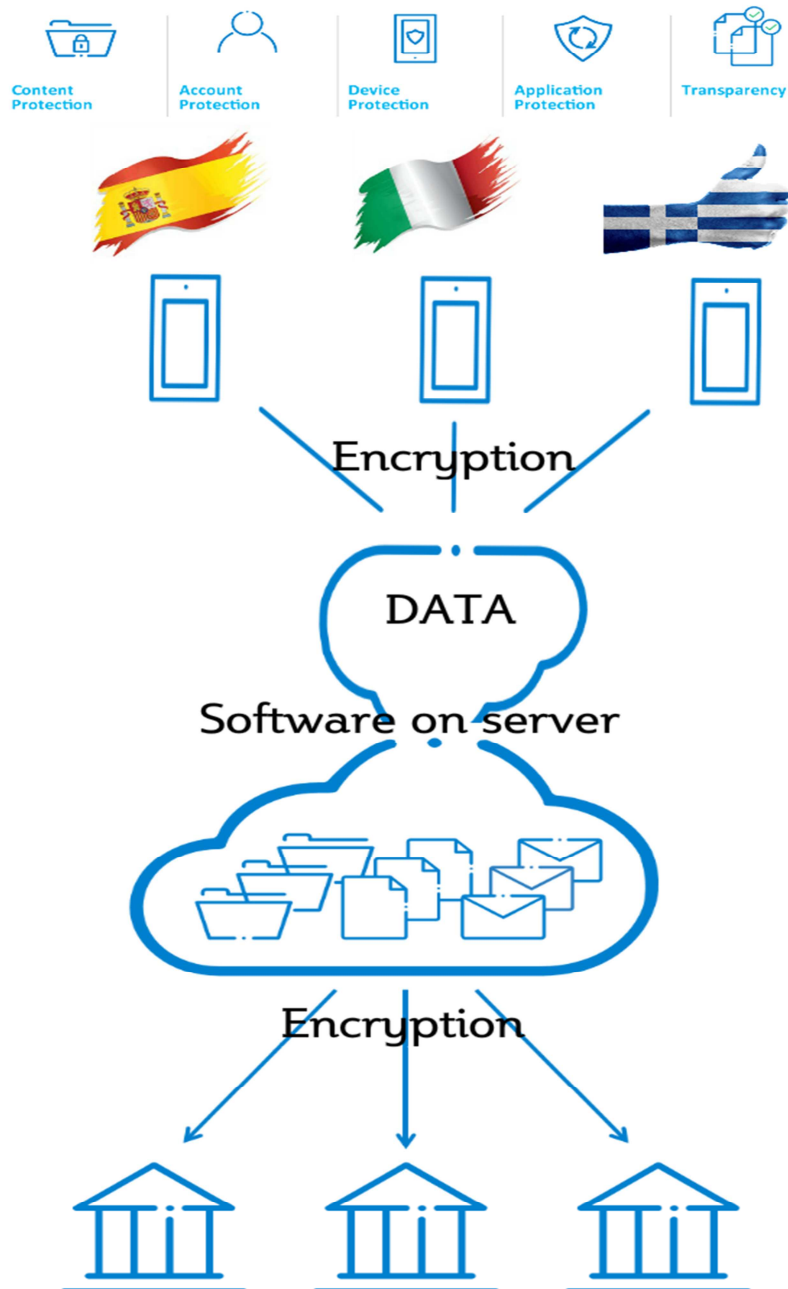


Figure 5-1: Data security in Flow Chart

6. DISCUSSION AND CONCLUSION

A data management system has been designed based on the designed survey and the submitted questionnaire. The system is a web based system which facilitates online collaboration and data management. By using centralized data storage, export options and online data analysis is a possibility. We realize the importance of securing data and securing the privacy of the submitted data.

The system can be adapted and we are open to suggestions regarding user-friendliness. During the Resfarm meeting in Rome (22 – 24 November 2015) suggestions were made regarding the layout and functionality of the rating field and suggestions were implemented. Field types, layout, order of fields or number of fields or other issues can be adapted if there is common interest in doing this.

Suggestions regarding privacy protection are also welcome. A partner from Italy raised the question whether the questionnaire should ask for the (personal) address of the farmer and if this address should be added to the database. If partners agree to leave or add or adapt fields because of privacy, this can be easily implemented.

This report shows examples of dynamic data analysis. The submitted and stored data can be used for all kinds of data analysis based on the inbuilt filter and sorting options. It is up to the partners to decide which of these instruments needs to be developed and which of these options will be used.

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ANNEX I FARMERS SURVEY

Full latest version of the farmers survey, in English:

RESFARM Questionnaire for farmers

Part 1. Description of the farm and the farmer

1.1. Are you the person responsible for making investments and financial decisions on the farm?

Yes	No
Continue with the questionnaire	Don't follow the questionnaire and ask for the responsible person

1.2. Where is your farm located?

You must ask for the complete postal address, including street, postal code, city and state/region.

You must include the geographical coordinates (GPS)

1.3. Table farm size

	Unit	Number
Total area of property (1 + 2). Ask about the two following land types	Ha	
1. Area of arable land: Land used to grow crops	Ha	
2. Area of permanent grassland: Lands for grazing for domesticated live-stock (cows, pigs, sheep and poultry)	Ha	
Number of plots	No	
Average distance from the plots	Km	
Number of heads of cattle (A + B + C + D)	No	
A. Number of cows on farm	No	
B. Number of pigs on farm	No	
C. Number of sheep on farm	No	
D. Number of poultry on farm	No	

1.4. What is the legal status of the farm? (Mark with X)

Farm's legal status	
1. Individual / family farm A farm that is owned or operated by a family or passed down by inheritance	
2. Limited company A company where the liability of members or subscribers is limited to what they have invested or guaranteed to the company	

3. Cooperative farm / group holding	
A farm that is run in cooperation with others in the purchasing and using of machinery, stock, etc., and in the marketing of produce through its own institutions (farmers' cooperatives)	

1.5. What is the proportion of your income from agrarian activities?

	100%	more than 50%	less than 50%
What is the proportion of your income from agrarian activities?			

1.6. Do you have a successor to your farm?

	Yes	No
Do you have a successor to your farm?		

1.7. Table residue management

Crop residue management (1 + 2 + 3 + 4)	Are you collecting residues?	Are you selling the residues?
1. Cereals		
2. Sunflower stalks		
3. Other arable crop residues		
4. Horticultural crop residues ¹		
¹ please list main horticultural crops:		
Manure management (a + b + c + d)	Are you storing manure?	Are you selling manure?
a) Cattle manure		
b) Pig manure		
c) Sheep manure		
d) Poultry manure ²		

1.8. Energy consumption

	Contracted energy load (kW)	Yearly consumption (kWh and/or €)
Electricity		
	Type	Yearly consumption (l/kg and/or €)
Fuel (transport excluded)		

1.9. Do you have any RE or energy efficient installation? (Y/N)

	Yes	No
Do you have any RE or energy efficient installation?		

If YES, continue to the 1.9.1 question

If NO, continue to the 1.9.2 question

**1.9.1. YES**

	Ener- gy/economic savings	Availability of grants/subsidies	Environmental concerns	Improvement of the farming processes
Select which one or more of the following reasons that led you to install it				

Which person/institution of the following listed, provided advice/information regarding the installation?	Yes	No
• Crop protection, seed or machinery seller		
• Buyer of the crops/animals (e.g. food processing enterprise...)		
• Independent agronomist or veterinarian		
• Public extension services		
• Advice service of a farmers' association, cooperative or union		
• Workshops, conferences, fairs and demonstrations		
• Other farmers /neighbours/rural community		
• Bank, accountant, lawyer		
• I don't receive external advice and follow my own opinion		

1.9.2. NO

	Yes	No
Do you know any RE/EF solution that could be potentially installed on your farm?		

Which is the biggest reasons that deters you from installing RE/EF solutions on your farm	Yes	No
• Cost		
• Administrative/fiscal complexities		
• Uncertainty regarding the results of the investment		
• Complexity of the operation and maintenance activities		
• Lack of interesting offers/information		
• Negative references from existing installations on other farms/households		

Part 2. Willingness to invest/innovate and communication channels

2.**2.1. Answer the following questions on a 1 to 5 scale for the period 2015-2020,**

remember that: 1 It will decrease a lot, 2 It will decrease, 3 Will remain stable, 4 It will increase, 5 It will increase a lot



	1	2	3	4	5
How do you intend to modify your farming activities?					

2.2. Rate your agreement with the following sentences on a 1 to 5 scale, remember that: 1 strongly disagree, 2, disagree, 3 somewhat agree, 4 quite agree, 5 totally agree

	1	2	3	4	5
• I take out insurance for farm activities					
• I have too many loans related to my farm					
• I keep a detailed written track of all what I produce, buy and sell					
• My farm is a profitable business					
• It is important to keep up with latest farming methods					
• I would pay more for environmentally friendly equipment and products					
• Compared to other farmers in my neighbourhood, my farm uses a lot of technology (Production system and machinery)					
• I participate in social activities with neighbours					
• I share thoughts about the business with family and try to get them to support the work					
•					

2.3. If you had € 10,000 to invest what would be your priorities?

Please, list three options	Sequence
• Buying land	
• Building/renovating barns	
• Tractors/transport	
• Energy systems	
• Buying crops/animals	
• Financial products	

2.4. Communication channels

What organizations or persons usually provide you with each type of advice?

	Advice on crops grown, crop protection products and machinery	Advice on the financial issues of the farm	Advice on legal issues
Crop protection, seed or machinery seller			
Buyer of the crops/animals (e.g. food processing enterprise...)			
Independent agronomist or veterinarian			
Public extension services			
Advice service of a farmers' association, cooperative or union			



Workshops, conferences, fairs and demonstrations			
Other farmers / neighbours/ rural community			
Bank, accountant, lawyer			

Part 3. Attitude towards securitizable contracts

Please answer the following questions with YES or NO

	Yes	No
3.1. Do you know what is a surface right cession?		
3.2. Do you know what is a lease?		
3.3. Do you have a production contract?		
3.4. I know the difference between arbitration and litigation		
3.5. I prefer solving disputes by arbitration than by litigation		

Rate your agreement with the following sentences in a 1 to 5 scale, remember that: 1 strongly disagree, 2, disagree, 3 somewhat agree, 4 quite agree, 5 totally agree

	1	2	3	4	5
3.6. If you know what a surface right cession is:					
• I prefer long term renting/easements/contracts because it gives me a stable predictable horizon, even if short term alternatives are slightly more economically advantageous					
3.7. If you know what a lease is:					
• I prefer a lease to a loan to introduce new assets on my land					
• I prefer fixed payments to variable ones, even if the variables are slightly more economically advantageous right now.					
• I prefer outsourcing the O&M of my equipment					
3.8. If you have a production contract					
• Having production contracts improves the security of my business					
• Having production contracts allows me to access new technologies and skills					
• Having production contracts facilitates financing investments on my farm					
• Having production contracts makes me too dependent on the sponsor					
3.9. If you do not have a production contract					
• I haven't been offered/ don't have enough information about production contracts					
• I am not interested in integral production contracts because it limits my control over my business					
3.10. In order to install, operate and maintain a renewable energy system, would you allow access to a third party to the following parts of your farm?					
• Farmhouse roof (residential)					
• Barn/stable Roof					
• Land					

3.11. Of the following considerations related to dispute resolution, please choose the two options more relevant for you	Sequence
• Costs	

• Time	
• Enforceability	
• Quality Outcome (Knowledge of the decision maker)	
• Support provided by Associations/administration	

Part 4. Interest and preferences regarding on-farm renewable energy systems (of the type that allows financing by capital markets)

4.1. In order to save € 200 monthly in your electricity bill you are offered the possibility to install a RES in your farm, you can choose between two options:

Option 1 (“immediate savings” plan): In this plan, you will pay a monthly bill of € 100 during 10 years. At the end of year 10 you will be offered the possibility of renewing the contract.

Option 2 (“fast amortization” plan): In this plan, you will pay € 3.000 upfront at the time of installation and € 300 monthly during 2 years. At the end of year 2 you will get full ownership of the RES.

Table of self-consumption plans

	"fast amortization" plan	"immediate savings" plan
Upfront payment	€ 3.000	€ -
Monthly savings	€ 200	€ 200
Monthly payments	€ 300	€ 100
Option to property	yes	no
Contract duration	2 years	10 years

Rate your preference between the two plans on a 1 to 5 scale, remember that: 1 strongly disagree, 2, disagree, 3 somewhat agree, 4 quite agree, 5 totally agree

	1	2	3	4	5
• Option 1: “fast amortization” plan					
• Option 2: “immediate savings” plan					

4.2. In order to increase your income you are offered the possibility of installing a grid-scale RES on your farm. You can choose between two options:

Option 1 ("fast amortization" plan): you are offered the possibility of acquiring a RES. You are not asked for cash payments but you have to sign over surface rights of 1 ha of your land for 12 years to the promoter. You won't receive any payment during the first 12 years. At the end of year 13 you will start to receive a yearly rent of € 20,000 during another 15 years (i.e. from year 13 to year 28). From year 13 you will have the ownership of the installation.

Option 2 ("immediate income" plan): you will be offered a monthly rent of €200 for a 30 years lease of 1 Ha of your land in order to allow a promoter to install a RES there.

Table of wholesale commercialization market preference plans

	"fast amortization" plan	"immediate income" plan
Yearly income	-	€ 2400
Option to property	Yes	No
Contract period	12 years	25 years

Rate your preference between the two plans in a 1 to 5 scale, remember that: 1 strongly disagree, 2, disagree, 3 somewhat agree, 4 quite agree, 5 totally agree

	1	2	3	4	5
• Option 1: "fast amortization" plan					
• Option 2: "immediate income" plan					

4.3. What do you consider that is the fair price for a 20-years lease of an Ha of the following types of land:

Type of land	Price
• Arable land	
• Grassland	
• Forest	
• Non-productive	

5.1. To be filled by the survey taker (interviewer)

Rate your preference between the two plans in a 1 to 5 scale, remember that: 1 strongly disagree, 2, disagree, 3 somewhat agree, 4 quite agree, 5 totally agree

	1	2	3	4	5
• The farmer understood the contents and objectives of the survey					
• The farmer is a good candidate for RESFARM					
• The farmer has actively participated in the survey					