D4.6. Experiences from pilot clusters

Prepared by:

ENEA

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It has been prepared by:
Arianna Latini, Germina Giagnacovo, Carlo Alberto Campiotti

Italian National Agency for New Technologies, Energy and Sustainable Economic Development
Via Anguillarese 301,
00123 Rome
Italy

With the collaboration of Spanish Agri-food Cooperatives, Confagri, Gaia, Service Coop de France, DREAm-Italia, CIRCE

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0. Introduction

This document is a product from the activity of “Collaborative Energy Management” as foreseen in the WP4 of the SCOoPE Project. This activity has involved five European countries (France, Greece, Italy, Portugal, Spain) to develop a cluster of agro-industries willing to share information about their production, operational management and energy use, consumption, and tariff, in order to increase their energy efficiency and their environmental compliance. WP4 has been lead by ENEA, Italy.

1. Brief description of EU pilot clusters

Twenty-five European agro-industrial facilities of different production sectors are already sharing energy information, aiming at common improvement through benchmarking. The first cluster experience (the Spanish F&V cluster) has started in December 2017, but the majority of the clusters have started to measure their energy consumption more recently in 2018.

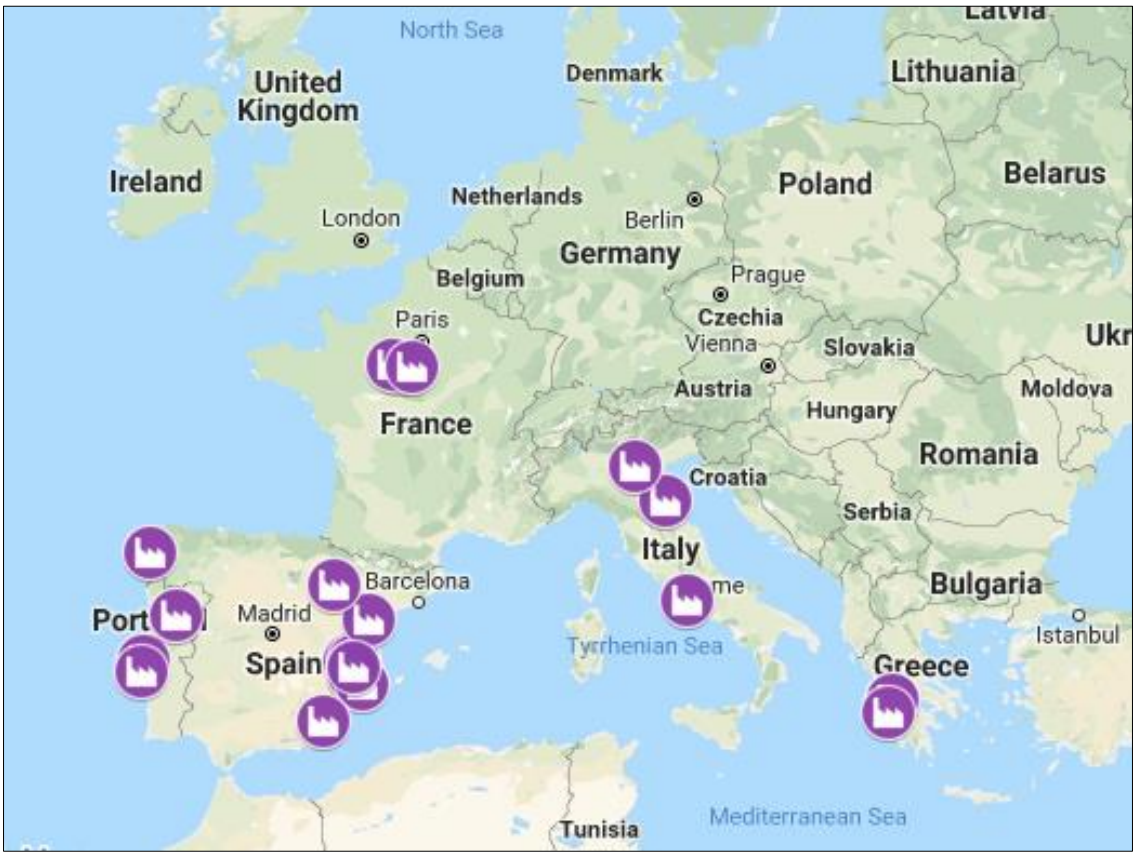

Figure 1. Map of engaged cooperatives in the six EU clusters.

They include animal feed plants and fruit & vegetables centers in Spain, fruit processing plants in Portugal and Italy, and cereal drying facilities in France and Greece. All of them are connected together through the SCOoPE Dashboard (software Power Studio SCADA, CIRCUTOR), which provides real time information about their energy performance.

The SCOoPE industrial facilities monthly receive a report containing information about their energy consumption and specific Key Performance Indicators, which allow them to monitor their energy parameters and planning their improvement. Moreover, they are assessed for implementing, in the future, an ISO 50.001 energy management system.

2. Identification of cooperatives/companies joining the National clusters

The finding and selection of the cooperatives/agroindustries willing to participate in the cluster has been the first experimental step of this action. Even though some partners of the Project Consortium are likely Association of Producers (i.e. Spanish Co-ops for the Spanish clusters, CONFAGRI for the Portuguese cluster and Service Coop de France for the French one), it was truly challenging to find the right keen participants. This was due mainly because cooperative managers are very focused on the daily plant activities, and it is difficult for them to find “extra” time to collaborate in such innovative activity which is demanding a lot of efforts.

To facilitate this task, we contacted several potentially interested processing plants, even by email or by phone, and sometimes by direct visit/meeting in the processing plant. We showed to company managers (COOs, i.e. Chiefs Of Operations) all the possible advantaged they could have gained from joining the cluster, as in the Table 1 which reports a list that we prepared specifically for this purpose.

Of course, all cluster participants exhibited a positive attitude versus the project and its objectives. However, many of them were initially reluctant to afford extra costs for their participation, so they received support from the Country Cluster Coordinators in order to find opportunities and get funding. For example, for the Greek cluster, Piraeus Bank represented its shareholder. In Italy, the San Lidano company obtained the funding to buy a system of 16 energy monitoring points thanks to the application presented for Regional Rural Development Plan, which was elaborated under ENEA counselling.

Once the cooperatives decided to join the cluster, an Agreement was signed between each cooperative and its Country Cluster Coordinator, and also an Action Plan was discussed together and then provided to cooperative COOs.

Table 1

LIST OF POSSIBLE ADVANTAGES IN PARTICIPATING TO THE COLLABORATIVE ENERGY MANAGEMENT EXPERIMENT IN THE FRAME OF THE SCOoPE PROJECT
• Real-time monitoring of energy consumptions in order to save energy thus saving money. If the company energy consumptions are measured continuously through installation of tele-metering devices, the manager of that company has a continuous real-time access to the energy consumptions every moment and this will allow to take the right decisions to optimize it.
• Decisions at operational level would be made more easily when it is possible to have a comparison with a benchmark for the specific processes.
• Possibility of increase of the energy efficiency and the innovation of the industry.
• Performance of an energy audit in the industry. Energy audits are still not mandatory in small and medium enterprises, but EU regulation is going to include SMEs among the enterprises that must clearly define and declare their energy consumption.
• Obtainment of a SCADA system for free, as tool of the project. The Dashboard will work as a SCADA system.
• Participation in a European Project that provides visibility for the industry at European level, through internet websites, project workshops and related congresses, posters describing the project and including the name of your industry joining the project cluster, etc. An official certificate of participation to the cluster will be also gained.
• Participation to brokerage events to share information among several stakeholders, including energy managers, industry managers and technicians, politicians, technology providers, bank and financing operators, etc.
• Pursuing the road of energy saving can more easily provide access to funding opportunities for agro-food industries.
• The formation of an energy cluster, composed of multiple industrial sites, is an example of cooperative interaction, and it is supposed to bring all benefits related to cooperation. The being part of the cluster may bring new advantages to the involved cooperatives/companies, which can start new joint initiatives/projects.
• Some industries can have already installed some tele-measuring devices for monitoring energy fluxes and uses. If the company has not already installed such devices, the project will offer its support to find funding opportunities for the necessary investments (for example by the National Funding for Energy Efficiency).
• When the tele-measuring devices are not available, they can be brought with a moderate cost. There is the possibility of requesting a quote for installing measuring devices and connecting them to the Dashboard developed by the SCOoPE Project for the Collaborative Energy Management.
• The Dashboard will allow to compare the energy consumption to the benchmarking through the use of Key Performance Indicators.
• It will be feasible to assess common purchasing of electric kWh and natural gas, hopefully having access to some discounted rate.
• Since the majority of the involved companies are in the sector of food processing, a careful attention to energy saving and a major environmental respect provide like an added-value to the final product, given that nowadays people are more sensitive to such environmental issues.
• Possibility of sharing information with other industries on processes, products and energy consumption and management (opening the way to industrial symbiosis).

- Main advantages to implement a dashboard software to control energy consumption in an installation:
  - Energy saving approximately 8-15% of controlled energy consumption.
  - Saving 5-10% of Operation and Maintenance Costs.
  - Installed measurement equipment gives the possibility for future disconnection-connection actions and system regulations.
  - Adjust contracted power and periods of use according to the maximum saving criteria.
  - Detection of unwanted latent consumption.
  - Control of operating costs and exact determination of energy consumption by product or service.
  - Useful to implement as energy management system as required by the ISO 50.001.

3. Study of the energy monitoring system to be installed in each site of the plant

For each cluster processing site, the specific production process was dissected. Afterwards, based on the customer requirements, and always taking into account the budget available from the cooperatives that they finally planned to invest in the SCOoPE project, a specific energy monitoring system, made of a certain number of measuring points, was designed and then acquired by each cooperative. The Figure 2 schematically shows the general structure of an energy management system based on monitoring devices, and a communication system between the measured data and the SCADA software (i.e. the Dashboard) for the energy management.

At this level of the cluster experimental set up, each Country cluster obtained a careful assistance from the technological providers-Key Actors. Independently, each Country Cluster Coordinator developed his own network of providers, by contacting very big companies (i.e. Schneider Electric, ABB, Siemens, etc.), as well as much smaller companies to get information and support, and to ask for the pricing of the instruments to be acquired by the companies. In general, notable differences among the offers proposed by these selling/consultant companies were found. Not only the pricing was so diverse, also their modality of customer assistance and their availability and interest in supporting the overall cluster development could be very distinct.

For example, at technical level, the Italian cluster was strongly supported by ASITA, a private technological provider company, supplying CIRCUTOR measuring devices. The relationship among ASITA, ENEA, DREAm-Italia and the three cluster companies became stronger and stronger, thanks to their high-level knowledge of possible innovative solutions to achieve a correct and customer necessities-based energy consumption monitoring system.

In addition, the Greek cluster was supported by the Vodafone Group, which has 25 years of experience in IoT and over 45 million active IoT connections. Vodafone has provided know-how and the SIM cards for the Greek cluster. They are very interested in testing the NB-IoT service in the Greek cluster and provide support during the entire cluster period. Vodafone has proposed to prepare a common press release with GAIA to disseminate Europe-wide the Greek cluster use case, which will be an excellent dissemination action for the SCOoPE Project.

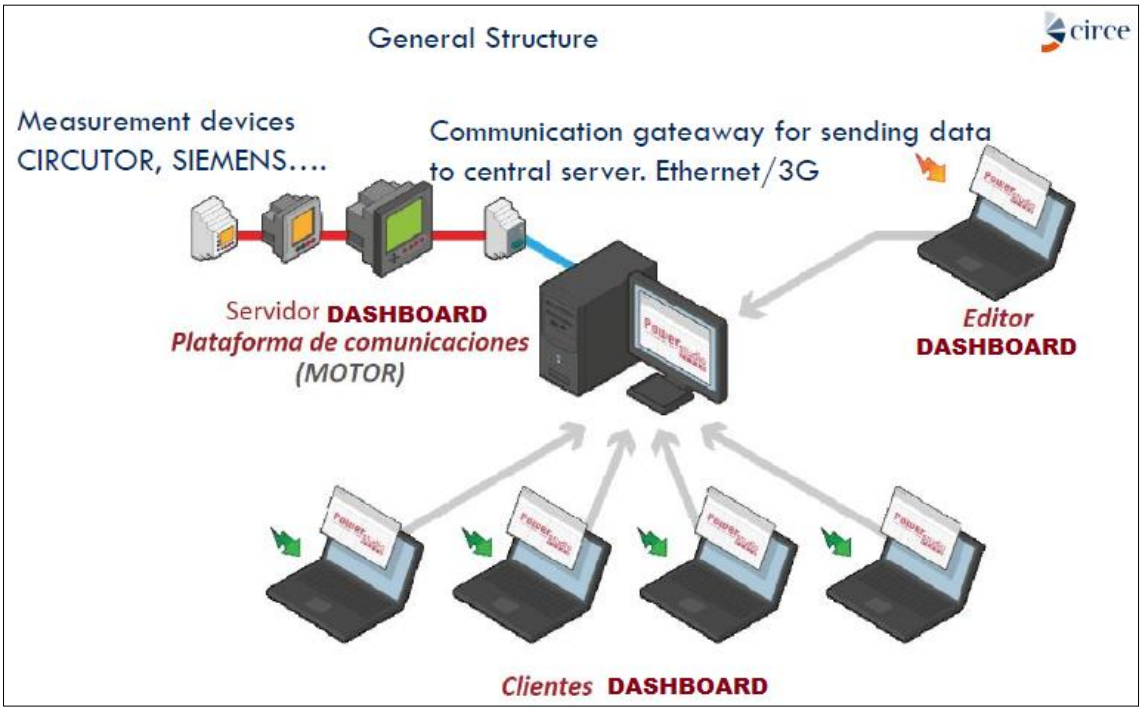

Figure 2. General structure of the energy consumption monitoring and management system implemented in the clusters.

Among the clusters, most of data-loggers are from CIRCUTOR, which is the same brand of the Dashboard. Notwithstanding, in a few sites also Siemens or other brands were used. It is worthy of note that in some clusters the cooperatives already used to have a previously installed energy monitoring system.

Another important point that has been addressed in order to make data directly available to the Dashboard was the kind of connection. The communication gateway for sending data to the central server could be Ethernet or 3G.

Even if several variants were present, a typical “ex-novo” monitoring system from CIRCUTOR could include the following pieces:

- A central control unit (mod. EDS/TCP)
- Some three-phase analysers of the network parameters (mod. CVM-MINI). For example, the EDS/TCP control unit has a LAN-Ethernet interface for configuration and connection to a local network, an RS485 serial port on which to combine the CVM-MINI meters, and a local 200MB cyclic memory where EDS / TCP historicizes

data from these meters. The CVM-MINI meters also have an RS485 serial port on which they can transmit the values of the instantaneous measurements they are making.

- The combined current transformers (CTs) of different sizes (N° 3 amperometric transformers per N° 1 analyser).

4. Installation of the measuring devices and connection to the Dashboard

From the physical installation of the acquired measuring instrumentation, up to the attainment of the connection and the data transmission to the central brain (the Dashboard), these are the main phases:

- installation of measuring devices;
- configuration and programming of the measuring equipment;
- elaboration of a linear diagram showing the installed analysers (what do they measure and to which process/group of processes they belong),
- obtainment of ID and password to access to the Dashboard and data measured.

The installation of the measuring devices in the appropriate points that were selected for being monitored was not always easy. They were often put in different areas of the plant, and in each area of the plant more than one instrument could be present. In each installation, the scheme of the electrical boards has been modified as less as possible.

These operations were always carried out in the presence of the Country Cluster Coordinator, the technology provider advisor, and the cooperative COO or technicians. In most cases, the cluster cooperatives had also to pay their staff of electricians or external companies to position the analysers and check their functionality. The installation generally required 1-2 days, depending on the specific cooperatives and particularly on the number of devices to be installed. Notwithstanding, diverse kind of problems very often emerged after installation.

The further step was the connection of the data registered by the installed instrumentation to the SCOoPE Dashboard. This was also performed in presence of the cooperative staff, including IT-experts. CIRCE was always available to check the connection, for finding suggestions and solutions to the several connection problems that arose during the implementation of each cluster.

As already mentioned, in some cases, the sites were already provided of a kind of energy measuring equipment. For example, in the Spanish F&V cluster, the 8 cooperatives already possessed a system monitoring on average 10 points, corresponding to main consumer equipment. In these cases, even though at the beginning it was expected an easier procedure of work, it was found that the connection of the analysers to the Dashboard was even more difficult to be obtained.

5. General management of the energy consumption monitoring and the measuring instruments

Finally, all measuring points of each company have been connected by Internet with a protocol such as Modus to the Dashboard and data is being measured each 5 minutes.

Figure 3. Screenshot of the Dashboard main page of real-time monitoring for a cooperative.

The Power Studio SCADA software has been configured specifically for each cluster, and for each company there are only three possible users who will access the data: 1) the company manager who has exclusively access to company data (user responsible for the company); 2) Country Cluster Coordinator who can access data from all companies that are part of the cluster; and 3) CIRCE (as Responsible for the Dashboard), Spanish Co-ops (as SCOoPE Project Coordinator) and ENEA (as WP4 Leader) who can access the data of the Italian and European cluster companies.

The dashboard shows in real time the consumption due to the sub-processes as a percentage of the total electricity consumption.

For each measuring point, each company has access to the following information:

- information on the work power according to the nominal power;
- historical information on the power used;
- graph of energy consumption as a function of time;
- data download in .xls;
- other variables measured by analyzers, such as reactive energy, intensities, etc.

After the setting up of this monitoring framework, these following common actions are now under consideration for getting a general management of the energy monitoring system:

- periodical teleconferences to evaluate the data monitored
- exchange of energy saving best practices and monitoring of the relevant KPIs
- identification of bottlenecks of the systems
- common meetings at the technical and management levels to identify proposed actions for improvement.

6. Data analyses, benchmarking and reporting

Main objectives that the SCOoPE Project aimed to achieve with the EU cluster experimentation were *i)* the development (or improvement) of the benchmarking by comparing the consumption of each site with average indicators; *ii)* the proposal for a common energy (electricity and/or fuel/gas) purchasing, and *iii)* the dissemination of the ISO 50.001 among members.

i) By using the Dashboard, monthly reports are being produced containing all monitored energy data and analyses. Each report includes the period of the reporting, the key parameters of the monitoring, a summary of billing parameters, the energy consumption per “fare” period, a balance of energy uses, as well as an active energy profile (see Fig. 3).

As expected, benchmarking results were very tricky due to the several parameters that should be taken into account and normalized among the cooperatives. Even though the information obtained from the comparisons needs to be more refined, evident differences in energy use and energy costs are clearly visible in the reports.

ii) Concerning a proposal for joint energy acquisition, at the moment it is still early to work for this task, since we need to accumulate more and more data of energy consumption and bills in order to study each company energy consumption and ask for proposal of energy purchasing that could be profitable for cluster companies.

iii) According to the task 4.6 of the SCOoPE Project, taking advantage of the fact that all the clusters and the Dashboard tool will match the key points in the ISO 50.001, cluster companies have been involved also in the implementation advisory on ISO 50.001. After this, a report will be done, reporting the advices provided, and assessing individual business situation and the recommendation onwards. In particular, CIRCE staff developed a diagnosis of implementation of ISO 50.001 in the cooperatives belonging to the different clusters and provided all Country Cluster Coordinators with an operational guide.

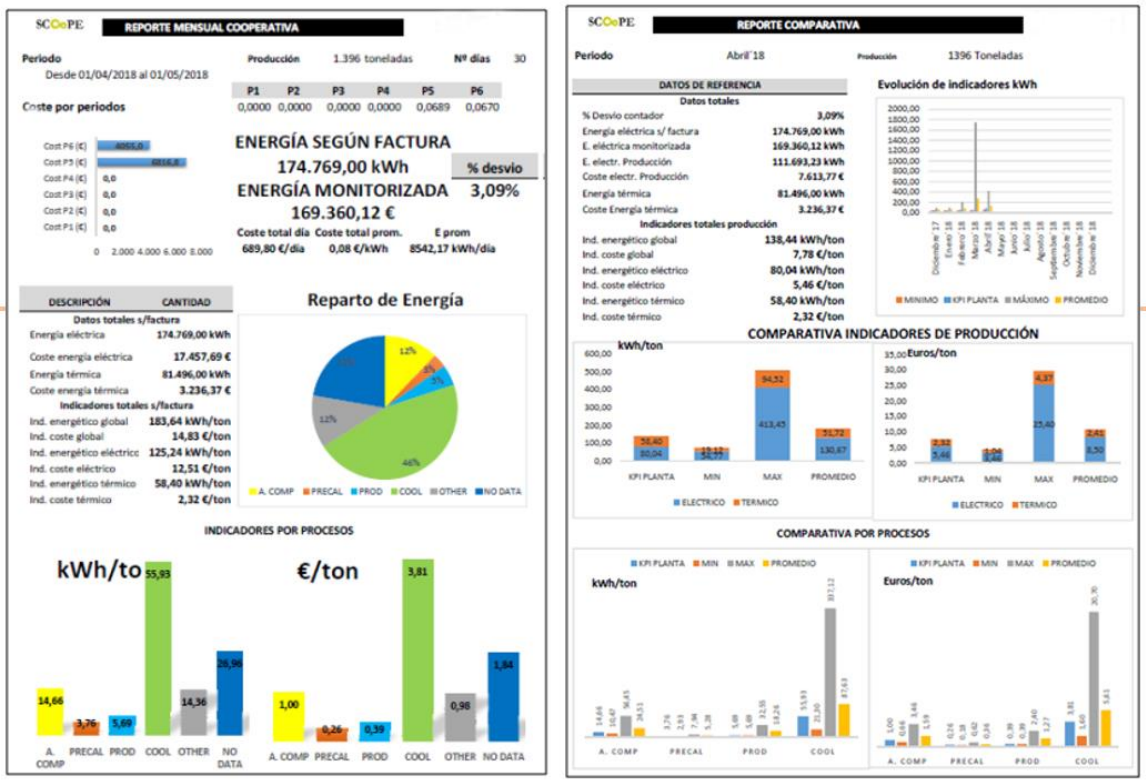

Figure 4. Example of information contained in a monthly report.

7. Conclusions

One main achievement of the EU Project SCOoPE is the experimentation of the clusters for the “Collaborative Energy Management” in agro-food cooperatives. At the moment, five out of six EU clusters are running, and the Dashboard receives their data. For several sites, energy consumption data are available since a few months before the realization of the connection to the Dashboard. This was due to the fact that installation and connection, in the real practice, are two different actions and must be carried out one after the other. Moreover, each of these actions would require as minimum as minimum, on average, one dedicated day. It should be kept in mind that cooperative staff is completely involved in the routine work that has to be performed in a typical plant operative working day, thus only a few time is available to them to be involved in activities other than production.

The realization of each Country cluster has been absolutely a work worthy of note. Unfortunately, some months of delay have been accumulated, leaving less time - with respect to that planned at the beginning - to focus on the last tasks related to WP4.

Starting from the first monthly reports many information and suggestions to cooperatives can be drawn, that will help to facilitate their future choices in relation to energy efficiency and savings.