



VINYES  
XCALOR

LAYMAN'S REPORT





### Project location

Vilafranca  
del Penedès  
(Spain)

### Duration

Almost 3 years: June  
2014 to November  
2016 (extended to  
May 2017)

### LIFE reference

LIFE13 ENV/ES000776

### Website

[www.vineyards4heat.eu](http://www.vineyards4heat.eu)

### Budget

**1,296,842 €**

### EC contribution (LIFE programme)

**49.59 %**  
of eligible costs)

### Partners



# THE VINEYARDS4HEAT PROJECT (V4H)

## WHERE IS THE PROJECT LOCATED?

The V4H project has been promoted and coordinated by **Vilafranca del Penedès Town Council**, located in one of the most important winemaking regions in Catalonia (Spain). It involves a partnership between three beneficiary members: **COVIDES** (a winegrowers' cooperative), **INNOVI** (a Catalan wine cluster) and **NOU VERD** (a social initiative cooperative).

The project has been co-funded by the European Commission's LIFE Programme and is focused on proving the feasibility of the Vineyards Virtuous Circle (VVC), that consists in using agricultural biomass gained from vine pruning as a source of local and renewable energy, proving environmental, economic and social benefits for the region and for the winemaking sector.



## PROJECT ORGANIZATION

The members of the V4H project undertake the following tasks:



Coordinates the management model and oversees energy supply. That is, it acts as an intermediary between thermal energy consumers (wineries or municipal buildings) and biomass managers and, at the same time, it takes on the role of energy supply company. It fulfils this function through EMAVSA (Vilafranca's municipal water board) that has been converted into an energy supply company. Within the framework of the project, a biomass district heating plant has been developed to run several municipal facilities.



Manages biomass supply. It collects the pruned vine shoots and manages the facilities used for storing and treating the harvested material for combustion and delivering it to the biomass boilers.



Catalan wine cluster that promotes competitiveness and innovation in the sector and represents wineries (potential consumers). Cavas Vilarnau have been actively involved in the project and have installed a vine biomass boiler.



Cooperative that brings together the region's winegrowers who, all in all, manage around 2,200 hectares. COVIDES manages and guarantees the supply of biomass, providing the plots where vine shoots are collected.

### THE PROJECT HAS BEEN STRUCTURED IN 3 KEY PHASES

1 Laying the groundwork for putting the VVC model into action. This involved both technical aspects (facilities, machinery...) and management and awareness-raising issues.

2 Conducting a validation test on the VVC to assess its technical and economic feasibility.

3 Unfolding a transverse phase that has the purpose of defining a roadmap for the consolidation of a long-term strategy and of extending the model both locally and across other regions, depending on the project's results.

1

2

3



**30.000 t/yr.**

Potential vine biomass  
production in  
the Penedès



## FROM WASTE TO SOURCE OF ENERGY

The EU's climate and energy goals for 2020 (20-20-20) call for 20% of energy supplied in member countries to originate from renewable sources and to reduce, by the same proportion, greenhouse gas emissions. These goals are also binding on Europe's winemaking sector, which makes it necessary to find alternatives to fossil fuels.

In the meanwhile, winegrowing in the Penedès region produces 30,000 tonnes per year in vine pruning waste (vine shoots). This material is usually burnt in the vineyards which doesn't allow for energy harnessing and causes pollution.

Vine pruning waste can easily be transformed into a source of biofuel that has high energy potential. In fact, it is calculated that vine shoots – if harvested across all of Europe's winemaking regions – could potentially generate the equivalent of 2.2 times the energy production of a nuclear power station.

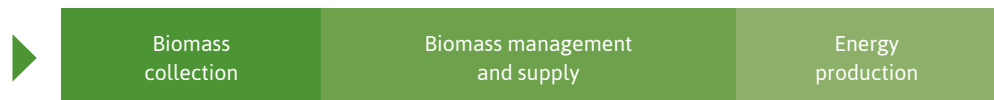


## THE VINEYARDS VIRTUOUS CIRCLE (VVC)

The main objective of the V4H project is to prove the feasibility of the Vineyards Virtuous Circle (VVC), a model of circular economy that consists in **using agricultural biomass from the pruning of vines as a source of renewable energy** to cover energy demands produced by the wine production chain and other local consumers. By doing so, the vine circle is closed and a green local economy is generated in line with the EU's energy and climate goals for 2030.

The VVC also influences the carbon cycle, that is based on returning to the atmosphere the same amount of CO<sub>2</sub> as has been stored during the vine's life-cycle (carbon dioxide is fixated through photosynthesis in the vine). In the vine biomass combustion process, this CO<sub>2</sub> is released once again into the atmosphere and VVC begins once again. The remaining ash is used as a fertilizer.

### THE VVC MODEL HAS 3 KEY STAGES



## MUCH MORE THAN GENERATING ENERGY

The benefits to be gained from this new way of using and managing vine pruning waste go beyond those associated with an alternative source of energy. The project:

- ▶ **Obtains a 0 Km renewable energy**, decentralized and local, that reduces dependence on fossil fuels and big energy companies.
- ▶ **Reduces CO<sub>2</sub> emissions to mitigate the effects of climate change** by substituting traditional fossil fuels for vine biomass.
- ▶ **Generates a new local green economy** in which new jobs related to the collection and treatment of biomass are generated and waste is recovered and transformed into a source of energy.
- ▶ **Cuts energy costs**, by using vine biomass that is easy to harvest locally in the region, it is more economic than traditional fuels.
- ▶ **Promotes competitiveness and innovation in the area**, enhancing and adding value to the economy of the Penedès region through the development of agricultural machinery to harvest the vine shoots, new installations for renewable energy, the feasibility of the VVC model that is easily exportable to other winemaking regions, etc.



# SOME FIGURES FROM THE V4H PROJECT

**778**

**hectares**

of vineyards for biomass collection  
(seasons 2014-2015, 2015-2016 and 2016-2017)



**469**

**tonnes**  
of collected  
vine biomass

**349**

**tonnes**  
of biomass  
for energy  
production

**240.70**

**t CO<sub>2</sub>**  
Emission reduction

**630**  
**kWh**

Total power  
installed  
(biomass  
boilers)

**409,544**  
**kWh/any**

Thermal  
energy  
produced  
(2016)



**815**

people benefitting from  
vine biomass supply

**4**

jobs created

**87,036**

people informed through  
communication actions

**13,000**

website  
visits  
(May 2017)

**309**

subscribers to  
the project's  
newsletter

**587,999 €**

investment in  
infrastructure and  
facilities

**57,885 €**

in economic  
savings



# BIOMASS COLLECTION, A KEY PROCESS

One of the project's key facets is guaranteeing the supply of biomass. As a result, we need winegrowers to make their plots available so that we can carry out pruning and collection tasks in an efficient way and transform the material into good quality biomass.

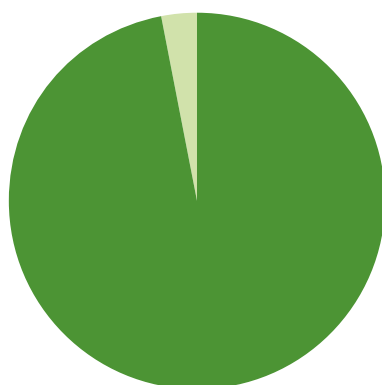
## COMMITMENT AND PLANNING WITH WINEGROWERS

Within the framework of the project, we have joined forces with members of the COVIDES cooperative who have offered their plots for the collection of vine shoots. With the purpose of assessing the winegrowers' interest in continuing their participation in the initiative and using the service, we carried out a satisfaction survey (32 winegrowers in total). According to the results of the survey, 97% intend to continue supplying their pruning waste (vine shoots) and the degree of satisfaction with the collection operation is rated at 3.2 out of 5.

Another key aspect of the biomass collection process is the planning stage. In many cases, a winegrower's plots are dotted across the territory and, consequently, to maximise efficiency, collection is planned according to area rather than to winegrowers, with whom we work with very closely.

# 97%

**of winegrowers participating in the project  
intend to continue offering their plots for  
the collection of biomass**





## TECHNICAL INNOVATIONS IN AGRICULTURAL MACHINERY

The pruning of vine shoots is carried out every year at the end of the grape picking season. In the framework of the project, we have used plots with the following types of crops:

- ▶ **Spur-pruned, cultivated with training system**
- ▶ **Head-pruned, without training system**

Pruning and collection techniques differ between the two types of crop and NOU VERD has used different machines.

### EXPERIMENTAL PRE-PRUNING MACHINE

Preventing vine shoots from coming into contact with the soil avoided additional treatment and processing costs to eliminate unwanted soil, stones and plastics. However, this represented a major challenge that needed to be overcome and for which purpose we designed a pre-pruning machine to vacuum the shoots directly from the plant before they fell to the floor.

We used the machine over various pruning seasons in spur-pruned vineyards and, despite making improvements to the model, we did not manage to produce a machine that was 100% satisfactory. While the pruning function was effective, the mechanism designed to collect the waste was not. It is possible that NOU VERD may continue working on improving the design of this experimental machine at a later stage.

### PICKING AND SHREDDING MACHINE

The Peruzzo Cobra Collina is a commercially available model to which we have made some adjustments to improve the collection of vine shoots. It has produced excellent results and it's the machine used by NOU VERD to collect almost all the project's biomass.



# BIOMASS MANAGEMENT, LOGISTICS FOR THE PROJECT'S FEASIBILITY

This stage assures the feasibility, present and future, of the project as it involves managing the demand and ensuring the supply of biomass to consumers. To do so, once the biomass has been collected from the various plots, it is transported to a storage plant where it is dried and prepared for distribution.

## REUSING ABANDONED FACTORIES...

This biomass plant has been installed in an old aluminium factory in the municipality of Vilafranca del Penedès that has been recovered for this new use. The installations cover 5,000 square metres and are found in a strategic position that facilitates supply to the district heating in Vilafranca's La Girada neighbourhood – one of the emblematic installations in the Vineyards 4 Heat project – and it assures a competitive price by reducing transport costs.

## ... AND CREATING NEW ENERGY COMPANIES

Another relevant facet of the project has been the design of a vine biomass energy supply model. To accomplish this, it was decided that Vilafranca's municipal waterboard (EMAVSA) should become the energy supply company to provide thermal energy to users in the district heating network and, upon the project's completion, to charge a tariff per kWh consumed. It was also decided that EMAVSA should be responsible for managing, alongside NOU VERD, the supply of biomass to power the boilers.

The energy model that this new company has put into action, needs to be consolidated via the broadening of the range of services it provides and its customer base.



# ENERGY PRODUCTION, WHEN VINES ARE TRANSFORMED INTO HEAT

Vine biomass is transformed into energy in biomass boilers that produce hot water for heating and/or DHW (district hot water). In the framework of the project, two vine biomass boilers have been installed:

**A 500 KW BOILER IN THE NEW LA GIRADA DISTRICT HEATING NETWORK, WHICH SUPPLIES 4 PUBLIC FACILITIES IN VILAFRANCA.**

**A 130 KW BOILER IN CAVAS VILARNAU, WHICH HAS ELIMINATED THE COMPANY'S DEPENDENCE ON FOSSIL FUELS.**

Compared to using gasoil or natural gas to power boilers, the use of vine biomass has meant a reduction in greenhouse gas emissions and has led to significant economic savings.

## TECHNICAL CONSIDERATIONS REGARDING VINE BIOMASS

When installing a biomass boiler that is to be run on agricultural biomass, there are certain technical considerations that need to be taken into account, primarily because the material is not very dense and becomes easily entangled.

### DEPOT WHERE THE BIOMASS IS STORED

Attach a support net along the sides so that biomass doesn't become entangled when the lorry unloads at the depot

### TRANSPORTATION OF BIOMASS FROM THE DEPOT TO THE BOILER

Use an articulated arm in the interior of the depot  
—  
Use a rotary valve to cut larger vine shoots

### BOILER

Plan for a spacious combustion chamber. The fuel is not very dense and it produces a high percentage of ash.  
—  
Covered with refractory material  
—  
Include a fluidized bed with chain to facilitate the flow of fuel

Clean exchangers with worm screw  
—  
Ensure a large opening to extract ash  
—  
Opt for a free configuration in the control settings so that the boiler can be adjusted to the type of fuel.

In all other respects, the experience gained through the project shows that agricultural biomass provides excellent thermal performance and the installations have worked flawlessly following the above technical recommendations.

The installation of these boilers in urban areas is only recommended when using a centralized (district heating) boiler and when long-term use is envisaged. This will ensure optimum yields and maximum returns on investment. In this sense, the kilowattage of the Cavas Vilarnau boiler represents the minimum recommended amount for vine biomass.

**CHARACTERIZATION DATA FOR AGRICULTURAL BIOMASS  
(GAINED FROM VINE PRUNING WASTE), ACCORDING TO  
THE FOREST SCIENCES CENTRE OF CATALONIA:**

**4,116.21 kWh/t**

Calorific value (LCV)



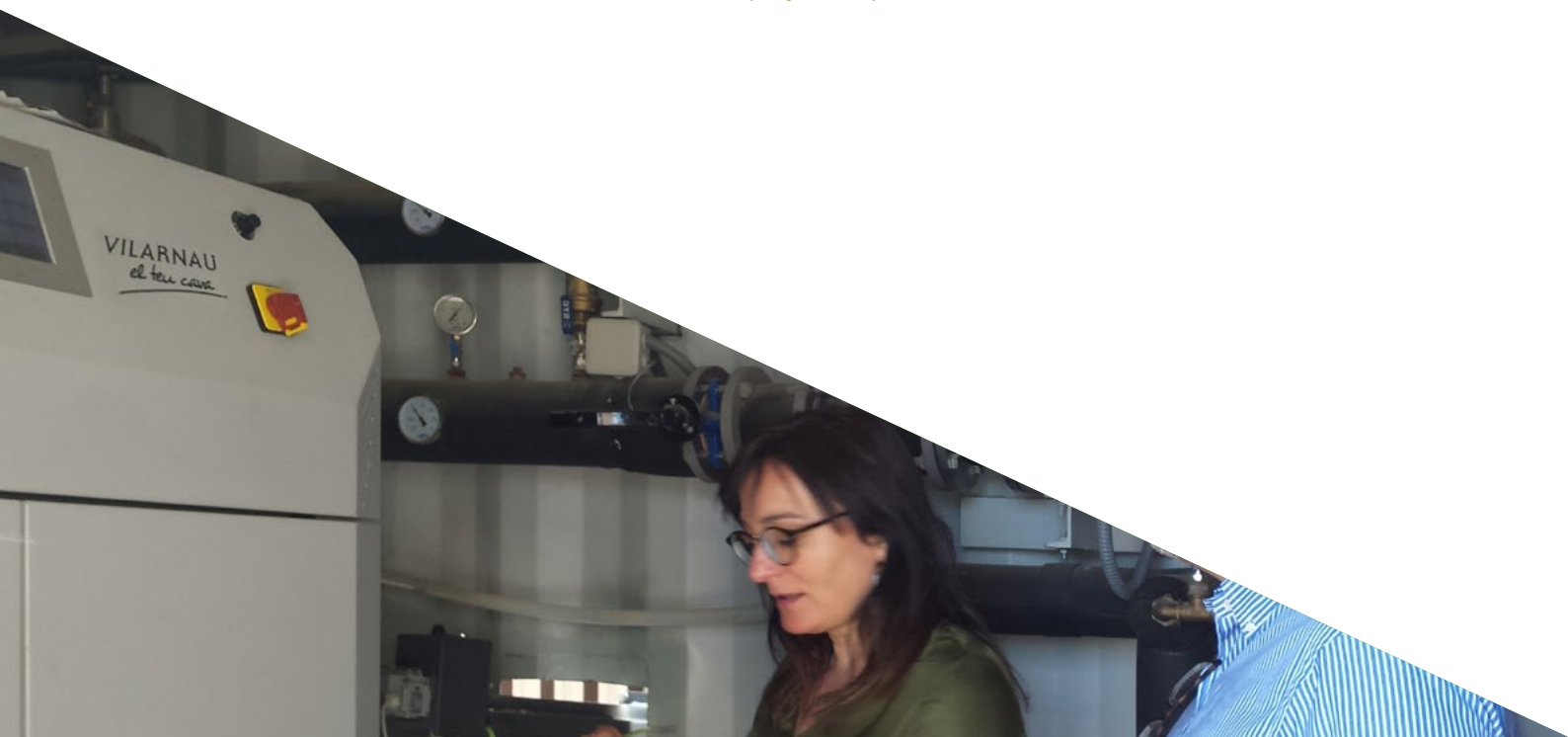
**157 kg/m<sup>3</sup>**

Density



**6.32 %**

Ash (dry base)





## LA GIRADA DISTRICT HEATING, VILAFRANCA'S NEW ENERGY RESOURCE

The district heating network in the neighbourhood of La Girada is the most emblematic achievement of the V4H project and it has involved deploying a new energy model across the town of Vilafranca del Penedès that employs a local source of renewable energy. Supply management has been the responsibility of EMAVSA, the municipal water board that has replaced energy supply companies.

The district heating network has a boiler room, a biomass storage depot and an urban heating network that was built at the beginning of 2016. Four public buildings are connected to the network:

- Dolors Piera Primary School
- An educational resource centre
- El Parquet Pre-school
- Alt Penedès Regional Archive

In the near future, we plan to connect additional facilities such as the Ricard Fortuny Sociosanitary Centre, among others.

The buildings in La Girada have replaced heating systems and DHW (Domestic hot water) that were powered by natural gas and/or electricity with a centralized heating system run on biomass. Traditional energy sources have not been entirely eliminated but they are only used to support renewables.

The deployment of the district heating network has led to an energy reduction of around 153,000 kWh of natural gas and 12,653 kWh of electricity per year. We expect to be able to increase this volume of saving with the continuous improvement of the energy management system and the optimization of the biomass power station.

**153,000 kWh**

**Natural gas saving**

**12,653 kWh**

**Electricity saving**

It should be noted that particle emissions from the combustion of biomass have a reduced impact on air quality. This was shown in the analysis of suspended particulate matter (PM10) and Benzo[a]pyrene (BaP) that was carried out over a six-month period in the area around La Girada district heating. The values obtained for these two parameters were below the maximum levels established in Royal Decree 102/2011 for the improvement of air quality.





# CONCLUSIONS

## THE FEASIBILITY OF THE VINEYARDS VIRTUOUS CIRCLE

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The project V4H has achieved one of its key objectives: to prove the feasibility of this circular economy model that converts a waste product (vine shoots) into a source of renewable energy (agricultural biomass) in a decentralized and local sphere, reducing CO<sub>2</sub> emissions whilst cutting energy costs and generating employment.

The boiler at Cavas Vilarnau and the district heating network for public facilities in La Girada neighbourhood, Vilafranca del Penedès, are clear proof of how vine waste can be an easy-to-use and renewable source of fuel.

Consequently, the project also provides a local strategy for mitigating the effects of climate change in which companies in the cava and winemaking sector can be more competitive and the territory of DO Penedès becomes an economic area that is low in carbon emissions and high in added-value.

## VINE BIOMASS: AN UNDERVALUED RESOURCE

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During the implementation of the Vineyards 4 Heat project, we detected certain resistance among technical specialists and engineers who act as advisors on agricultural biomass usage. Said resistance is based on the perception that vine biomass is more problematic than forest biomass with which there is broader experience. Within the framework of the project, it has been shown how biomass boilers work very efficiently with vine biomass, taking into account the technical considerations mentioned above.

Moreover, it should be recalled that agricultural biomass is a local source of energy that is available on an annual basis and is more economical than forest biomass. As a result, we feel it is important to carry out an awareness campaign to promote vine biomass as an alternative source of energy that is both feasible and easy to implement.



## THE PENEDÈS: BECOMING A REFERENCE IN SUSTAINABILITY AMONG WINEMAKING REGIONS

Over the past two and a half years, V4H has laid the foundations for this to be an independent project that extends as new boilers are installed and companies manage physical aspects of vine biomass, a resource that has proven to be feasible and apt for use in biomass boilers, following the technical considerations that have emerged during the deployment of the project.

The project's expansion in the Penedès is as a result of the following companies and organizations wishing to use vine biomass as a source of thermal energy:

### **RICARD FORTUNY SOCIOSANITARY CENTRE**

The centre is close to becoming the first client of the Vilafranca Municipal Services Company. The executive study to connect it to La Girada district heating network has been carried out and the economic study to provide the service has also been completed. The negotiations for a thermal energy supply contract are at an advanced stage.

### **THE NEW LA GIRADA HIGH SCHOOL**

We are currently involved in discussions with the Generalitat Government of Catalonia on proceeding with the connection of the school to the biomass DH, as was originally foreseen during the construction of the heat network with a manhole installed for this purpose.

### **CAVAS PERALADA**

An energy auditory on the production and bottling installations, located in Vilafranca del Penedès, has been carried out. To date, the company is studying the results of the study to prioritize the installation of a biomass boiler in the short term.

### **ADJUSTMENTS TO THE BIOMASS BOILER IN SANT SADURNÍ D'ANOIA**

The town council has installed a biomass boiler for public facilities although some technical adjustments are required to be able to use vine biomass successfully.





## NECESSARY GUIDELINES FOR THE REPLICABILITY OF THE PROJECT

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The practical experience and studies carried out over the course of the project have highlighted a series of recommendations and practices to guarantee success in the adoption of thermal energy from vine biomass:

► **Use tried and tested machinery for the collection of vine shoots**

The project recommends the Italian machine Peruzzo Cobra Collina for its reliability and collection capacity. We will be acquiring additional units to respond to the expected increase in demand for biomass. At the same time, we will no longer lead the R+D on the pre-pruning collection prototype as the tests have not produced satisfactory results.

► **Collect and manage biomass near to the consumption centres**

The collection process must be planned to be as efficient as possible and so that agricultural workers can clear their plots swiftly. The drying and storage of vine biomass must be strategically located near to the main consumption centres to keep prices competitively low and to avoid increases derived from transport costs.

► **Large facilities with sustained demand are preferable**

This type of biomass is not very dense and, consequently, the depot needs to be large and boilers need to be of medium to high kilowattage to guarantee correct supply given the physical characteristics of the fuel.

With reference to the viability of the project's depreciation estimates, this type of biomass combustion is suited to an energy demand that is stable and long-term, avoiding peaks in consumptions at certain times of day or at specific times of year.

► **Make certain technical improvements to boilers**

Among other improvements, boilers should have a chain conveyor system in the combustion chamber to counter the fuel's lack of fluidity and with continuous cleaning to avoid unnecessary stops and starts.

► **Set up a municipal services company**

This is a key element as it ensures the continuity of the project, it guarantees supply and customer confidence and at the same time it helps establish the energy model based on renewable, decentralized 0 km fuels.



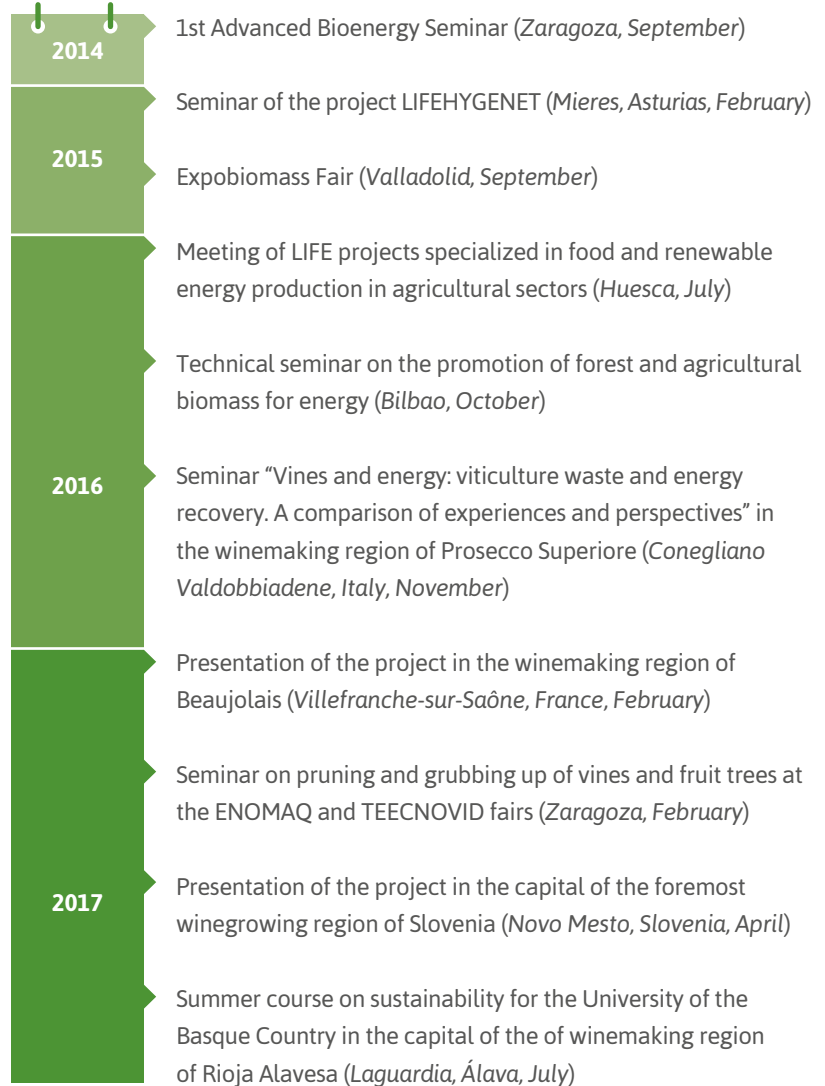


## REPLICABILITY INVOLVES SPREADING EXPERTISE ON THE PROJECT TO OTHER WINEMAKING REGIONS

Moreover, we are fully aware that the expertise gained from actions carried out across the Penedès must be applicable in other winemaking regions interested in renewable energies. Indeed, replicability was another initial objective in the V4H project.

The expertise we have gained in over two years to prove the feasibility (technical, economic and environmental) of closing the Vineyards Virtuous Circle (VVC) has been shared with experts, winemakers, wineries, councils and companies in other wine producing regions across Europe.

Among other forums and sectorial meetings, both national and international, the V4H project has been present at the following events:

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- A vertical timeline with green arrow-shaped markers pointing to the right, listing events from 2014 to 2017. The years are displayed in white text on green rectangular backgrounds.
- 2014**
    - 1st Advanced Bioenergy Seminar (Zaragoza, September)
  - 2015**
    - Seminar of the project LIFEHYGENET (Mieres, Asturias, February)
    - Expobiomass Fair (Valladolid, September)
    - Meeting of LIFE projects specialized in food and renewable energy production in agricultural sectors (Huesca, July)
    - Technical seminar on the promotion of forest and agricultural biomass for energy (Bilbao, October)
  - 2016**
    - Seminar "Vines and energy: viticulture waste and energy recovery. A comparison of experiences and perspectives" in the winemaking region of Prosecco Superiore (Conegliano Valdobbiadene, Italy, November)
    - Presentation of the project in the winemaking region of Beaujolais (Villefranche-sur-Saône, France, February)
    - Seminar on pruning and grubbing up of vines and fruit trees at the ENOMAQ and TEECNOVID fairs (Zaragoza, February)
  - 2017**
    - Presentation of the project in the capital of the foremost winegrowing region of Slovenia (Novo Mesto, Slovenia, April)
    - Summer course on sustainability for the University of the Basque Country in the capital of the of winemaking region of Rioja Alavesa (Laguardia, Álava, July)

... Governments will  
reduce general taxes and  
will increase taxation  
imposed on CO<sub>2</sub>  
emissions.

The Energy of Nations  
Dr. Jeremy Leggett  
(Solarcentury)



## “2016 SUSTAINABLE CITY AWARD”, ACKNOWLEDGEMENT FOR A PROJECT WITH FUTURE VISION



In March 2016 Vilafranca del Penedès Town Council received the Award for Sustainable City in the category of Waste Management, marking an important milestone for the V4H project. The award, presented by the Environmental Forum Foundation, with support from the Ministry of the Environment, acknowledges the “energy recovery project using vine waste as biomass for the generation of energy and the reduction of fossil fuel consumption”.

## EPILOGUE

The V4H project has brought the LIFE13 ENV/ES/000776 project to a successful close and it has laid the foundations for the project to have continuity in the long term through Vilafranca’s municipal water board (EMAVSA) that has been converted into a municipal services company.

The actions carried out have been coordinated so that the project would prove successful in the territory of the Penedès, and, at the same time, we have remained fully aware that the expertise gained must be replicable in any other winemaking region interested in the initiative, whether in Catalonia, Spain or Europe.





With the support of and partnerships with:

