BODEGAS ENGUERA'S CARBON FOOTPRINT

INTRODUCTION

Today, it is acknowledged that the use of fossil fuels increases the concentration of greenhouse gases and, thus, global warming. The climate change experienced by our planet is a problem of global magnitude, regardless of the location of gas emissions. The purpose of the Kyoto Protocol, signed in 1997, was to reduce emissions by 5.2% during the period from 2008 to 2012. This reduction in pollutant gases is imposed on all professional sectors. Due to the known influence of the climate on agriculture in general and on the cultivation of vines in particular, it is important that the wine-making sector reduce its greenhouse gas emissions so that this problem does not worsen and there are no major repercussions in the vegetative cycle of the vine (Kerner and Rochard, IFV, 2007).

The tool used to analyse greenhouse gas emission is carbon footprint measurement. Once the value of the carbon footprint is known, methods focusing on its reduction must be implemented. There is no official method for assessing a carbon footprint, but there is a common point in all the methodologies: emissions are calculated by analysing the emission factors. These emission factors are based on the amount of greenhouse gases issued during the entire manufacturing process of a product.

The Carbon Proof method that was used to calculate Bodegas Enguera's carbon footprint is based on the evaluation method of France's carbon balance sheet and the International Wine Carbon Calculator Protocol developed in Australia. This document will list the different emission factors taken into account, the calculation method, the results obtained and the launch of different projects to compensate emissions.

1. MATERIAL AND METHODS

As we have already mentioned, the method used by Carbon Proof is based on the evaluation methods of France's carbon balance sheet and the International Wine Carbon Calculator Protocol. Both methods analyse pollutant gas emission factors. Their difference lies in the selection of emission factors and the inclusion or exclusion of carbon wells.

France's Carbon Balance Sheet Method (ICV – French Institute of the Vine and Wine):

This measurement method was developed by ADEME (French Agency for Environment and Energy Management) and is considered official in France. It is characterised by not taking into account carbon wells and includes an extensive list of emission factors. This method is the basis of the IFV and LCI (Life Cycle Inventory) methods, primarily aimed at the calculation of emissions by the French wine industry. The second method is different from the first in that it does not take into account emissions associated with the transportation of wine to customers. The choice of emission factors is made after defining the perimeter of said emissions. For the French wine-making sector, the perimeter in which emissions are calculated is defined between the production premises and the warehouses that dispatch the finished products. The data taken into account is from the last financial year. The emission factors are split into six main categories:

- Internal energy (energy, fuel and power equipment).
- Employee transportation (commuting to work, business trips, etc.).
- Supplies and their related load (weight of the supplies and the distances travelled to deliver them).
- Waste and its related load (weight, nature and destination).
- Fixing buildings and equipment.
- External services or service providers.

The balance is expressed in equivalent tonne of carbon or equivalent tonne of CO_2.

The International Wine Carbon Calculator Protocol Method:

The company Provisor Pty Ltd. was the precursor of this method, which is based on the PAS 2050 developed in the United Kingdom. It was agreed by different international wine institutes in the United States (Wine Institute of California), New Zealand (New Zealand Winegrowers), South Africa (Integrated Production of Wine South Africa) and Australia (Winemakers Federation of Australia). This method does not allow the carbon emissions level of products to be defined to calculate the amount of life cycles of said products, but rather gives a general idea of the way to calculate emissions associated with products from the wine-making sector.

The method splits emission factors into three areas. The first (scope 1) includes emissions directly related to the company's activity. The second (scope 2) includes the purchase of electricity and the emission of energy for heating or air conditioning. Lastly, the third (scope 3) is related to emissions resulting from the purchase of products or services from other companies. Emissions in the short-term carbon cycle are excluded from the field of application of the calculation: the fixing of buildings and equipment, employee trips and most of the phytosanitary and enological products used in making the wine and in viticulture.

Emission factors included in the Carbon Proof method:

The Carbon Proof method considers the carbon balance sheet method to be incomplete, since it does not take into account carbon sinks, such as the vine and cork oaks, from which cork stoppers are made. Furthermore, certain emission factors do not appear, such as most of the products used in viticulture

and enology. If we look at the carbon balance sheet methods, the IFV method is the closest to the Carbon Proof calculation expectations for our practical case, since it includes emissions produced by transportation to different points of sale, as well as those mentioned above.

The list of emission factors identified in the Carbon Proof method to measure the carbon footprint of a *bodega* appears in Table 1. The segmentation of emission factors in different groups was carried out in order to clarify certain concepts.

Emission Factor Groups	Emissions Factors
Gas oil except wine transportation	CO_2 emission per litre of agricultural gas oil
	CO_2 emission per litre of car gas oil
	CO_2 emission per litre of car petrol
Production, transportation and bottle recycling	CO_2 emission per litre of bottles produced and transported
	CO_2 emission per litre of recycled bottles
Production, transportation and recycling of other primary materials (cardboard, labels)	CO_2 emission per litre of cardboard produced and transported
	CO_2 emission per litre of cardboard recycled
Barrels	CO_2 emission per barrel produced and transported
Sales	CO_2 released per km travelled in the promotion of wines
	CO_2 released per km travelled in the transportation of wines
Electricity	CO_2 released per kW of electricity used
Gas	CO_2 released per m^3 of gas used
Fixings	CO_2 emission per m^2 of buildings
Employee trips	CO_2 released per km

Table 1: Emission factor groups and emission factors used for the calculation of Bodegas Enguera's carbon footprint, using the Carbon Proof method.

2. RESULTS AND DISCUSSIONS

The carbon footprint measurement was made during 2010. The result is expressed in equivalent g of CO_2 and is reflected in a histogram, making known all the emissions and sinks, as well as the final carbon footprint.

Figure 1 reflects the percentage pie chart of CO_2 emissions, which each production factor releases into the atmosphere by carrying out its operations.

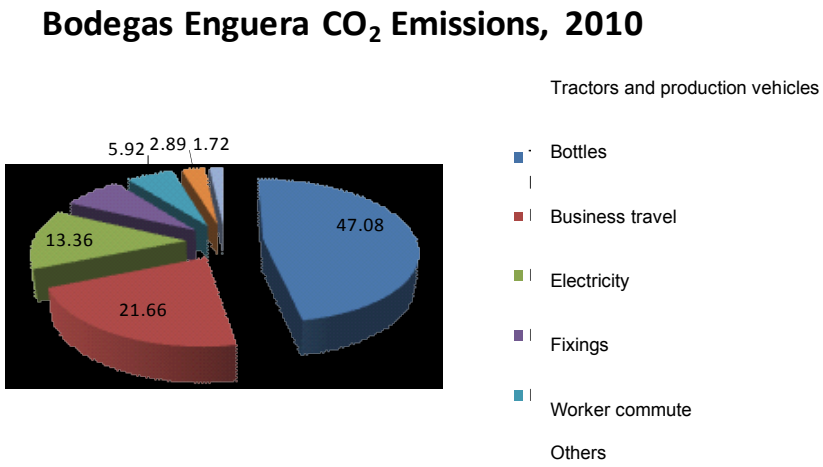

Figure 1: Distribution (%) of Bodegas Engue

This chart reflects the fact that the most significant proportion of CO_2 emissions is produced by the consumption of fuel by production vehicles (tractors, grape harvesters, diggers, etc.). Immediately after come the production, transportation and recycling of glass bottles. The production of bottles requires significant energy consumption by the machinery responsible for their manufacture, in addition to the consumption of fuel required for its transportation and recycling. The segment that consumes the third greatest amount of energy is sales. The marketing and distribution of wine encompasses the transportation of the product: lorry, plane or ship, usually all the way to travelling for business reasons, such as travelling to fairs, foreign market studies, etc. The fourth most significant sector of emissions is the consumption of electricity, whose value depends largely on the country's energy mix, that is, energy emissions produced by Spanish electricity, which in 2010 was 0.215 equivalent kg of CO2/kW. The energy mix is the mean consumption of different energy sources in the country: carbon fuel, nuclear energy, wind energy, solar energy, etc. With 5.92% of emissions, the fixing of buildings and structures is the fifth most significant emissions factor. This sector is responsible for all the emissions released into the atmosphere by the transportation and manufacture of fixings (buildings, warehouses, machinery, etc.). As long as the number of fixings remains the same, the number of emission to be recorded in this sector will not change. Emissions produced by employee travel are low in comparison with other sectors. Lastly, emissions from the production, transportation and recycling of other basic products (cardboard, labels and phytosanitary and enological products) can be considered negligible in comparison with those relating to bottle glass emissions. The production and transportation of the barrels Is low, partly because oak trees soak up CO_2 and also because Bodegas Enguera renews its barrel park with only 60 units a year. We have considered, however, that is was important to separate this area from the rest, especially from raw materials, in order to highlight its low contribution, particularly because some of the emissions necessary to produce and transport barrels are compensated by the oaks' storing of CO_2.

The results of the CO_2 sinks and the net carbon footprint (after deducting the sinks) appear in Figure 2.

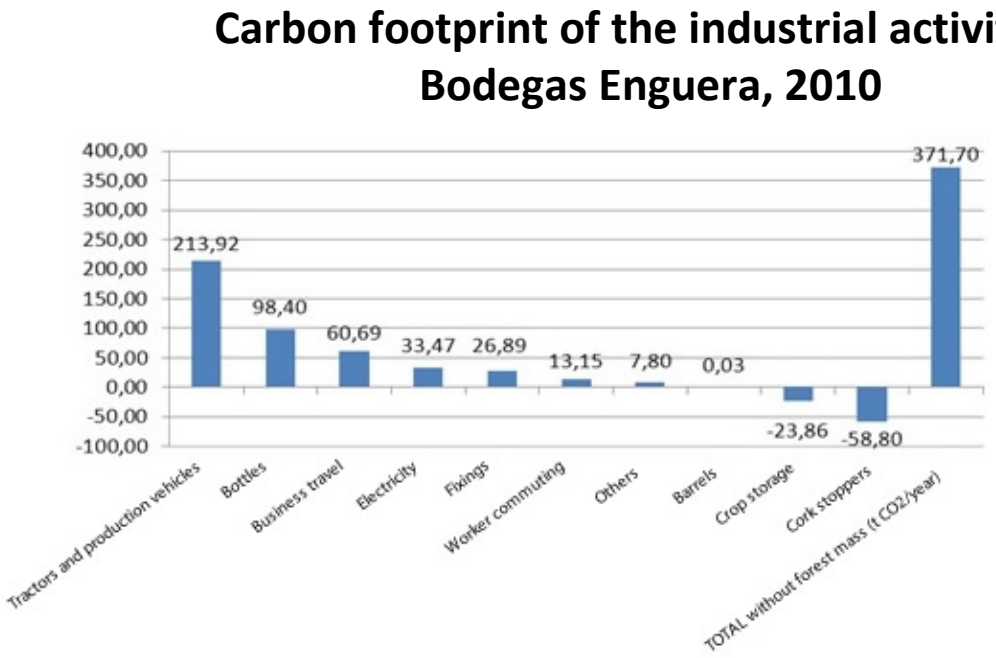

Figure 2: Carbon footprint values (eq. t CO_2/year) of Bodegas Enguera, 2010.

The value of Bodegas Enguera's carbon footprint for 2010 was 371.7 equivalent tonnes of CO_2.

The vine and the cork stoppers have enabled the blocking of 82.66 equivalent tonnes of CO_2, which significantly reduces the carbon footprint. The blocking by the vineyard is not based solely on the number of hectares, but on the production of kilos of grapes per surface unit. An increase in production per hectare will make the vineyard capture more CO_2. This can be explained by the process of photosynthesis. The sugar contact in the grapes shows the CO_2 captured in the growth of the vine, which is the only part truly blocked by the plant. The rest is returned into the atmosphere. It should be emphasised that CO_2 emissions from the fermentation of grapes during the vinification process have been deducted from the crop storage data shown in Figure 2.

The blocking of CO_2 in a cork stopper is related to the storage of the gas by cork oaks (tree species from which cork is extracted). From this capture of emissions, the necessary emissions are deducted in order to produce and transport the cork stoppers. The final balance is a CO_2 capture that is expressed in kg of equivalent CO2/cork and encompasses, according to Amorim (cork stopper manufacturer), 0.147 kg of equivalent CO_2 seized by a stopper. By using these stoppers, whose manufacturer is located in the same zone (Altura, Castellón), Bodegas Enguera blocked a total of 58.8 equivalent tonnes of CO_2 in 2010.

Possibilities for reducing the carbon footprint:

The possibilities for reducing the carbon footprint at a wine-making sector company are extensive. Some may be:

- Reducing the glass content of bottles by reducing their weight.
- Increasing the percentage of cork stoppers with respect to total corks used by reducing the proportion of synthetic corks that release more CO_2.
- Reducing the number of tractor rounds made by using harvesters and other work optimisation techniques.
- Using the train instead of the car or plane for business trips may help reduce the company's CO_2 emissions.
- Wooden stakes as pilots in the formation of trellises in the vineyard produce less CO_2 emissions than the production of steel bars.
- Promoting the use of nitrogen as opposed to carbon dioxide for inertisation could be another alternative.

CO_2 emissions compensation projects

The purpose is not only to compensate Bodegas Enguera's emissions as safely as possible, but also to foster environmental care at companies in the sector.

Bodegas Enguera, in addition to its 160 hectares of vineyard, owns 81 hectares of pine forest in the Valencia region. This forest soil covered in pinelands and Mediterranean mountain enables it to store 4.5 tonnes of equivalent CO_2 per hectare per year, according to data from the Valencia Regional Government. Therefore, these 81 hectares enable Bodegas Enguera to compensate 364.5 tonnes of CO_2 per year.

7.2 tonnes still need to be compensated for the 2010 balance sheet. According to studies conducted on the cork oak, one hectare planted with this species in the Iberian Peninsula can store up to 4 tonnes of equivalent CO_2 per year. So, in order to reconcile this balance sheet, Bodegas Enguera will participate in the planting of two hectares of cork oak. Through our Altura (Castellón) cork supplier, the planting of cork oaks is carried out in a recently burned mountain zone.

This action enables the bodega to achieve its environmental impact goal. Thanks to new plantations, CO_2 emissions are compensated, thereby neutralising the carbon footprint of Bodegas Enguera.

CONCLUSION

Bodegas Enguera's carbon footprint in 2010 was 371.7 equivalent tonnes of CO_2. From 2012, these emissions will be fully compensated thanks to the maintenance of 81 hectares of pine trees and the repopulation of two hectares of cork oaks. With its aim of improving knowledge of viticulture, through IMV we wish to share our experience in the field of carbon footprint measurement. Through the ONG Carbon Proof, other *bodegas*, cooperatives and organizations in the sector may use the methodology studied by our company.

BIOGRAPHY

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