INTEGRATED BENCHMARKING AND SELF-ASSESSMENT TOOL FOR THE WINE INDUSTRY. THE AMETHYST PROJECT

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INTRODUCTION

Lack of and access to information is often a barrier to energy efficiency improvement for many companies, and this is especially true for small and medium-sized enterprises (SMEs). This includes information on the current energy efficiency performance as well as identifying the opportunities for efficiency improvement. This is especially true for the European wine industry. The EU is the world's largest producer of wine, producing 70 percent of the world's wine. However, European wine makers are faced with increasing global competition and increasing energy costs, affecting the bottom line of many wine makers. This is especially worrisome, as wineries are found in rural areas and many are SMEs, reducing the degree to which they can respond effectively to these challenges.
Reducing energy use is an important way to increase the profitability of wineries across Europe. Combined wineries consume a considerable amount of energy, estimated at 125 PJ/year. Mostly electricity, often consumed at peak hours make the rising costs of power supply a major issue for many (small) wineries.
The AMETHYST project (EIE/06/114/SI2.442478) aimed to develop an integrated benchmarking and self-assessment tool for small and mid-scale wine manufacturers, as these are mostly faced with barriers on the lack of information. It builds on previous experience with the development of a similar energy efficiency tool for wineries in California (United States).
This benchmarking and self-assessment tool gives wineries insight in the relative energy efficiency of the winery, and the potential to reduce energy costs. It allows the user to identify and evaluate opportunities for energy (and water) efficiency improvement and to evaluate the reduction of operation costs. This will help the wineries around the European Union in developing an implementation plan for energy efficiency improvement.
The AMETHYST model is specifically developed for the countries France, Spain, Italy and Germany, together responsible for nearly 80% of EU wine production.
The benchmark tool is a software tool working in an Excel environment. It is available as free from internet (http://www.amethyst-project.eu/), together with a manual, in five languages: English, French, Italian, Spanish and German. Eight computer-assisted workshops have been given in important wine regions in the four Countries partner of the project.

MATERIALS AND METHODS

The developed tool is based on the Californian model "BEST winery" which was developed in 2005 by Lawrence Berkeley National Laboratory and Fetzer Vineyards, with financial support of the California Energy Commission (CEC).
In this tool a best winery is conceived which uses the best available technology from an energy and water point of view. The main steps of the wine-making process where energy and water are consumed, are mathematically described in order to calculate the consumptions of the best winery which are then compared with the real ones, giving two intensity indexes (EEI for energy, and WII for water). Values of these indexes > 100 mean that the real winery should improve its energy and water efficiency by means of possible measures suggested by the model.

Energy use

Much of the energy used in winemaking goes to refrigeration for fermentation cooling, cold stabilization and cold storage. The rest is mainly used for compressed air, hot water or electricity for pumping and bottling line motors, though compressed air demand is highly variable from winery to winery. Enclosed areas for storage and processes also require lighting and many are cooled. The biggest use of compressed air is in the presses for which the compressor must have sufficient capacity to charge the air receiver so it is ready for each pressing cycle. However, presses are only used about 1,200 hours or

less per year. Hot water is needed for cleaning barrels and equipment and for heating red wine ferments and yeast generator tanks. Other non-process use power is required for buildings and other miscellaneous administrative or maintenance applications.

Water use

The main use of water within the winery itself (excluding vineyards) is for cleaning. The major water use areas are the crush pad and press area, the fermentation tanks (both primary and malolactic fermentation), barrel washing, barrel soaking, the bottling line, and the cellars and barrel storage areas. Water is also used for humidification in the cellars and barrel storage areas, and other non-production uses at the winery, like toilets and sinks in office buildings and maintenance workshops.

Some wineries treat their own wastewater, while others send it to a municipal treatment plant. Many wineries have begun to use treated wastewater to irrigate vineyards or landscaping, or may use it for frost protection, fire protection or dust abatement.

In addition to increased costs for water, the more water that is used, the higher the costs are for wastewater disposal and for the energy required for water pumping and/or heating.

Energy and water efficiency opportunities

AMETHYST provides a menu of opportunities for energy and water efficiency. This menu can be used to examine specific energy efficiency opportunities and to identify a set of possible measures that can help wineries achieve maximum benefit, for the following sections: refrigeration; pumping; compressed air; motors; lighting; hot water supply; cogeneration (Combined Heat and Power), water.

For each measure the estimates for energy or water savings and payback periods are given based on data from “BEST Winery” properly up-dated.

RESULTS AND DISCUSSION

Development of the country versions of the tool

A specific version of the model was developed for Italy, France, Spain and Germany.

Starting from the original Californian model, the main wine types and processing steps typical of the partner countries were included (for example the sparkling wine module had to be developed ex novo).

Energy use was modelled as eleven main process steps:

- Receiving;
- Pressing;
- Thermovinification;
- Pre-fermentation cold treatment including process steps such a crio-maceration and must clarification;
- Fermentation either in tanks or barrels;
- Second fermentation for sparkling wines production;
- Malolactic fermentation either in tanks or barrels;
- Clarification, stabilization or electrodialysis;
- Aging and storage;
- Disgorging and yeast removal in sparkling wine production;
- Bottling.

In addition, we have separately calculated energy requirements for pumping and for additional miscellaneous uses, such as lighting, office equipment, water heating, space heating, and forklift operation.

Water consumption was modelled for use in crush pad and storage areas, barrel rooms, bottling, refrigeration, non-productive losses, cleaning barrels and bottling lines.

Some important key assumptions were made for calculation of the benchmark energy and water use: stainless steel tanks (isolated only in the stabilisation steps); a glycol base cooling system including a water cooling tower; the energy required for space heating is delivered by fuels and not by electricity; an energy-efficient winery stores barrels in natural caves or well-isolated rooms where air-conditioning is not required.

For each country specific oenological regions were selected, characterized for climatic aspects and inserted in the tool, since the ambient temperature is a main variable affecting the energy use.

The developed versions were tested in some wineries and then the final versions were up-loaded on the project web-sites (http://www.amethyst-project.eu/) and presented to local wineries during specific workshops which were the main means of dissemination of the tool.
The results from the workshops were a lot of interest and positive feedback especially on the material presented and given during the workshops and the contents of the tool. The main interest for the workshop participants were in terms of benchmark and comparison with the results of their competitors, rather than their global energy and water consumption; in other words, at present energy and water represent a small percentage of their overall costs, therefore the image they have is more important to them than the money they can save on their invoices.

CONCLUSIONS

Three key conclusions were drawn at the end of the project:

- There is a need for benchmarking information

In all countries the winemakers' industry is looking for benchmarking information, allowing comparison with the position of competitors, rather than indicative index data.

- Image is key

Energy is generally not a real problem for winemakers, as the cost is relatively low compared to overall costs. Therefore the main issue in energy and water optimization is often not money but image; this comes back to the first conclusion, as it explains why results are most interesting when compared with results of competitors.

- Results depend on the characteristics of the user

The size of the winery will have an impact on the results: during the workshops, it was noted that generally big wineries had much better results than the small ones. This is partly linked to the size effect, but also to the fact that the big wineries are more recent, and therefore often more optimized in terms of energy and water consumption, as using more modern process units.
It is likely that the use of the tool will not be spontaneous. Consultants will probably be needed to help disseminate it among the wineries. As several consultants in the different countries have shown an interest for this, it is a good sign that this dissemination will indeed take place.
Interesting options would be to compare the results obtained at several perimeters (within a region, from region to region, from country to country), but also to compare results for one winery for several years in a row.

Abstract The project AMETHYST aimed at developing a benchmarking and self-assessment tool for small and mid-scale wine producers. The tool gives wineries insight in the relative energy and water efficiency of the winery and the potentials to improve this position. Based on previous experiences with wineries it is estimated that savings of more than 20% can be obtained in a cost-effective way. This will result in reductions in peak electricity use, reduced CO_2 emissions, and improve the bottom line of wineries across the EU. This project is for 50% funded by the European Union Intelligent Energy for Europe programme, with other sponsors such as the Regione Piemonte, The Regulatory Council for the Rioja Wines and ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie, Del. Reg. Midi-Pyrénées).
This paper presents the concepts and steps followed in the development of the model and the results obtained during the presentation of the tool to European wineries.

Keywords. Benchmarking; efficiency; energy; water; wine industry.

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