Deliverable 2.5: Report on Prioritized Best Practices

WP2. Tuning up a self-assessment tool for wine (LCA-LCC based)

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ECO-PROWINE - Life Cycle perspective for Low Impact Winemaking and Application in EU of Eco-innovative Technologies

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1 Introduction

The wine market has a really significant size worldwide and especially in Europe. The global production of wine for 2009 (excluding juice and must) was estimated between 262.4and 269.6 MHl, i.e. -1.9 to +0.8% in relation to 2008 (266 MHl in the middle of the estimation range. The European Union is the world leader in terms:

- Vine growing area: Community vineyards account for almost 45% of all the world's areas under vines. Italy, France and Spain account for 86% of production and vineyard area in the EU;
- Wine production volume: about 65% of the world's wine production is managed by European winegrowers;
- Consumption: Consumption in EU shows a decrease for 2009 to reach 120,2 MHl vs 126,0 MHl in 2008 and 128,3 MHl in 2007. For the 2002/03 wine year, EU consumption is estimated at 130 million hl, i.e. almost 60% of world consumption;
- Trade, Intra-EU trade, still represents a major share of the total world volume, according to recent EU Commission data and during 2008/09 totaled 43.2 MHl. France, Italy and Spain form the leading trio of exporting countries, accounting for almost 60% of world exports (average quantities from 2001 to 2003 – including intra-EU trade).

The energy expended for the production of wine is enormous. Some studies indicate in 2.618 GJ the amount of energy required for processing of 1 tonne of grapes into a final product; 1.063 GJ/tonnes in the vineyard and 1.555 GJ/tonnes in the winery. Based on these values, the total energy requirement for the global winemaking industry (excluding bottle making and final product transport) can be estimated in over 105 PJ which represents a significant energy requirement, enough to supply, for example, all the space heating and hot water needs for 1.67 million households in the UK for a year.

The global GHG contribution of winemaking results at 153 kg CO2/tonne and 235 kg CO2/tonne for the vineyard and winery respectively. Taking into account bottle manufacturing and transportation, it has been estimated that the total carbon footprint could be an average of 2 kg of carbon per standard bottle resulting in a total carbon footprint for the global wine industry of 76.3 million tonnes of CO_2.

Solid and liquid residues, not treated in an appropriate way, can have serious impact on the environment. Winemaking activity is known to produce high amounts of wastewater (from 0,5 to 14liters for each liter of wine produced) with sometimes extremely high organic loads (COD 2.500-67.000 mg/L).It must be pointed out that Europe accounts for 65% of the global wine production, and that the large majority occurs in the southern countries namely Italy, France, Spain, Portugal and Greece, where climatic conditions impose an increased need for energy in winemaking and a more careful use of water resources.

Moreover, most of the production is concentrated in few regions, where grape growing is by far the biggest and almost exclusive agricultural activity, and the wine industry accounts for the largest employment source. For instance, wine in Languedoc-Roussillon in France represents 45% of the total final agricultural output and vineyard holdings account for more than 70% of all agricultural holdings. Similarly, grape-growing involves more than 50% of the total agricultural activity in Rioja and Castilla-La Mancha (Spain), Norte and Centro (Portugal), Champagne (France), Toscana (Italy), Sicily(Italy), Rheinland-Pfalz (Germany). In these regions, wine industry has an enormous environmental and economic impact.

The European wine sector constitutes a very diversified and dynamic sector in continuous evolution where the analysis of the environment impact caused by the production process is a critical need. Wine production has a considerable contribution to the value of final agricultural output in many producer Member States (particularly, in Spain: 5.4%, Luxemburg: 7.5%, Austria: 6.1%, Italy: 9.8%, France: 14.3%, Portugal: 16.8%). In spite of the fact that the principles of viticulture and wine production are the same throughout the world; natural, economic, social and technological conditions of individual producers can be very different.

To achieve the minimization of the environmental impacts, the companies' managers have to consider a global vision of the whole process, "from the cradle to the grave", so that the resources consumed and the wastes per unit of product are known and can be reduced. This approach involves the use of the Life Cycle Assessment as a new tool for the environmental management in order to achieve a higher degree of eco-efficiency.

The strategic idea is to foster this methodology among wine producers and, by this way, achieve a wide market uptake. The ECO-PROWINE LCA-LCC tool is a new tool offered to wine-makers and wine industry stakeholders in order to promote sustainable wine production around the EU and properly guide wine-makers towards more environmentally friendly and socio-economically aware production practices. The tool can be used for many purposes, from the self-assessment of a winery's sustainability performance to the suggestion of high-level improvement measures, benchmarking and environmental labeling.

The current deliverable focuses on the improvement measures included in the tool's operation and gives an overview of the best practices gathered by the consortium from literature research, own experiences and previous projects that the partners have implemented, trying, in parallel to properly prioritize them, mainly in terms of investment costs, since their environmental performance varies significantly even for the same measure, due to equipment diversities and efficiency, diversity of techniques used as part of a measure and domain/level of application (vineyard, winery, etc. – full, partial, experimental, combined application, etc.), different characteristics of wineries and landscapes etc.

2 Methodology

The main aim of the ECOPROWINE project is to provide the proper guidance to wine-makers around the EU (and beyond) so as to allow them to achieve significant reduction of the CO_2 emissions, energy and water consumption, along with waste quantity generated as part of the adopted wine-making processes. Moreover, the project aims at providing the necessary information to wine makers, in order to support them in improving their sustainability performance and ultimately contributing to the global sustainability improvement, through the motivation to consumers to purchase wine products that have been awarded with the ECOPROWINE sustainability label.

Obviously, the wine production, from the grape farming, has many factors that affect its overall environmental and sustainability performance. ECO-PROWINE will offer information on best practices that, if followed by the end-users of the tool, can increment the performance of the process evaluated. The improvement measures to be provided by the ECOPROWINE tool, will be provided in a qualitative form, since it is difficult to provide accurate assumptions on quantitative improvements these measures can achieve for the wineries. More specific guidance will be provided through on-site visits in the wineries and respective audits performed by the project consortium, in order to formulate tailor-made action plans for each winery and set realistic and achievable objectives, while estimating the exact cost for the selected improvement actions.

2.1 Data Sources

All the information provided within this deliverable, concerning the improvement measures and their prioritization/classification on the basis of the estimated cost for their implementation, have resulted from an extensive study and exploitation of the following types of sources:

- Data incorporated in studies and research conducted by the project consortium participants
- Data from studies conducted in the framework of national, EU and international projects
- Data from studies conducted from consulting companies and ESCOs worldwide, for their own wine-making costumers

2.2 Prioritization Approach

Given the collection of the aforementioned information and taking into consideration the overall operational framework of the ECOPROWINE tool, the following methodological steps have been followed towards the prioritization of best practices to be included in the tool and utilized in order to properly guide wine makers towards improving their sustainability performance:

1. Collection of information material and extensive study in order to isolate the improvement measures that can be exploited for the operation of the self-assessment tool.
2. Definition of the steps involved in the wine-making process and identification of the relevant inputs (responsible for the sustainability performance of a winery) that are linked to each of the aforementioned steps, based on the LCA-LCC adopted algorithm that has resulted from previous project activities (customized for the needs of the project).
3. Given the correlation between steps and inputs, the third step includes, at first the definition of correlations between best practices and steps of the wine-making process.
4. Subsequently, the next step focuses on drilling in the steps of the process and creating links between best practices and the inputs they refer to.
5. Since information gathered concerning best practices include also their characterization in terms of cost (no cost, low cost, middle cost, high cost), this step includes their prioritization per step and per input of the wine-making process. The definition of the cost categories has been made as follows, taking into account that the project refers to small wineries and wine-making enterprises:
    a. No Cost: 0 €
    b. Low Cost: <5.000 €
    c. Middle Cost: 5.000 € - 15.000 €
    d. High Cost: > 15.000 €

Given all the aforementioned information and results (correlations, priority list) the tool will be able to provide specific high-level guidance to wine-makers, for improving the sustainability performance of their wine production. More specifically, the tool will utilize the aforementioned information and results, while considering the results of the regression analysis performed upon the data provided by the participating in the tool wineries (leading to the identification of the problematic inputs and process steps) and the information of the winery assessed each time, towards presenting those improvement measures that fit to the profile, wine-making process and needs of each winery, thus avoiding to provide only some generic guidance. Even though improvements will be provided in a qualitative manner, they comprise useful inputs for the additional services offered by the ECOPROWINE consortium (onsite visits, audits, measurements and action plan drafting), since they will point out the steps and inputs of the process where the auditor has to focus on, in order to end-up to tailor-made action plans with accurate qualitative estimations of costs and improvements.

3 Best Practices in Wine-Making Processes

Based on the aforementioned methodology the following (extensive) list has been formulated for the purposes of the project and towards the realization of the ECOPROWINE tool operational model.

INPUTS	PROCESSES	IMPROVEMENTS/BEST PRACTICES
Fuel / gasoil	Transportation	Assure the correct vehicle maintenance. Keep tires aligned and with adequate pressure
		Transportation vehicles must comply with existing legislation governing environmental emissions and impacts.
		Use transport vehicles adapted to run on alternative fuels with low environmental impact (biodiesel, hydrogen, electricity, etc.)
		Have short distances between vineyards and celler
		Keep the grapes cool stored in the vineyards, instead of driving more often between celler and vineyard
		Use collection points to transfer grapes from different producers to the winery
		Transport routes will be managed efficiently, using as few resources as possible and ensuring the product is maintained in the best possible condition during transportation.
	Vineyard Management	Plant your vineyards on well suited areas, well aligned rows and slope inclinations;
		Sandy soil allows easier soil preparation and reduces fuel input
		A deep soil preparation before planting ensures less Energy input the years after
		Use of part resistance grapevines reduces the number of treatments
		Prefer well adapted varieties and rootstock to reduce water and soil treatments
		Prefer well adapted and well cared trellis system to reduce number of treatments and save time per treatment
		Use of concert, steel or plastic Materials for trellis system increase energy input
		Use of specific fertilizers in accordance with a soil inspection
		Use of a trop irrigation system instead of a overhead irrigation

		Cultivation of biodiversity areas and protection of landscape elements around vineyards helps to save energy
	Vineyard. Preparation of the soil	In plots with gradients over 8%, terraces should be constructed across the slope of the land rather than aggressive leveling with surrounding terrain.
	Vineyard. Planting	The rows of vines must be arranged in such a way to minimise soil erosion.
	Vineyard. Soil maintenance	In vine rows, use mechanical means (farming techniques), mulching, and/or herbicides when the previous methods do not allow adequate weed control.
		Plough when the soil conditions could be as favorable as possible to assure low tractor consumption. Control humidity and compaction of the soil.
		Plough works should be done going in depth 15-25cm in order to reduce tractor consumption
	Vineyard. Machinery	Have machinery checked and calibrated at least once every four years by an authorised centre.
		The plough tools used should be correctly dimensioned according the tractor. Tools must be correctly hooked with the tractor.
		Drive the tractor using the 60-80% of the nominal power. Adequate the working speed and the tools weigh.
		Assure the maintenance of the tractor, follow the constructor maintenance guide. Check the correct cleaning of the air filter and the fuel filter. Use the appropriate lubricants.
	Harvesting	Handpicking instead of machine harvest
	Winery process. Machinery	Maintain and inspect equipment, machinery, deposits, etc. in accordance with the specific conditions to ensure they work correctly and to avoid spillages, breaks, etc.
		Respect the maintenance plan for the machinery involved in the winery process. Inspection and check to assure the machinery perfect working order before the crop
	Overall	Take advantage of dominant winds and insolation in the design of the winery.
		Install automatic door closing systems to prevent air currents in the winery.
		Climatize the winery with 22ºC maximum in winter and 25ºC minimum in summer
		Use modulating burners in the boilers in order to regulate fuel consumption
Natural gas*	Overall	Change from natural gas to biomass or alternative energy sources
		Change to electric forkslifts and electric stacker trucks
		In case of water heating change to solar panels or heat exchange systems
		Take advantage of dominant winds and insolation in the design of the winery.
		Install automatic door closing systems to prevent air currents in the winery.

		Climatize the winery with 22ºC maximum in winter and 25ºC minimum in summer
	Thermal equipment	Check the refractories and the insulation of hot surfaces; increase the thickness or change them if necessary to reduce heat losses in order to increase the efficiency of the boilers.
		Check and maintain the boiler. Bleed the circuits to remove air, etc.
		Study the possibility of installing multiple lower power boilers, lighting them when necessary, so as to take advantage of the performance of devices yield properly
Electricity*	Overall	Install photovoltaic panels on the winery building roofs for in-house production of electric energy and to add a shadowing layer which helps keeping cellar temperature low during the summer season
		Use different/low energy light systems for working processes and winery standby times
		Save Energy by using time switches and motion detectors
		Use as much and as often daylight i.e. install daylight spots, avoid rooms without daylight
		Use of cogeneration (combined heat and power) is useful because of low energy demand
		Use in the Building envelope reflective roofing materials
		The integrity of insulation and vapor barriers may be inspected through the use of thermography
		Control system/scheduling of compressors
		Floating Head Pressure (FHP) involves additional fan power to reduce compressor power.
		Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on compressor motors.
		Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on condenser fans
		If the airflow is kept constant, reducing the inlet air temperature reduces energy used by the compressor
		Isolate buildings adequately
		Take advantage of the insulating conditions of the floor for parts of the winery that require stable conditions.
		Use independent thermostats, sectorizing by zones
		Climatize with automatic devices according to external temperatures
		Refrigeration systems, implant a proper maintenance, advanced control systems and operator training
		Use trigeneration in the refrigeration section because it reduces refrigeration energy use
		Replace air cooled condensers by evaporative condensers

		Use nighttime air cooling in the refrigeration system
		Install automatic purgers on evaporative condensers
		Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on evaporator (air unit) fans.
		Switch off lights when not occupied
		Separate different lighting circuits, especially in large areas, centralizing switches for better control of the system. Using control and saving devices for lamps (time switches, presence, etc.)
		Establish a regular cleaning plan to ensure proper lighting flow. Maintain clean rooms
		Use natural illumination when possible. Check the lighting levels according and adequate the devices to the activities developed in the area.
	Harvesting	Harvest at night or in the coolest hours of the day, to bring grapes at the winery at lower temperatures and reduce need of cooling of grapes or juices
	Destemming	Destemming machinery should be cleaned every day.
	Pumping	Use Variable-frequency drives (VFDs). VFDs match motor output to real-time load and can result in savings as high as 45 percent, depending on the application. They can also improve power factor, potentially resulting in fewer utility surcharges.
		Use multiple pumps. In many cases, using multiple pumps can be a cost-effective and efficient way to handle varying loads. This measure can save anywhere from 10 to 50 percent of energy used for pumping.
		Downsize your motors. Motors are often more powerful than necessary, producing needlessly high energy consumption and peak power draw. If possible, consider replacing such motors with smaller units
		Upgrade to high-efficiency motors. When considering whether to repair or replace aging motors, keep in mind that new, more-efficient units can save significant amounts of energy and yield short simple payback periods.
	Pressing	Use tube cooler instead or dryice cooling systems for cooling the mush instead of cooling chamber
		Use low pressure systems and short pressing times
		Use daylight at the crushpad, work during daytime
		Use gravity if possible, no pumpings means low energy input and a low input of phenols as well
		Use of pectolytic enzymes makes the pressing process faster and less energy intensive
	Cooling/Refrigeration	Tank insulation. Making sure that storage tanks used for effective way to reduce energy consumption. Multiple types of insulation exist, including spray-on (for large applications), foil-covered bubble wrap, and rigid foam. Though exact savings will vary depending on the specific tank and insulation used, this measure should generally reduce refrigeration energy use by about 25 percent.

		Nighttime air cooling. Bringing in low-temperature outside consumption and lower peak power use during the day in such places as warehouses, offices, and cold stabilization areas where outside-air circulation is not already required. Savings can easily add up to about 20 percent of overall cooling energy. Air during the night to provide cooling can reduce electricity
		Air infiltration through doors. By employing air-sealing and ensuring that doors are properly closed whenever possible, you can save as much as 15 percent of your total refrigeration energy consumption.
		Electrodialysis. Tartrates are small crystals that form when tartaric acid mixes with potassium in the wine at low temperatures. Although these crystals are tasteless and odorless, they are often considered to be unsightly and are frequently removed from wine using a process called cold stabilization, which requires wine to be chilled and then reheated. However, a process called electrodialysis (which uses membranes in conjunction with an electric current) can reduce energy consumption by nearly 90 percent compared to cold stabilization because the need for freezing and reheating is effectively eliminated. Because membrane replacement can be potentially costly, check with a manufacturer first to ensure that this measure will be economical for your particular winery.
		Install destratification fans in cellars. Destratification ceiling fans can help to maintain a consistent air temperature throughout a cellar, resulting in lower cooling requirements.
		Use modulating burners in the boilers in order to regulate fuel consumption
		In case of non-close cooling circuit for the deposits, recycle the cooling water for other uses.
		Reduced infiltration load from proper door management and tight sealing doors, energy requirements for refrigeration will be reduced due to reductions in infiltration.
		Use trigeneration in the refrigeration section because it lowers refrigeration energy use
		Implant a proper maintenance, advanced control systems and operator training
	Settling	Settling by gravity for at least 12 hours saves Energy compared to filter systems
		A sharp settling reduces the energy amount required for cooling the fermenting juice
		Energy intensive Processes like centrifugation and cross flow filtration needs high electricity input
	Fermentation	A slight increase of fermentation temperature, together with some adaptation of yeast strain and nutritional strategy choices, can reduce energy consumption without significant technical breakout
		Bacteria co-inoculum can anticipate the onset of malolactic fermentation and avoid wine heating needs during fall and winter.
		Use or store the off heat produced for cooling the fermenting juice
		Work with thermostats. If there are not used, place the cutting keys in accessible places.
		If necessary, increase the temperature of the wine, preferably heating the deposits using a closed cycle system.
		Isolating the warehouse malolactic fermentation is performed to prevent heat losses that may undermine this process.

	Clarification	Racking the wine more often makes it easier zu filter by the use of less filter aids
		Use of environment-friendly filters (allow an easy removal of the cake from the filter) (These filters are fitted with a dry cake discharge system using a gas such as nitrogen instead of water. This device is generally more expensive but involves a lower loss of wine)
	Stabilization	The use of stabilizing additives (metatartaric acid, carboxymethylcellulose, arabic gum, mannoproteins…) can substitute in some cases the cold treatment or the electrodialysis for tartaric stabilization, both very expensive in terms of use of electric energy.
	Bottling	The use of newglass or professional external located bottle cleaning stations
		Use of mobile commercial bottling lines provides an efficient input of energy
		Bottle whole days to prevent energy inefficient start up times
		Inspection and check the machinery before the bottling, synchronize all the devices, lubricate the transport belts, control online installation, etc.
	Cleaning	Fast cleaning (avoiding the drying up that makes cleaning more difficult)
		Prevention of spills
	Ageing in barrels	Check cooling piping isolation
	Fining and filtering	Electrodialysis uses selectively permeable membranes and an electric current to remove tartrates from wine
		Correct Sizing of Pipes and use more efficient pumps
	Electrical equipment	Install electronic starter drives in high power engines which startup frequently, so as to decrease the energy demand at startup (to control the intensity) and extend engine life.
		Use a frequency regulation in order to assure the electrical devices work properly
Biomass		Dispose of the broken pallets as biomass waste to energy system
		Biomass waste to energy system of the chopped stems resulting from pruning in the case of vineyards with phytosanitary problems
		Biomass waste of the leaves and stems resulting from thinning and canopy management in the case of vineyards with phytosanitary problems
Water (tap water)	Cleaning	Sweep floors. As much as 20 percent of the water used to wash floors can be saved by simply sweeping away solid debris first.
		Use of broom or squeegee for dry cleaning
		Screens should be placed in floor drains to prevent solid materials from being washed into the liquid waste stream
		The use of foaming guns which add air to the cleaner to make a foam and allow to increase the cleaning action, thanks to a longer time in contact with the side, thus improving the overall efficiency

		Use of high-pressure and low-flow spray nozzles for rinsing floor instead of using a normal water hose (if used in conjunction with quick-disconnect fittings, they are useful tools to eliminate the need to turn off the water at the valves)
		The use of high pressure (16 bars) with warm water, to clean floor, vats and barrels allows a stronger mechanical effect,
		The use of reactive nozzles to clean the press and its drains Use of warm water with the high pressure hoses
		Use high-pressure nozzles. By providing more-effective and focused cleaning, high-pressure nozzles can reduce water consumption by up to 40 percent compared to standard washing options, making them highly economical.
		Find and repair leaks. Leaks can occur any place where water is used and may add up to considerable water waste. Establishing an ongoing effort to detect and repair leaks can yield significant savings at low cost (a water leak from a tap may involve a water consumption of 200 hl per year).
		Create a water-management plan.
		The cellar must be designed too to make the cleaning and the water runoff easier: smooth floor with light slope (2-3%), suited area between the soil and the vats, nearby draining points, etc. are preferable.
		Easy-cleaned floor
		Floor with slope and evacuation point
		Fast cleaning (avoiding the drying up that makes cleaning more difficult)
		Wet before washing
		Efficient and complete removal of waste material from tanks and equipment prior to cleanup
		Prevention of spills
		Installation of watercounter
		Read daily the water counters
		Install some water counters linked to the wine making process specifically
		Store and reuse used cleaning water that was previously used for rinsing
		Use rain water for cleaning. Rain waters should not be mixed with the process wastewater stream to avoid any flow overloading of the treatment system and they must be collected in a separate rain water network
		Cleaning waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant
		Use of high-capacity vat
		The kind of vat is also important to reduce water consumption. Indeed, concrete vats with epoxy resin and stainless steel vats require less water for their cleaning thanks to a lower porosity.

		Cascaded rinse procedures for tank cleaning.
		Use good cleaning products
		Use closed systems for cleaning operations
		Use of low-volume/high-pressure washers, or use of equipment for mixing water jet and a compressed air stream which will reduce water consumption by 50-75% when compared to a low-pressure system
		Ozone tank cleaning of barrels, (ozone cleaning will generally eliminate the need for hot water in barrel cleaning)
		Use semi-automatic or automatic barrel washing systems.
		Clean the bottles preferably by blowing or using the minimum amount of water necessary to ensure efficient cleaning
		Upgrade the water-treatment system. By upgrading the water treatment system, you can reduce the number of times that bleed-off is needed each day, yielding large savings from reduced water consumption, chemical consumption (for water treatment), labor costs for maintenance, and the energy savings that result from cleaner heat-transfer surfaces. Upgrades may include the installation of automatic controls (to monitor water pH levels and the concentration of dissolved solids, and to add chemicals or bleed-off water as appropriate), make-up and blow-down submeters, side stream filtration, ozonation, and high-bonding chemical or physical treatment. Though the actual savings from upgrades will depend on the individual cooling-tower system, payback periods can be as short as six months, according to the Saving Water Partnership, a group of Oregon utilities that promote water conservation.
		In the bottle washers, water could be used for the last two rows of rinsing nozzles, and then collected and recycled for use in the previous rinsing nozzles prior to discharge.
		Daily cleaning of the bottling line. Dry cleaning (blowing)
		Install automatic quick closing valves to reduce the risk of leaks and discharges
	Cooling/Refrigeration	Use of storm water to operate cooling towers in preference to bore water, as this will substantially reduce the amount of water removal (bleeding) required to stop salts accumulating
		Reuse the cooling waters
		Cooling system in a closed circuit. It is highly recommended as it avoids spillage and waste
		Avoid using water streaming cooling because of its high water consumption.
		In the bottle washers, water could be used for the last two rows of rinsing nozzles, and then collected and recycled for use in the previous rinsing nozzles prior to discharge.
	General considerations	Installation a flow meter to measure the water consumption

		Registering periodically water consumption
		Checking pressure of water in the taps
		Check pipes connections and taps
Water, well, in ground	Irrigation	Installation of watercounter
		Read daily the water counters
		Install some water counters linked to the wine making process specifically
		Create a water-management plan.
		Reduce amount of irrigation water
		Irrigate and fertilize together
		Recycle irrigation plastic tubing and emitters
		Find and repair leaks. Leaks can occur any place where water is used and may add up to considerable water waste. Establishing an ongoing effort to detect and repair leaks can yield significant savings at low cost.
		Use drip irrigation instead of sprinkling
		Use variable speed pumping. You can avoid building rafts and / or storage tanks, very expensive to build
		Choose the correct dimensioning of the pumping facilities properly (not oversize).
		Ensure proper maintenance of pumps, check the technical documentation provided by the manufacturer, and perform a daily inspection of the pump operation. Annual inspection outside the irrigation season
		Control the pressure in the water network. Avoid using pressure reducing valves. Rearrange the distribution network, in turns with the same energy demand, can be adjusted in order to get the correct operation of the same, avoiding the pumping pressure in certain parts and the use of other reducing valves.
		Install drippers with a coefficient of variation lower than 5%. Droppers use little sensitive seals which are a function of the minimum pitch diameter and the water flow speed transmitter.
		In plots on sloping terrain, subsoiling must be performed to facilitate root system development and improve water infiltration, thus preventing erosion and enhancing soil hydric capacity.
		Ensure the correct adjustment of the pumping system, introduction of variable frequency drives for pump operation, improved yields in the drive equipment, automation control systems.
		Designing energy-optimized irrigation networks so as to improve the power factor. Decreased water consumption with the restructuring and modernization of the irrigation system

		In irrigation communities try to reorganize the distribution of water, it shifts energy demand
		Use irrigation techniques that ensure the most efficient water consumption and optimise water resources.
		Water must be analysed every year in the summer.
	Fertilization	For the production period (from year 3), a fertilisation plan must be established based according to the results of the soil analyses, the composition of irrigation water, yields, harvested crop quality, a visual inspection of the behavior of the plantation, the handling system and the type of soil.
Inorganic fertilizers	Fertilization	Minimizing the use of inorganic fertilizers
		Checking labels for information on toxicity, and choose the least toxic where possible
		Recycle fertilizer and soil amendment bags
		Irrigate and fertilize together
		Nutrients must be supplied mainly by the soil.
		Restrict the use of quick-release fertilizers to reduce contamination.
		Distribute the addition of nitrogenous fertilisers throughout the vegetative cycle.
Organic fertilizers	Fertilization	Recycle fertilizer and soil amendment bags
		Producing organic commercial fertilizers causes a negative energy input
		Build up a natural humus layer for a better storage of Nutrients
		Supply the nutrients preferably in the form of composted organic material.
		At least one quarter of nitrogenous contributions must consist of organic nitrogen obtained from well-prepared manures or composts.
		Maintain plant, natural or inducted cover to preserve soil fertility.
		Restrict the application of leaf-based fertilizers and only use them when fully justified after analysing the leaves or fruits in question, or in the event of clear deficiencies or problems documented in previous years.
		Carry out fertilisation plans to prevent the excessive contribution of nutrients that will not be used by plants and which may contaminate aquifers.
Insecticide General	Crop protection	Minimizing the use of insecticides
		Insurance that Material Safety Data Sheets (MSDS) are kept for all pesticides
		Using pesticides that will have the least impact on non-target organisms
		Avoiding spraying in adverse weather conditions

		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage
		Dispose of insecticide bags or drums according to laws and regulations
		Disposal of respirator mask filters according to laws and regulations
		Checking labels for information on toxicity, and choose the least toxic where possible
		Respect all beneficial autochthonous insects as fas as possible and only use selective pesticides when other control techniques are not viable.
Herbicide general	Crop protection	Minimizing the use of herbicides
		Insurance that Material Safety Data Sheets (MSDS) are kept for all herbicides
		Avoiding spraying in adverse weather conditions
		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage
		Dispose of herbicide bags or drums according to laws and regulations
		Disposal of respirator mask filters according to laws and regulations
		Checking labels for information on toxicity, and choose the least toxic where possible
		Elimination of plant remains and physical preparation of the terrain. Eliminate all roots, particularly if the previous crop was grapewine.
		Elimination of weeds, pathogens and pests using cropping techniques.
		In plantations on terrain previously cultivated with grapevine, the soil must be left for at least 4 years before this crop is cultivated again.
		Do not plant crops associated with grapevine on the same plot.
		Do not apply herbicides to the entire (100 %) surface area (not crop).
		In plantations with spontaneous plant cover during the autumn and winter, maintain this cover during that period.
		Pruning must contribute effectively to the control of vine yield and vigour, the establishment of adequate exposed leaf surface (EFSp)/crop ratio and the maintenance of an optimum microclimate of clusters and leaves, since this will provide qualitative and phytosanitary benefits.
		Use of cropping techniques that enhance production quality, such as green pruning (weeding and removal of lateral shoots), cluster thinning, leaf stripping, etc.
		The machinery used to apply phytosanitary products, herbicides, leaf fertilisers, etc. must be in perfect working order. The producer must check and calibrate the machinery on an annual basis.
		In pest and disease control, preference must be given to biological, biotechnical, cultural, physical and genetic methods rather than chemical methods.

		Weeds must be controlled by mechanical means whenever possible. However, whenever weeds cannot be controlled using farming machinery, herbicides must be used on a localised basis, preventing the dispersion that may occur if applied using small drop micro-sprinkling techniques.
		In addition to efficiency and selectivity, it is also very important to take into consideration the herbicide absorption coefficient, which must be high in order to reduce the risks of environmental contamination.
		In sandy soils, residual herbicides must not be used.
		Herbicides must be applied at the moment of maximum weed sensitivity, thus allowing minimal doses of active matter to be applied.
		If chemical products are used, treatments must, if possible, be applied locally to the plant or in the plot. Moreover, active matter should be alternated with other different treatment methods.
		Adopt all possible hygiene measures and cropping practices designed to reduce the impact of phytosanitary problems in the crop.
		Cropping must be performed in appropiate conditions to ensure grapes reach the winery in perfect condition.
Fungicide general	Crop protection	Checking labels for information on toxicity, and choose the least toxic where possible
		Avoiding spraying in adverse weather conditions
		Dispose of fungicide bags or drums according to laws and regulations
		Disposal of respirator mask filters according to laws and regulations
		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage
Copper	_	Less copper for plant protection prevents the use of systemic fungicides - bad for soil accumulation
		Plant protection only with copper causes more treatments per year, bad fuel input
		Observe national advices in number of treatments and permitted quantity
Sulphur		Regularly use of sulphur reduces the demand on systemic fungicides and acaricides
		Observe national advices in number of treatments and permitted quantity
		Keep distances between sulphur treatment and manual leafwork
Metabisulphite	Maceration	Processing healthy grapes without mold decreases the demand on KPS
		Topped vats and exclusion of oxigen reduces the need of KPS
		Well hygienic conditions reduces need of KPS
Gaseous SO2	Maceration	A Separate permission to receive Gaseous SO2 is used

		Use closed vats
		Lower fermentation temperatures
		Use of liquid solution at the fermentation vat respirator to decrease the amount of gases released
		The use of SO2 must be restricted to the minimum technologically necessary, taking into consideration the limits established.
		Limit the use of SO2 after completion of malolactic fermentation to the minimum technologically necessary, taking into account the limit established.
		Restrict the use of SO2 to the necessary minimum established.
		Restrict the use of SO2 to the minimum technologically necessary specified.
Sulphur dioxide	Maceration	A Separate permission to receive Gaseous SO2 is used
		Use closed vats
		Lower fermentation temperatures
		Use of liquid solution at the fermentation vat respirator to decrease the amount of gases released
Yeasts	Fermentation	Use of dry yeasts ensure a consistent fermentation at low temperatures
		Spontaneously fermentation may use more Energy by finishing fermentation
		Use preferably autochthonous yeasts and, when technologically appropriate, use the selected yeasts.
		Use natural additives whenever possible.
Diammonium phosfate	Fermentation	Nutrients at all need to be used in case of insufficient supply. Must analyses are recommendet
		Adequate supply of nutrients ensures a quick end fermentation
Ammonium sulfate	Fermentation	Nutrients at all need to be used in case of insufficient supply. Must analyses are recommendet
		Adequate supply of nutrients ensures a quick end fermentation
Sugar	Fermentation	Add RTK for chaptalisation instead of sugar
		Waive the add of sugar by aiming a high level of natural sugar content
		Machines to concentrate juice (i.e. reverse osmosis, vacuum destillation) by extraction of water needs a lot Energy
egg albumin	clarification	The use of protein based fining products with allergenic potential (casein, albumin) have to be declared at the label

milk casein	clarification	
isinglass	clarification	The use of protein based fining products at all produces a negative effect concerning water, material and energy and is not part of a good oenological practice
Gelatin	clarification	
Bentonite	clarification	Used bentonite to trash after dewatering
		Use bentonite instead of thermic stabilisation
wood barrels	aging/storage	Use of 3 hl Barrels or bigger ones instead of 225 lit.
		Clean out the barrels at a washing station helps to save energy and water
Glass bottles	bottling	Use recycled glass material
		Use light weighted bottles
		Bottles must be handled accordingly to prevent them from breaking and spilling wine.
		Conditions that may facilitate bottle breakage will be reduced to a minimum.
		Empty bottles (glass bottles) will be transferred to the nearest recycling point for subsequent processing.
paper labels	bottling	Use easy removeable labels
		Use of waterproof labels
adhesive	bottling	Reduction in the amount of glue used in packaging
plastic closures	bottling	Bad for quality of the wine at all, use screwcap and save in this way the capsule

cork closures	bottling	Except for a bad water balance, natural corks produces less emissions than other closures
aluminium closures	bottling	Needs a lot of Energy in production, therefore possible to recycle and no need of additional capsules
cardboard boxes	bottling	Use of recycling used materials (e.g. cardboard) wherever possible
		Use cardboard boxes with eco-label
		Use thin inserts and no over-packaging
plastic capsules	bottling	Not needed at bottles with screwcap
aluminium capsules	bottling	Needs a lot of Energy in production, therefore possible to recycle
detergent	cleaning	Use hot water and clean shortly after work
		Cleaning chemicals minimization
	bottling	Prevent the use of chlorinated chemicals
		Do some neutralisation before dumping the chemicals down the drain
		Use a professional maybe external bottle cleaning station
		Use steam for sterilisation of the bottling line
		If cleaning products are used, use the most suitable product according to the type of dirt and the recommended doses.
		Use of foaming gungs
		Use cleaners as paracetic which eliminates the need to rinse
		Consider to heat water from a residual heat source. Use this hot water for cleaning, thereby reducing the use of detergents
Wastewater Produced	Treatment	Flow equalization for the effluent produced by a winery through temporary storage
		Equalization tank
		Segregation of the different waste streams based on strength. It allows less contaminated waste streams to be discharged directly to the sewer after screening, thus reducing the volume of liquid waste that needs to be treated
		Domestic waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant,
		Septage removal according to laws and regulations
		Cleaning waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant

		Pomaces distillation
		Use of high-capacity vat
		Pretreatment screens
		Grit chamber
		Purify dirty water according to its contamination characteristics before discharging.
		Install a water separation network: dirty water (processing water and sewage) and rainwater.
	Reception	The vehicle or boxes must be left in an area ready for washing and dirty water must be collected.
	Destemming	Stemss must be collected and stored directly in a watertight container to prevent run-off of liquid effluents, and controlled accordingly.
	Ageing in barrels	Remove completely the wine from the barrels before cleaning. Cleaning water must be sent to the treatment plant
	Stabilization	Reduce wastewater: Separate the sewage system from the rainwater collection system, in order to send to the sewage system only effluents
		Reduce wastewater: Removing solid content –installation of mesh screens
		Recycling some of the rinse water
		Use growing algae in order to reduce water waste
		Production of fungals proteins using wastewater from wineries
		Making dry cleaning operations
		High pressure with warm water
	Bottling	Don't use caustic soda for bottle cleaning in the first use
	Cleaning	Ensure adequate control of all residues produced during the cleaning processes.
		Clean machinery, deposits, piping and equipment using pressurised hot water.
		First clean the deposit with only a little water in order to collect it and use as by-product if possible.
		Then clean the deposit thoroughly with a large amount of water for subsequent use.
		When cleaning sets of deposit, transfer the dilution from one deposit to another until the solution is no longer effective and then check the deposits.
		When cleaning floors, dry clean before cleaning with water, and then collect any solids and deposit them in a container.
		Clean common asphalted areas using mechanical sweepers or pressure systems with a closing or locking device on the nozzle.

		Control cleaning temperature
		Automatic cleaning systems
		Use washing water in a serial process, use the leaving water from washing the stemmer (after screening) for the first wash of barrel tanks, etc.
		Collect in the same tank water from the first wash presses and barrels, reuse it for the first wash of different barrels and tanks, so it could be a high concentration of pomace in water in order to be sold with pomace waste and feces
Organic solid waste (pomace, lees etc.)	Treatment	Centrifugation of wine from lees
		Wine and must lees have to be stored in a separate vat and can be filtered or salvaged for further distillation or spreading.
		The first cleaning water coming from the cleaned vat, which is highly polluted, can be added to the lees.
		Grit chamber
		Incorporate pomace into vineyard
		Incorporate grape rachis into vineyard
		Deliver pomace to compost facility
		Deliver grape rachis to compost facility
		Lawn cuttings and chipped brush to compost
		Use grilles to retain thick solid residue.
		Biological treatment discontinous: aerated storage
		Biological treatment continous
		Low-rate activated sludge
		Spreading
		Physical treatments: evaporation, Thermo-concentration, evapo-concentration, ultrafiltration
		On-site composting before land spreading in other land
		In order to reduce solid waste: Off-site composting
		Collect leeds and send them to a distillery
		Reduce solid waste using composting

		Reduce solid waste with extraction of polyphenols
	Reception	After unloading, any solid waste adhered to the interior of the vehicle or the boxes must be placed in adequate containers.
		If a selection table is used, waste must be deposited in a special container.
		A selection table should be used to remove herbaceous debris or grapes in poor condition.
		Stock the solid waste to compost when possible.
	Destemming	Solid waste should be compacted or crushed for direct application in the field or for improving composting.
	Fermentation	Collect as much pomace as possible from the bottom of the deposit.
	Pressing	Deposit the dry pomace in closed containers that prevent overflows and control them accordingly for evaluation purposes.
		If the pomace is expelled through a recipient, make sure it is correctly positioned beforehand to prevent any type of overflow.
		If the pomace is transported to the press by a paste pump, check all the connections beforehand to prevent wine spillages.
		Empty the paste contained in the hoses into a recipient or deposit to prevent it from overflowing when the connections are disconnected.
		Place trays or recipients to collect leaking wine released during pressing.
		Empty the dry pomace and remove any solid residue from the press.
		Use compressed air as cold as possible (external) in order to reduce compressor consumption.
	Storage	Store in watertight containers and deal with lees and solid remains still on the bottom of the deposit after emptying.
	Fining and filtering	Collect and control the residue and by-products of the fining agent accordingly without pouring down drains.
		Collect and control the filtering residue and by-products (diatomaceous earth, cellulose layers...), without pouring down drains.
		Collect and control the residue in order to sell it for distillation
	Machinery	Ensure adequate control of all residues produced in maintenance processes.
	cleaning	After emptying, and whenever possible, dry clean the equipment, deposits, etc. to eliminate and control residue (grapes, stems, lees, and pomace).
Non-recyclable waste		Incandescent, and fluorescent bulbs to trash
		Electrical ballasts disposed as toxic waste
		Dispose of bathroom paper according to laws and regulations
		Disposal of spent fire chemicals by service company

paper (recycling)		Recycle waste paper
		Bottling line label rejections recycled with office paper after baling
		Fiberboard cartons for recycling after baling
plastic (recycling)		Use of returnable or recyclable packaging. However, it should be noted that this practice may involve a significant increase in water use for washing. Therefore, the benefits associated with the reduction in raw material consumption must be weighed against the impact of increased water consumption and wastewater discharge before a facility decides to rely on recycled packaging
		Recycle HDPE containers
		Recyclepolyethylene bottles
glass (recycling)		Use of returnable or recyclable packaging. However, it should be noted that this practice may involve a significant increase in water use for washing. Therefore, the benefits associated with the reduction in raw material consumption must be weighed against the impact of increased water consumption and wastewater discharge before a facility decides to rely on recycled packaging
		Recycle glass bottles
		Broken glass and tasting room bottles for recycling
metals (recycling)		Rrecycle aluminum cans
		Tasting room capsules and bottling line broken capsules segregated and recycled for tin, antimony or aluminum

4 Prioritization Tables

The following table expands the aforementioned table, including also the classification of improvement measures/best practices in terms of cost. Prioritized improvements include No Cost and Low Cost improvements and they are clearly highlighted in the following tables in contrast with Middle and High Cost measures.

INPUTS	PROCESSES	IMPROVEMENTS/BEST PRACTICES	COST
Fuel / gasoil	Transportation	Assure the correct vehicle maintenance. Keep tires aligned and with adequate pressure	Low Cost
		Transportation vehicles must comply with existing legislation governing environmental emissions and impacts.	Medium Cost
		Use transport vehicles adapted to run on alternative fuels with low environmental impact (biodiesel, hydrogen, electricity, etc.)	High Cost
		Have short distances between vineyards and celler	No Cost
		Keep the grapes cool stored in the vineyards, instead of driving more often between celler and vineyard	Low Cost
		Use collection points to transfer grapes from different producers to the winery	No Cost
		Transport routes will be managed efficiently, using as few resources as possible and ensuring the product is maintained in the best possible condition during transportation.	Low Cost
	Vineyard Management	Plant your vineyards on well suited areas, well aligned rows and slope inclinations;	No Cost
		Sandy soil allows easier soil preparation and reduces fuel input	No Cost
		A deep soil preparation before planting ensures less Energy input the years after	Medium Cost
		Use of part resistance grapevines reduces the number of treatments	No Cost
		Prefer well adapted varieties and rootstock to reduce water and soil treatments	No Cost
		Prefer well adapted and well cared trellis system to reduce number of treatments and save time per treatment	Low Cost
		Use of concret, steel or plastic Materials for trellis system increase energy input	Medium Cost
		Use of specific fertilizers in accordance with a soil inspection	Low Cost

		Use of a trop irrigation system instead of a overhead irrigation	Medium Cost
		Cultivation of biodiversity areas and protection of landscape elements around vineyards helps to save energy	Low Cost
	Vineyard. Preparation of the soil	In plots with gradients over 8%, terraces should be constructed across the slope of the land rather than aggressive leveling with surrounding terrain.	Low Cost
	Vineyard. Planting	The rows of vines must be arranged in such a way to minimise soil erosion.	No Cost
	Vineyard. Soil maintenance	In vine rows, use mechanical means (farming techniques), mulching, and/or herbicides when the previous methods do not allow adequate weed control.	Low Cost
		Plough when the soil conditions could be as favorable as possible to assure low tractor consumption. Control humidity and compaction of the soil.	No Cost
		Plough works should be done going in depth 15-25cm in order to reduce tractor consumption	No Cost
	Vineyard. Machinery	Have machinery checked and calibrated at least once every four years by an authorised centre.	Low Cost
		The plough tools used should be correctly dimensioned according the tractor. Tools must be correctly hooked with the tractor.	No Cost
		Drive the tractor using the 60-80% of the nominal power. Adequate the working speed and the tools weigh.	No Cost
		Assure the maintenance of the tractor, follow the constructor maintenance guide. Check the correct cleaning of the air filter and the fuel filter. Use the appropriate lubricants.	No Cost
	Harvesting	Handpicking instead of machine harvest	Medium Cost
	Winery process. Machinery	Maintain and inspect equipment, machinery, deposits, etc. in accordance with the specific conditions to ensure they work correctly and to avoid spillages, breaks, etc.	Low Cost
		Respect the maintenance plan for the machinery involved in the winery process. Inspection and check to assure the machinery perfect working order before the crop	Low Cost
	Overall	Take advantage of dominant winds and insolation in the design of the winery.	High Cost
		Install automatic door closing systems to prevent air currents in the winery.	Medium Cost
		Climatize the winery with 22ºC maximum in winter and 25ºC minimum in summer	No Cost
		Use modulating burners in the boilers in order to regulate fuel consumption	Medium Cost
Natural gas*	Overall	Change from natural gas to biomass or alternative energy sources	High cost
		Change to electric forkslifts and electric stacker trucks	High cost
		In case of water heating change to solar panels or heat exchange systems	High cost

		Take advantage of dominant winds and insolation in the design of the winery.	High Cost
		Install automatic door closing systems to prevent air currents in the winery.	Medium Cost
		Climatize the winery with 22ºC maximum in winter and 25ºC minimum in summer	No Cost
	Thermal equipment	Check the refractories and the insulation of hot surfaces; increase the thickness or change them if necessary to reduce heat losses in order to increase the efficiency of the boilers.	Medium Cost
	Thermal equipment	Check and maintain the boiler. Bleed the circuits to remove air, etc.	Low Cost
	Thermal equipment	Study the possibility of installing multiple lower power boilers, lighting them when necessary, so as to take advantage of the performance of devices yield properly	High Cost
Electricity*	Overall	Install photovoltaic panels on the winery building roofs for in-house production of electric energy and to add a shadowing layer which helps keeping cellar temperature low during the summer season	High Cost
Electricity*	Overall	Use different/low energy light systems for working processes and winery standby times	Low Cost
Electricity*	Overall	Save Energy by using time switches and motion detectors	Low Cost
Electricity*	Overall	Use as much and as often daylight i.e. install daylight spots, avoid rooms without daylight	Medium Cost
Electricity*	Overall	Use of cogeneration (combined heat and power) is useful because of low energy demand	High cost
Electricity*	Overall	Use in the Building envelope reflective roofing materials	Medium Cost
Electricity*	Overall	The integrity of insulation and vapor barriers may be inspected through the use of thermography	Low Cost
Electricity*	Overall	Control system/scheduling of compressors	Low Cost
Electricity*	Overall	Floating Head Pressure (FHP) involves additional fan power to reduce compressor power.	Medium Cost
Electricity*	Overall	Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on compressor motors.	Low Cost
Electricity*	Overall	Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on condenser fans	Low Cost
Electricity*	Overall	If the airflow is kept constant, reducing the inlet air temperature reduces energy used by the compressor	Low Cost
Electricity*	Overall	Isolate buildings adequately	Medium Cost
Electricity*	Overall	Take advantage of the insulating conditions of the floor for parts of the winery that require stable conditions.	Low Cost
Electricity*	Overall	Use independent thermostats, sectorizing by zones	Low Cost
Electricity*	Overall	Climatize with automatic devices according to external temperatures	Medium Cost
Electricity*	Overall	Refrigeration systems, implant a proper maintenance, advanced control systems and operator training	No Cost

		Use trigeneration in the refrigeration section because it reduces refrigeration energy use	High Cost
		Replace air cooled condensers by evaporative condensers	Medium Cost
		Use nighttime air cooling in the refrigeration system	Low Cost
		Install automatic purgers on evaporative condensers	Low Cost
		Adjustable Speed Drives (ASDs)/Variable Frequency Drives (VFDs) on evaporator (air unit) fans.	Low Cost
		Switch off lights when not occupied	No Cost
		Separate different lighting circuits, especially in large areas, centralizing switches for better control of the system. Using control and saving devices for lamps (time switches, presence, etc.)	Low Cost
		Establish a regular cleaning plan to ensure proper lighting flow. Maintain clean rooms	No Cost
		Use natural illumination when possible. Check the lighting levels according and adequate the devices to the activities developed in the area.	No Cost
	Harvesting	Harvest at night or in the coolest hours of the day, to bring grapes at the winery at lower temperatures and reduce need of cooling of grapes or juices	Low Cost
	Destemming	Destemming machinery should be cleaned every day.	Low Cost
	Pumping	Use Variable-frequency drives (VFDs). VFDs match motor output to real-time load and can result in savings as high as 45 percent, depending on the application. They can also improve power factor, potentially resulting in fewer utility surcharges.	Low Cost
		Use multiple pumps. In many cases, using multiple pumps can be a cost-effective and efficient way to handle varying loads. This measure can save anywhere from 10 to 50 percent of energy used for pumping.	Medium Cost
		Downsize your motors. Motors are often more powerful than necessary, producing needlessly high energy consumption and peak power draw. If possible, consider replacing such motors with smaller units	High Cost
		Upgrade to high-efficiency motors. When considering whether to repair or replace aging motors, keep in mind that new, more-efficient units can save significant amounts of energy and yield short simple payback periods.	High Cost
	Pressing	Use tube cooler instead or dryice cooling systems for cooling the mush instead of cooling chamber	Medium Cost
		Use low pressure systems and short pressing times	High cost
		Use daylight at the crushpad, work during daytime	No Cost
		Use gravity if possible, no pumpings means low energy input and a low input of phenols as well	No Cost
		Use of pectolytic enzymes makes the pressing process faster and less energy intensive	Low Cost

	Cooling/Refrigeration	Tank insulation. Making sure that storage tanks used for effective way to reduce energy consumption. Multiple types of insulation exist, including spray-on (for large applications), foil-covered bubble wrap, and rigid foam. Though exact savings will vary depending on the specific tank and insulation used, this measure should generally reduce refrigeration energy use by about 25 percent.	Low Cost
		Nighttime air cooling. Bringing in low-temperature outside consumption and lower peak power use during the day in such places as warehouses, offices, and cold stabilization areas where outside-air circulation is not already required. Savings can easily add up to about 20 percent of overall cooling energy. Air during the night to provide cooling can reduce electricity	No Cost
		Air infiltration through doors. By employing air-sealing and ensuring that doors are properly closed whenever possible, you can save as much as 15 percent of your total refrigeration energy consumption.	No Cost
		Electrodialysis. Tartrates are small crystals that form when tartaric acid mixes with potassium in the wine at low temperatures. Although these crystals are tasteless and odorless, they are often considered to be unsightly and are frequently removed from wine using a process called cold stabilization, which requires wine to be chilled and then reheated. However, a process called electrodialysis (which uses membranes in conjunction with an electric current) can reduce energy consumption by nearly 90 percent compared to cold stabilization because the need for freezing and reheating is effectively eliminated. Because membrane replacement can be potentially costly, check with a manufacturer first to ensure that this measure will be economical for your particular winery.	High Cost
		Install destratification fans in cellars. Destratification ceiling fans can help to maintain a consistent air temperature throughout a cellar, resulting in lower cooling requirements.	High Cost
		Use modulating burners in the boilers in order to regulate fuel consumption	Medium Cost
		In case of non-close cooling circuit for the deposits, recycle the cooling water for other uses.	Low Cost
		Reduced infiltration load from proper door management and tight sealing doors, energy requirements for refrigeration will be reduced due to reductions in infiltration.	No Cost
		Use trigeneration in the refrigeration section because it lowers refrigeration energy use	High Cost
		Implant a proper maintenance, advanced control systems and operator training	High Cost
	Settling	Settling by gravity for at least 12 hours saves Energy compared to filter systems	No Cost
		A sharp settling reduces the energy amount required for cooling the fermenting juice	Medium Cost
		Energy intensive Processes like centrifugation and cross flow filtration needs high electricity input	High cost
	Fermentation	A slight increase of fermentation temperature, together with some adaptation of yeast strain and nutritional strategy choices, can reduce energy consumption without significant technical breakout	No Cost
		Bacteria co-inoculum can anticipate the onset of malolactic fermentation and avoid wine heating needs during fall and winter.	Low Cost
		Use or store the off heat produced for cooling the fermenting juice	Medium Cost
		Work with thermostats. If there are not used, place the cutting keys in accessible places.	Low Cost

		If necessary, increase the temperature of the wine, preferably heating the deposits using a closed cycle system.	Low Cost
		Isolating the warehouse malolactic fermentation is performed to prevent heat losses that may undermine this process.	Medium Cost
	Clarification	Racking the wine more often makes it easier zu filter by the use of less filter aids	Low Cost
		Use of environment-friendly filters (allow an easy removal of the cake from the filter) (These filters are fitted with a dry cake discharge system using a gas such as nitrogen instead of water. This device is generally more expensive but involves a lower loss of wine)	Low Cost
	Stabilization	The use of stabilizing additives (metatartaric acid, carboxymethylcellulose, arabic gum, mannoproteins…) can substitute in some cases the cold treatment or the electrodialysis for tartaric stabilization, both very expensive in terms of use of electric energy.	High Cost
	Bottling	The use of newglass or professional external located bottle cleaning stations	Low Cost
		Use of mobile commercial bottling lines provides an efficient input of energy	Low Cost
		Bottle whole days to prevent energy inefficient start up times	Low Cost
		Inspection and check the machinery before the bottling, synchronize all the devices, lubricate the transport belts, control online installation, etc.	Low Cost
	Cleaning	Fast cleaning (avoiding the drying up that makes cleaning more difficult)	No Cost
		Prevention of spills	No Cost
	Ageing in barrels	Check cooling piping isolation	Low Cost
	Fining and filtering	Electrodialysis uses selectively permeable membranes and an electric current to remove tartrates from wine	Medium Cost
		Correct Sizing of Pipes and use more efficient pumps	Low Cost
	Electrical equipment	Install electronic starter drives in high power engines which startup frequently, so as to decrease the energy demand at startup (to control the intensity) and extend engine life.	Low Cost
		Use a frequency regulation in order to assure the electrical devices work properly	No Cost
Biomass		Dispose of the broken pallets as biomass waste to energy system	Low Cost
		Biomass waste to energy system of the chopped stems resulting from pruning in the case of vineyards with phytosanitary problems	Low Cost
		Biomass waste of the leaves and stems resulting from thinning and canopy management in the case of vineyards with phytosanitary problems	Low Cost
Water (tap water)	Cleaning	Sweep floors. As much as 20 percent of the water used to wash floors can be saved by simply sweeping away solid debris first.	Low Cost
		Use of broom or squeegee for dry cleaning	Low Cost
		Screens should be placed in floor drains to prevent solid materials from being washed into the liquid waste stream	Low Cost

		The use of foaming guns which add air to the cleaner to make a foam and allow to increase the cleaning action, thanks to a longer time in contact with the side, thus improving the overall efficiency	Low Cost
		Use of high-pressure and low-flow spray nozzles for rinsing floor instead of using a normal water hose (if used in conjunction with quick-disconnect fittings, they are useful tools to eliminate the need to turn off the water at the valves)	Low Cost
		The use of high pressure (16 bars) with warm water, to clean floor, vats and barrels allows a stronger mechanical effect,	Low Cost
		The use of reactive nozzles to clean the press and its drains Use of warm water with the high pressure hoses	Low Cost
		Use high-pressure nozzles. By providing more-effective and focused cleaning, high-pressure nozzles can reduce water consumption by up to 40 percent compared to standard washing options, making them highly economical.	Low Cost
		Find and repair leaks. Leaks can occur any place where water is used and may add up to considerable water waste. Establishing an ongoing effort to detect and repair leaks can yield significant savings at low cost (a water leak from a tap may involve a water consumption of 200 hl per year).	Low Cost
		Create a water-management plan.	Medium Cost
		The cellar must be designed too to make the cleaning and the water runoff easier: smooth floor with light slope (2-3%), suited area between the soil and the vats, nearby draining points, etc. are preferable.	High cost
		Easy-cleaned floor	Medium Cost
		Floor with slope and evacuation point	Medium Cost
		Fast cleaning (avoiding the drying up that makes cleaning more difficult)	No Cost
		Wet before washing	No Cost
		Efficient and complete removal of waste material from tanks and equipment prior to cleanup	No Cost
		Prevention of spills	No Cost
		Installation of watercounter	Low Cost
		Read daily the water counters	No Cost
		Install some water counters linked to the wine making process specifically	Low Cost
		Store and reuse used cleaning water that was previously used for rinsing	Low Cost
		Use rain water for cleaning. Rain waters should not be mixed with the process wastewater stream to avoid any flow overloading of the treatment system and they must be collected in a separate rain water network	Low Cost
		Cleaning waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant	Low Cost
		Use of high-capacity vat	High Cost

		The kind of vat is also important to reduce water consumption. Indeed, concrete vats with epoxy resin and stainless steel vats require less water for their cleaning thanks to a lower porosity.	High Cost
		Cascaded rinse procedures for tank cleaning.	Low Cost
		Use good cleaning products	No Cost
		Use closed systems for cleaning operations	High Cost
		Use of low-volume/high-pressure washers, or use of equipment for mixing water jet and a compressed air stream which will reduce water consumption by 50-75% when compared to a low-pressure system	Low Cost
		Ozone tank cleaning of barrels, (ozone cleaning will generally eliminate the need for hot water in barrel cleaning)	Low Cost
		Use semi-automatic or automatic barrel washing systems.	Medium Cost
		Clean the bottles preferably by blowing or using the minimum amount of water necessary to ensure efficient cleaning	Low Cost
		Upgrade the water-treatment system. By upgrading the water treatment system, you can reduce the number of times that bleed-off is needed each day, yielding large savings from reduced water consumption, chemical consumption (for water treatment), labor costs for maintenance, and the energy savings that result from cleaner heat-transfer surfaces. Upgrades may include the installation of automatic controls (to monitor water pH levels and the concentration of dissolved solids, and to add chemicals or bleed-off water as appropriate), make-up and blow-down submeters, side stream filtration, ozonation, and high-bonding chemical or physical treatment. Though the actual savings from upgrades will depend on the individual cooling-tower system, payback periods can be as short as six months, according to the Saving Water Partnership, a group of Oregon utilities that promote water conservation.	High Cost
		In the bottle washers, water could be used for the last two rows of rinsing nozzles, and then collected and recycled for use in the previous rinsing nozzles prior to discharge.	Low Cost
		Daily cleaning of the bottling line. Dry cleaning (blowing)	Low Cost
		Install automatic quick closing valves to reduce the risk of leaks and discharges	Low Cost
	Cooling/Refrigeration	Use of storm water to operate cooling towers in preference to bore water, as this will substantially reduce the amount of water removal (bleeding) required to stop salts accumulating	No Cost
		Reuse the cooling waters	Low Cost
		Cooling system in a closed circuit. It is highly recommended as it avoids spillage and waste	High Cost
		Avoid using water streaming cooling because of its high water consumption.	No Cost
		In the bottle washers, water could be used for the last two rows of rinsing nozzles, and then collected and recycled for use in the previous rinsing nozzles prior to discharge.	Low Cost

	General considerations	Installation a flow meter to measure the water consumption	Low Cost
		Registering periodically water consumption	Low Cost
		Checking pressure of water in the taps	Low Cost
		Check pipes connections and taps	Low Cost
Water, well, in ground	Irrigation	Installation of watercounter	Low Cost
		Read daily the water counters	No Cost
		Install some water counters linked to the wine making process specifically	Low Cost
		Create a water-management plan.	Medium Cost
		Reduce amount of irrigation water	No Cost
		Irrigate and fertilize together	No Cost
		Recycle irrigation plastic tubing and emitters	No Cost
		Find and repair leaks. Leaks can occur any place where water is used and may add up to considerable water waste. Establishing an ongoing effort to detect and repair leaks can yield significant savings at low cost.	Low Cost
		Use drip irrigation instead of sprinkling	Medium Cost
		Use variable speed pumping. You can avoid building rafts and / or storage tanks, very expensive to build	Medium Cost
		Choose the correct dimensioning of the pumping facilities properly (not oversize).	Medium Cost
		Ensure proper maintenance of pumps, check the technical documentation provided by the manufacturer, and perform a daily inspection of the pump operation. Annual inspection outside the irrigation season	Low Cost
		Control the pressure in the water network. Avoid using pressure reducing valves. Rearrange the distribution network, in turns with the same energy demand, can be adjusted in order to get the correct operation of the same, avoiding the pumping pressure in certain parts and the use of other reducing valves.	Low Cost
		Install drippers with a coefficient of variation lower than 5%. Droppers use little sensitive seals which are a function of the minimum pitch diameter and the water flow speed transmitter.	Low Cost
		In plots on sloping terrain, subsoiling must be performed to facilitate root system development and improve water infiltration, thus preventing erosion and enhancing soil hydric capacity.	Medium Cost
		Ensure the correct adjustment of the pumping system, introduction of variable frequency drives for pump operation, improved yields in the drive equipment, automation control systems.	Low Cost

		Designing energy-optimized irrigation networks so as to improve the power factor. Decreased water consumption with the restructuring and modernization of the irrigation system	Medium Cost
		In irrigation communities try to reorganize the distribution of water, it shifts energy demand	No Cost
		Use irrigation techniques that ensure the most efficient water consumption and optimise water resources.	Low Cost
		Water must be analysed every year in the summer.	Low Cost
	Fertilization	For the production period (from year 3), a fertilisation plan must be established based according to the results of the soil analyses, the composition of irrigation water, yields, harvested crop quality, a visual inspection of the behavior of the plantation, the handling system and the type of soil.	Low Cost
Inorganic fertilizers	Fertilization	Minimizing the use of inorganic fertilizers	Low Cost
		Checking labels for information on toxicity, and choose the least toxic where possible	Low Cost
		Recycle fertilizer and soil amendment bags	No Cost
		Irrigate and fertilize together	No Cost
		Nutrients must be supplied mainly by the soil.	Low Cost
		Restrict the use of quick-release fertilizers to reduce contamination.	Low Cost
		Distribute the addition of nitrogenous fertilisers throughout the vegetative cycle.	Low Cost
Organic fertilizers	Fertilization	Recycle fertilizer and soil amendment bags	No Cost
		Producing organic commercial fertilizers causes a negative energy input	Medium Cost
		Build up a natural humus layer for a better storage of Nutrients	Low Cost
		Supply the nutrients preferably in the form of composted organic material.	Low Cost
		At least one quarter of nitrogenous contributions must consist of organic nitrogen obtained from well-prepared manures or composts.	Low Cost
		Maintain plant, natural or inducted cover to preserve soil fertility.	Medium Cost
		Restrict the application of leaf-based fertilizers and only use them when fully justified after analysing the leaves or fruits in question, or in the event of clear deficiencies or problems documented in previous years.	Low Cost
		Carry out fertilisation plans to prevent the excessive contribution of nutrients that will not be used by plants and which may contaminate aquifers.	Medium Cost
Insecticide General	Crop protection	Minimizing the use of insecticides	Low Cost
		Insurance that Material Safety Data Sheets (MSDS) are kept for all pesticides	No Cost

		Using pesticides that will have the least impact on non-target organisms	Low Cost
		Avoiding spraying in adverse weather conditions	No Cost
		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage	No Cost
		Dispose of insecticide bags or drums according to laws and regulations	No Cost
		Disposal of respirator mask filters according to laws and regulations	No Cost
		Checking labels for information on toxicity, and choose the least toxic where possible	Low Cost
		Respect all beneficial autochthonous insects as fas as possible and only use selective pesticides when other control techniques are not viable.	Low Cost
Herbicide general	Crop protection	Minimizing the use of herbicides	Low Cost
		Insurance that Material Safety Data Sheets (MSDS) are kept for all herbicides	No Cost
		Avoiding spraying in adverse weather conditions	No Cost
		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage	No Cost
		Dispose of herbicide bags or drums according to laws and regulations	No Cost
		Disposal of respirator mask filters according to laws and regulations	No Cost
		Checking labels for information on toxicity, and choose the least toxic where possible	Low Cost
		Elimination of plant remains and physical preparation of the terrain. Eliminate all roots, particularly if the previous crop was grapewine.	Low Cost
		Elimination of weeds, pathogens and pests using cropping techniques.	Low Cost
		In plantations on terrain previously cultivated with grapevine, the soil must be left for at least 4 years before this crop is cultivated again.	No Cost
		Do not plant crops associated with grapevine on the same plot.	No Cost
		Do not apply herbicides to the entire (100 %) surface area (not crop).	No Cost
		In plantations with spontaneous plant cover during the autumn and winter, maintain this cover during that period.	No Cost
		Pruning must contribute effectively to the control of vine yield and vigour, the establishment of adequate exposed leaf surface (EFSp)/crop ratio and the maintenance of an optimum microclimate of clusters and leaves, since this will provide qualitative and phytosanitary benefits.	No Cost
		Use of cropping techniques that enhance production quality, such as green pruning (weeding and removal of lateral shoots), cluster thinning, leaf stripping, etc.	Low Cost

		The machinery used to apply phytosanitary products, herbicides, leaf fertilisers, etc. must be in perfect working order. The producer must check and calibrate the machinery on an annual basis.	Low Cost
		In pest and disease control, preference must be given to biological, biotechnical, cultural, physical and genetic methods rather than chemical methods.	No Cost
		Weeds must be controlled by mechanical means whenever possible. However, whenever weeds cannot be controlled using farming machinery, herbicides must be used on a localised basis, preventing the dispersion that may occur if applied using small drop micro-sprinkling techniques.	Low Cost
		In addition to efficiency and selectivity, it is also very important to take into consideration the herbicide absorption coefficient, which must be high in order to reduce the risks of environmental contamination.	Low Cost
		In sandy soils, residual herbicides must not be used.	No Cost
		Herbicides must be applied at the moment of maximum weed sensitivity, thus allowing minimal doses of active matter to be applied.	No Cost
		If chemical products are used, treatments must, if possible, be applied locally to the plant or in the plot. Moreover, active matter should be alternated with other different treatment methods.	Low Cost
		Adopt all possible hygiene measures and cropping practices designed to reduce the impact of phytosanitary problems in the crop.	No Cost
		Cropping must be performed in appropriate conditions to ensure grapes reach the winery in perfect condition.	Low Cost
Fungicide general	Crop protection	Checking labels for information on toxicity, and choose the least toxic where possible	Low Cost
		Avoiding spraying in adverse weather conditions	Low Cost
		Dispose of fungicide bags or drums according to laws and regulations	No Cost
		Disposal of respirator mask filters according to laws and regulations	No Cost
		Storage of pesticides in a well-ventilated dry area, out of direct sunlight place within a secondary containment to avoid possible spillage	Low Cost
Copper	_	Less copper for plant protection prevents the use of systemic fungicides - bad for soil accumulation	Low Cost
		Plant protection only with copper causes more treatments per year, bad fuel input	Low Cost
		Observe national advices in number of treatments and permitted quantity	No Cost
Sulphur		Regularly use of sulphur reduces the demand on systemic fungicides and acaricides	Low Cost
		Observe national advices in number of treatments and permitted quantity	No Cost
		Keep distances between sulphur treatment and manual leafwork	No Cost
Metabisulphite	Maceration	Processing healthy grapes without mold decreases the demand on KPS	Low Cost

		Topped vats and exclusion of oxigen reduces the need of KPS	Low Cost
		Well hygienic conditions reduces need of KPS	Low Cost
Gaseous SO2	Maceration	A Separate permission to receive Gaseous SO2 is used	Low Cost
		Use closed vats	High Cost
		Lower fermentation temperatures	Low Cost
		Use of liquid solution at the fermentation vat respirator to decrease the amount of gases released	Low Cost
		The use of SO2 must be restricted to the minimum technologically necessary, taking into consideration the limits established.	No Cost
		Limit the use of SO2 after completion of malolactic fermentation to the minimum technologically necessary, taking into account the limit established.	No Cost
		Restrict the use of SO2 to the necessary minimum established.	No Cost
		Restrict the use of SO2 to the minimum technologically necessary specified.	No Cost
Sulphur dioxide	Maceration	A Separate permission to receive Gaseous SO2 is used	Low Cost
		Use closed vats	High Cost
		Lower fermentation temperatures	Low Cost
		Use of liquid solution at the fermentation vat respirator to decrease the amount of gases released	Low Cost
Yeasts	Fermentation	Use of dry yeasts ensure a consistent fermentation at low temperatures	Low Cost
		Spontaneously fermentation may use more Energy by finishing fermentation	Low Cost
		Use preferably autochthonous yeasts and, when technologically appropriate, use the selected yeasts.	Low Cost
		Use natural additives whenever possible.	Low Cost
Diammonium phosfate	Fermentation	Nutrients at all need to be used in case of insufficient supply. Must analyses are recommendet	Low Cost
		Adequate supply of nutrients ensures a quick end fermentation	Low Cost
Ammonium sulfate	Fermentation	Nutrients at all need to be used in case of insufficient supply. Must analyses are recommendet	Low Cost
		Adequate supply of nutrients ensures a quick end fermentation	No Cost
Sugar	Fermentation	Add RTK for chaptalisation instead of sugar	Medium Cost

		Waive the add of sugar by aiming a high level of natural sugar content	Low Cost
		Machines to concentrate juice (i.e. reverse osmosis, vacuum destillation) by extraction of water needs a lot Energy	Medium Cost
egg albumin	clarification	The use of protein based fining products with allergenic potential (casein, albumin) have to be declared at the label	No Cost
milk casein	clarification		
isinglass	clarification	The use of protein based fining products at all produces a negative effect conserning water, material and energy and is not part of a good oenological practice	Low Cost
Gelatin	clarification		
Bentonite	clarification	Used bentonite to trash after dewatering	Low Cost
		Use bentonite instead of thermic stabilisation	Low Cost
wood barrels	aging/storage	Use of 3 hl Barrels or bigger ones instead of 225 lit.	Medium Cost
		Clean out the barrels at a washing station helps to save energy and water	Medium Cost
Glass bottles	bottling	Use recycled glass material	Low Cost
		Use light weighted bottles	Low Cost
		Bottles must be handled accordingly to prevent them from breaking and spilling wine.	No Cost
		Conditions that may facilitate bottle breakage will be reduced to a minimum.	Low Cost
		Empty bottles (glass bottles) will be transferred to the nearest recycling point for subsequent processing.	Low Cost
paper labels	bottling	Use easy removeable labels	Low Cost

		Use of waterproof labels	Low Cost
adhesive	bottling	Reduction in the amount of glue used in packaging	No Cost
plastic closures	bottling	Bad for quality of the wine at all, use screwcap and save in this way the capsule	Medium Cost
cork closures	bottling	Except for a bad water balance, natural corks produces less emissions than other closures	Medium Cost
aluminium closures	bottling	Needs a lot of Energy in production, therefore possible to recycle and no need of additional capsules	Medium Cost
cardboard boxes	bottling	Use of recycling used materials (e.g. cardboard) wherever possible	Low Cost
		Use cardboard boxes with eco-label	Medium Cost
		Use thin inserts and no over-packaging	Medium Cost
plastic capsules	bottling	Not needed at bottles with screwcap	No Cost
aluminium capsules	bottling	Needs a lot of Energy in production, therefore possible to recycle	Medium Cost
detergent	cleaning	Use hot water and clean shortly after work	Low Cost
		Cleaning chemicals minimization	No Cost
	bottling	Prevent the use of chlorinated chemicals	Low Cost
		Do some neutralisation before dumping the chemicals down the drain	Low Cost
		Use a professional maybe external bottle cleaning station	Medium Cost
		Use steam for sterilisation of the bottling line	Low Cost
		If cleaning products are used, use the most suitable product according to the type of dirt and the recommended doses.	Low Cost
		Use of foaming gungs	Low Cost
		Use cleaners as paracetic which eliminates the need to rinse	Low Cost
		Consider to heat water from a residual heat source. Use this hot water for cleaning, thereby reducing the use of detergents	Low Cost
Wastewater Produced	Treatment	Flow equalization for the effluent produced by a winery through temporary storage	No Cost
		Equalization tank	Medium Cost
		Segregation of the different waste streams based on strength. It allows less contaminated waste streams to be discharged directly to the sewer after screening, thus reducing the volume of liquid waste that needs to be treated	No Cost

		Domestic waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant,	No Cost
		Septage removal according to laws and regulations	No Cost
		Cleaning waters: they should be separated and treated aside in an individual or municipal wastewater treatment plant	No Cost
		Pomaces distillation	Low cost
		Use of high-capacity vat	High Cost
		Pretreatment screens	Low Cost
		Grit chamber	Low Cost
		Purify dirty water according to its contamination characteristics before discharging.	Low Cost
		Install a water separation network: dirty water (processing water and sewage) and rainwater.	Medium Cost
	Reception	The vehicle or boxes must be left in an area ready for washing and dirty water must be collected.	No Cost
	Destemming	Stemss must be collected and stored directly in a watertight container to prevent run-off of liquid effluents, and controlled accordingly.	Low Cost
	Ageing in barrels	Remove completely the wine from the barrels before cleaning. Cleaning water must be sent to the treatment plant	No Cost
	Stabilization	Reduce wastewater: Separate the sewage system from the rainwater collection system, in order to send to the sewage system only effluents	Low Cost
		Reduce wastewater: Removing solid content –installation of mesh screens	No Cost
		Recycling some of the rinse water	Low Cost
		Use growing algae in order to reduce water waste	Low Cost
		Production of fungals proteins using wastewater from wineries	Low Cost
		Making dry cleaning operations	Low Cost
		High pressure with warm water	Low Cost
	Bottling	Don't use caustic soda for bottle cleaning in the first use	No Cost
	Cleaning	Ensure adequate control of all residues produced during the cleaning processes.	No Cost
		Clean machinery, deposits, piping and equipment using pressurised hot water.	Low Cost
		First clean the deposit with only a little water in order to collect it and use as by-product if possible.	Low Cost
		Then clean the deposit thoroughly with a large amount of water for subsequent use.	Low Cost

		When cleaning sets of deposit, transfer the dilution from one deposit to another until the solution is no longer effective and then check the deposits.	Low Cost
		When cleaning floors, dry clean before cleaning with water, and then collect any solids and deposit them in a container.	No Cost
		Clean common asphalted areas using mechanical sweepers or pressure systems with a closing or locking device on the nozzle.	Low Cost
		Control cleaning temperature	low Cost
		Automatic cleaning systems	Medium Cost
		Use washing water in a serial process, use the leaving water from washing the stemmer (after screening) for the first wash of barrel tanks, etc.	No Cost
		Collect in the same tank water from the first wash presses and barrels, reuse it for the first wash of different barrels and tanks, so it could be a high concentration of pomace in water in order to be sold with pomace waste and feces	Low Cost
Organic solid waste (pomace, lees etc.)	Treatment	Centrifugation of wine from lees	Low Cost
		Wine and must lees have to be stored in a separate vat and can be filtered or salvaged for further distillation or spreading.	Low Cost
		The first cleaning water coming from the cleaned vat, which is highly polluted, can be added to the lees.	No Cost
		Grit chamber	Low Cost
		Incorporate pomace into vineyard	Low Cost
		Incorporate grape rachis into vineyard	Low Cost
		Deliver pomace to compost facility	Low Cost
		Deliver grape rachis to compost facility	Low Cost
		Lawn cuttings and chipped brush to compost	Low Cost
		Use grilles to retain thick solid residue.	Low Cost
		Biological treatment discontinous: aerated storage	Medium Cost
		Biological treatment continous	Medium Cost
		Low-rate activated sludge	Low Cost
		Spreading	Low Cost
		Physical treatments: evaporation, Thermo-concentration, evapo-concentration, ultrafiltration	Medium Cost

		On-site composting before land spreading in other land	Low Cost
		In order to reduce solid waste: Off-site composting	Low Cost
		Collect leeds and send them to a distillery	Low Cost
		Reduce solid waste using composting	Low Cost
		Reduce solid waste with extraction of polyphenols	Low Cost
	Reception	After unloading, any solid waste adhered to the interior of the vehicle or the boxes must be placed in adequate containers.	No Cost
		If a selection table is used, waste must be deposited in a special container.	No Cost
		A selection table should be used to remove herbaceous debris or grapes in poor condition.	No Cost
		Stock the solid waste to compost when possible.	Low Cost
	Destemming	Solid waste should be compacted or crushed for direct application in the field or for improving composting.	Low Cost
	Fermentation	Collect as much pomace as possible from the bottom of the deposit.	No Cost
	Pressing	Deposit the dry pomace in closed containers that prevent overflows and control them accordingly for evaluation purposes.	Low Cost
		If the pomace is expelled through a recipient, make sure it is correctly positioned beforehand to prevent any type of overflow.	Low Cost
		If the pomace is transported to the press by a paste pump, check all the connections beforehand to prevent wine spillages.	Low Cost
		Empty the paste contained in the hoses into a recipient or deposit to prevent it from overflowing when the connections are disconnected.	Low Cost
		Place trays or recipients to collect leaking wine released during pressing.	Low Cost
		Empty the dry pomace and remove any solid residue from the press.	Low Cost
		Use compressed air as cold as possible (external) in order to reduce compressor consumption.	Low Cost
	Storage	Store in watertight containers and deal with lees and solid remains still on the bottom of the deposit after emptying.	Low Cost
	Fining and filtering	Collect and control the residue and by-products of the fining agent accordingly without pouring down drains.	Low Cost
		Collect and control the filtering residue and by-products (diatomaceous earth, cellulose layers…), without pouring down drains.	Low Cost
		Collect and control the residue in order to sell it for distillation	Low Cost
	Machinery	Ensure adequate control of all residues produced in maintenance processes.	No Cost
	cleaning	After emptying, and whenever possible, dry clean the equipment, deposits, etc. to eliminate and control residue (grapes, stems, lees, and pomace).	No Cost

Non-recyclable waste		Incandescent, and fluorescent bulbs to trash	No Cost
		Electrical ballasts disposed as toxic waste	Low Cost
		Dispose of bathroom paper according to laws and regulations	No Cost
		Disposal of spent fire chemicals by service company	Low Cost
paper (recycling)		Recycle waste paper	No Cost
		Bottling line label rejections recycled with office paper after baling	No Cost
		Fiberboard cartons for recycling after baling	No Cost
plastic (recycling)		Use of returnable or recyclable packaging. However, it should be noted that this practice may involve a significant increase in water use for washing. Therefore, the benefits associated with the reduction in raw material consumption must be weighed against the impact of increased water consumption and wastewater discharge before a facility decides to rely on recycled packaging	Low Cost
		Recycle HDPE containers	No Cost
		Recyclepolyethylene bottles	No Cost
glass (recycling)		Use of returnable or recyclable packaging. However, it should be noted that this practice may involve a significant increase in water use for washing. Therefore, the benefits associated with the reduction in raw material consumption must be weighed against the impact of increased water consumption and wastewater discharge before a facility decides to rely on recycled packaging	Low Cost
		Recycle glass bottles	No Cost
		Broken glass and tasting room bottles for recycling	No Cost
metals (recycling)		Rrecycle aluminum cans	No Cost
		Tasting room capsules and bottling line broken capsules segregated and recycled for tin, antimony or aluminum	No Cost

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