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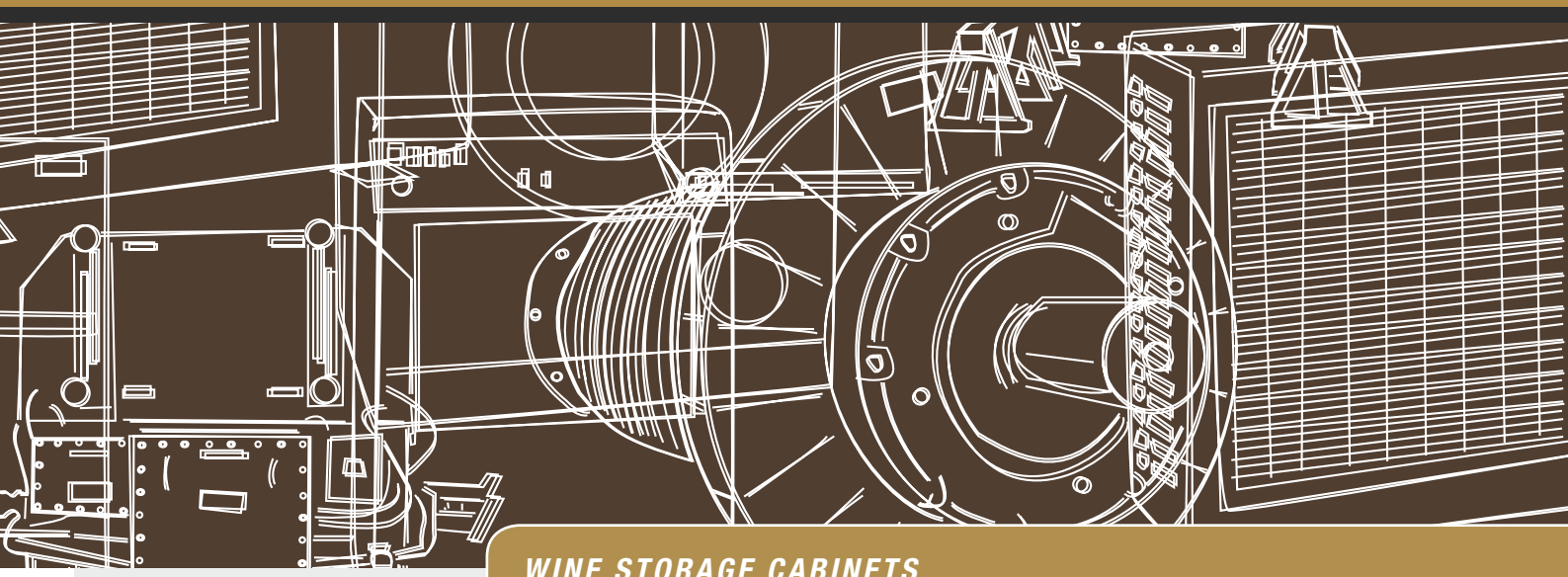
NATIONAL APPLIANCE AND EQUIPMENT ENERGY EFFICIENCY PROGRAM

No Action Proposal



WINE STORAGE CABINETS

PREPARED FOR

THE AUSTRALIAN GREENHOUSE OFFICE UNDER
THE NATIONAL APPLIANCE & EQUIPMENT ENERGY
EFFICIENCY PROGRAM

No Action Proposal - Wine Storage Cabinets

This report has been commissioned by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) to explore the need for measures to address the energy efficiency of wine storage cabinets in Australia. Although these products resemble refrigerators in some respects, their main functions and design characteristics are substantially different, and there is little direct competition between the products.

Wine storage cabinets are relatively new to the Australian market. Sales are growing strongly from a low base, but given the specialist nature of the product – to maintain a stock of wine at the temperature and humidity conditions best suited to maturation – it is difficult to envisage an ultimate ownership rate above about 10%. The energy consumption of individual cabinets is comparable to that of small refrigerators and other major household appliances that are energy labelled (dishwashers, clothes washers and clothes dryers), although the projected national energy impact is much lower because ownership is expected to remain low.

Currently there is no Australian Standard applicable to wine storage cabinets, and hence no basis for energy testing, labelling or MEPS. Nevertheless there is some interest in the market in indicating the energy consumption of models. Many suppliers are publishing energy consumption values without specifying the method of test or the test conditions, although given that most models are imported from Europe the most likely test is an ISO standard. The available data suggest a strong correlation between capacity and energy efficiency, and also differences in efficiency for models of similar capacity, of which prospective buyers should be made aware.

At least one supplier has had models tested under AS/NZS 4474 Performance of household electrical appliances – refrigerating appliances, even though a rigorous application of the standard suggests that the models did not meet the criteria for refrigerating appliances. The tests in AS/NZS 4474 are not appropriate for wine storage cabinets because the ambient temperature is too high and the extreme performance test is unnecessary. In fact, applying these tests could give a lower apparent energy rating to – or exclude altogether – those wine storage cabinet designs which are likely to be more energy-efficient in use.

CONCLUSIONS

- Wine storage cabinets are not a high priority in terms of national energy efficiency objectives, because of their relatively low sales.
- Nevertheless, the public interest would be served by the provision of consistent energy efficiency information for wine storage cabinets. Most suppliers are already making statements about energy consumption, but without substantiation and not necessarily to a common standard.
- Australia should support the development of an internationally accepted energy test standard for wine storage cabinets, preferably

STAKEHOLDER COMMENT

NAEEEC invites comments from any interested person or organisation on the measures proposed in this study. Comments should be directed to energy.rating@greenhouse.gov.au by 31 December 2004. Information sessions for industry participants can be arranged during the comment period if requested.

Electronic copies of profiles and full reports released for public discussion can be obtained from www.energyrating.gov.au

based on or linked to the ISO refrigerator test standards which are used for refrigerator testing in Europe. This is appropriate as most of the wine storage cabinet models sold in Australia are imported from Europe.

- Once an accepted international test standard is available, NAEEEC should consider using it as the basis for energy labelling of wine storage cabinets in Australia.
- AS/NZS 4474 is designed to test the energy performance of refrigerators, freezers and 'cold appliances', which perform quite different tasks from wine storage cabinets. It should not be used for testing and labelling wine storage cabinets. If a wine storage cabinet meets the definition of a refrigerator or a cold appliance (as some may) and its supplier opts to have it tested accordingly, then it should be energy labelled and marketed as a refrigerator or a cold appliance, not as a wine storage cabinet.
- Until wine storage cabinets are brought within the scope of energy labelling regulations, the only control on the veracity and verifiability of their suppliers' statements about their energy use is general consumer protection legislation.
- The total energy consumption of wine storage cabinets is projected to remain relatively low, so measures that restrict the range of models on the market (eg Minimum Energy Performance Standards) are not likely to be warranted.

RECOMMENDATIONS

It is recommended that

1. NAEEEC should support the development, by ISO, of an internationally accepted energy test standard for wine storage cabinets, preferably based on or linked to the ISO refrigerator test standards;
2. If and when the new test becomes available, NAEEEC should consider its adoption for energy labelling of wine storage cabinets in Australia.
3. In the meantime, AS/NZS 4474 should be clarified to state that it only covers the defined categories of products (refrigerators, freezers and cold appliances) and that any products energy tested in accordance with those categories must be labelled and marketed accordingly (ie a product tested as a cold appliance cannot be marketed as a wine storage cabinet).
4. NAEEEP should contact the suppliers of wine storage cabinets to alert them of the need to ensure that any statements they may make about energy performance must be capable of substantiation under consumer legislation, and should not be presented as derived from or based on Australian standards or energy labelling.
5. The market for wine storage cabinets be reviewed at not more than 3 yearly intervals to reconsider the case for mandatory energy labelling and minimum energy performance standards.

NEXT STEPS

This paper is the first stage in the NAEEEC's consideration of these issues. Its publication marks the beginning of consultations with wine storage cabinet suppliers and other stakeholders on whether the measures proposed are feasible and desirable.

The following stages are envisaged:

1. NAEEEC will invite comments from stakeholders on the measures proposed in this study, up to the end of December 2004. Comments should be directed to energy.rating@greenhouse.gov.au by 31 December 2004. Information sessions for industry participants can be arranged during the comment period if requested.
2. If warranted after consideration of comments, NAEEEC will
   - contact ISO and other appropriate agencies to support the development of an internationally accepted energy test standard for wine storage cabinets;
   - contact Standard Australia to clarify that AS/NZS 4474 *Performance of household electrical appliances - refrigerating appliances* does not cover wine storage cabinets.
   3. The next stage will depend on when an internationally accepted energy test standard for wine storage cabinets becomes available.

NAEEEC MEMBERS

The Commonwealth, New Zealand, and all State and Territory governments are part of NAEEEC. Representatives are senior officials from various government agencies and statutory authorities or persons appointed to represent those bodies.

The *Australian Greenhouse Office (AGO)* is the Australian Government agency responsible for monitoring the National Greenhouse Strategy in cooperation with State and Territory Governments and with the support of local government, industry and the community. The AGO chairs NAEEEC and other members provide support for its activities.

The NSW *Ministry of Energy and Utilities* (incorporated within the Department of Energy, Utilities and Sustainability since 1 January 2004) provides policy advice to the NSW Government and operates a regulatory framework aimed at facilitating environmentally responsible appliance and equipment energy use. The Ministry is represented on the Energy Efficiency and Greenhouse Working Group, through which the appliance and equipment related elements of the National Greenhouse Strategy are being progressed.

The NSW *Sustainable Energy Development Authority* was established in February 1996 with a mission to reduce the level of greenhouse emissions in New South Wales by investing in the commercialisation and use of sustainable energy technologies.

The *Office of the Chief Electrical Inspector* is the Victorian technical regulator responsible for electrical safety and equipment efficiency. Its mission is to ensure the safety of electricity supply and use throughout the State. The corporate vision of the Office is to demonstrate national leadership in electrical safety matters and to improve the superior electrical safety record in Victoria. The Office's strategic focus is to ensure a high level of compliance is sustained by industry with equipment efficiency labelling and associated regulations.

The *Sustainable Energy Authority* was established in 2000 by the Victorian Government to provide a focus for sustainable energy in Victoria. The Authority's objective is to accelerate progress towards a sustainable energy future by bringing together the best available knowledge and expertise to stimulate innovation and provide Victorians with greater choice in how they can take action to significantly improve energy sustainability.

The *Electrical Safety Office*, Department of Industrial Relations, is the Queensland technical regulator responsible for electrical safety and appliance and equipment energy efficiency. The office ensures compliance with electrical safety and efficiency regulations throughout Queensland.

The *Department of Energy* is the lead agency with regard to sustainable development within the Queensland energy sector and is involved in a range of activities that reflect the importance of a sustainable approach. These activities involve developing and evaluating policies and initiatives through flexible and responsible decision making that allows economic, environmental and social outcomes from the energy sector to be maximised.

The Western Australian electricity regulator *Energy Safety* (a Division of the Department of Consumer and Employment Protection) is responsible for the technical and safety regulation of the electrical industry in WA. This includes the safety of consumers' electrical installations and appliances and the auditing of appliances and equipment to check compliance with energy efficiency and prescribed safety requirements.

The Western Australian *Sustainable Energy Development Office* promotes more efficient energy use and increased use of renewable energy to help reduce greenhouse gas emissions and increase jobs in related industries.

The *Office of the Technical Regulator* seeks to ensure the coordinated development and implementation of policies and regulatory responsibilities for the safe, efficient and responsible provision and use of energy for the benefit of the South Australian community.

The Tasmanian Government's interest is managed by the Department of Infrastructure, Energy and Resources' *Office of Energy, Planning and Conservation (OEPC)*. The OEPC provides policy advice on energy related matters including energy efficiency. Its web site is www.dier.tas.gov.au/energy/indext.html.

Electricity Standards and Safety is the technical regulator responsible for electrical safety throughout Tasmania. Regulatory responsibilities include electrical licensing, appliance approval and equipment energy efficiency.

The Australian Capital Territory's interest is managed by the *Energy Policy Unit, Economic Management Branch*, Department of Treasury. The primary function of this Unit is to provide the ACT Government with advice on National and Territory energy related matters including energy efficiency.

The *Department of Infrastructure, Planning and Environment* is responsible for the administration of regulations in the Northern Territory regarding various aspects of safety, performance and licensing for goods and services including electrical appliances.

The *Energy Efficiency and Conservation Authority (EECA)* is the principal body responsible for delivering New Zealand's National Energy Efficiency and Conservation Strategy (NEECS). EECA's function is to encourage, promote and support energy efficiency, energy conservation and the use of renewable energy sources.

Analysis of the Potential for Energy Efficiency Measures

for

Wine Storage Cabinets

Prepared for the

National Appliance and Equipment Energy Efficiency Committee (NAEEEC)
and the
Australian Greenhouse Office

by

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October 2004

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Summary

This report has been commissioned by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) to explore the need for measures to address the energy efficiency of wine storage cabinets in Australia. Although these products resemble refrigerators in some respects, their main functions and design characteristics are substantially different, and there is little direct competition between the products.

Wine storage cabinets are relatively new to the Australian market. Sales are growing strongly from a low base, but given the specialist nature of the product – to maintain a stock of wine at the temperature and humidity conditions best suited to maturation – it is difficult to envisage an ultimate ownership rate above about 10%. The energy consumption of individual cabinets is comparable to that of small refrigerators and other major household appliances that are energy labelled (dishwashers, clothes washers and clothes dryers), although the projected national energy impact is much lower because ownership is expected to remain low.

Currently there is no Australian Standard applicable to wine storage cabinets, and hence no basis for energy testing, labelling or MEPS. Nevertheless there is some interest in the market in indicating the energy consumption of models. Many suppliers are publishing energy consumption values without specifying the method of test or the test conditions, although given that most models are imported from Europe the most likely test is an ISO standard. The available data suggest a strong correlation between capacity and energy efficiency, and also differences in efficiency for models of similar capacity, of which prospective buyers should be made aware.

At least one supplier has had models tested under AS/NZS 4474 *Performance of household electrical appliances – refrigerating appliances,* even though a rigorous application of the standard suggests that the models did not meet the criteria for refrigerating appliances. The tests in AS/NZS 4474 are not appropriate for wine storage cabinets because the ambient temperature is too high and the extreme performance test is unnecessary. In fact, applying these tests could give a lower apparent energy rating to – or exclude altogether – those wine storage cabinet designs which are likely to be more energy-efficient in use.

Conclusions

- Wine storage cabinets are not a high priority in terms of national energy efficiency objectives, because of their relatively low sales.

- Nevertheless, the public interest would be served by the provision of consistent energy efficiency information for wine storage cabinets. Most suppliers are already making statements about energy consumption, but without substantiation and not necessarily to a common standard.

- Australia should support the development of an internationally accepted energy test standard for wine storage cabinets, preferably based on or linked to the ISO refrigerator test standards which are used for refrigerator testing in Europe. This is

appropriate as most of the wine storage cabinet models sold in Australia are imported from Europe.

- Once an accepted international test standard is available, NAEEEC should consider using it as the basis for energy labelling of wine storage cabinets in Australia.

- AS/NZS 4474 is designed to test the energy performance of refrigerators, freezers and 'cold appliances', which perform quite different tasks from wine storage cabinets. It should not be used for testing and labelling wine storage cabinets. If a wine storage cabinet meets the definition of a refrigerator or a cold appliance (as some may) and its supplier opts to have it tested accordingly, then it should be energy labelled and marketed as a refrigerator or a cold appliance, not as a wine storage cabinet.

- Until wine storage cabinets are brought within the scope of energy labelling regulations, the only control on the veracity and verifiability of their suppliers' statements about their energy use is general consumer protection legislation.

- The total energy consumption of wine storage cabinets is projected to remain relatively low, so measures that restrict the range of models on the market (eg Minimum Energy Performance Standards) are not likely to be warranted.

Recommendations

It is recommended that

1. NAEEEC should support the development, by ISO, of an internationally accepted energy test standard for wine storage cabinets, preferably based on or linked to the ISO refrigerator test standards;

2. If and when the new test becomes available, NAEEEC should consider its adoption for energy labelling of wine storage cabinets in Australia.

3. In the meantime, AS/NZS 4474 should be clarified to state that it only covers the defined categories of products (refrigerators, freezers and cold appliances) and that any products energy tested in accordance with those categories must be labelled and marketed accordingly (ie a product tested as a cold appliance cannot be marketed as a wine storage cabinet).

4. NAEEEP should contact the suppliers of wine storage cabinets to alert them of the need to ensure that any statements they may make about energy performance must be capable of substantiation under consumer legislation, and should not be presented as derived from or based on Australian standards or energy labelling.

5. The market for wine storage cabinets be reviewed at not more than 3 yearly intervals to reconsider the case for mandatory energy labelling and minimum energy performance standards.

Next Steps

This paper is the first stage in the NAEEEC's consideration of these issues. Its publication marks the beginning of consultations with wine storage cabinet suppliers and other stakeholders on whether the measures proposed are feasible and desirable.

The following stages are envisaged:

1. NAEEEC will invite comments from stakeholders on the measures proposed in this study, up to the end of December 2004. Comments should be directed to energy.rating@greenhouse.gov.au, by 31 December 2004. Information sessions for industry participants can be arranged during the comment period if requested.

2. If warranted after consideration of comments, NAEEEC will

   - contact ISO and other appropriate agencies to support the development of an internationally accepted energy test standard for wine storage cabinets;
   - contact Standard Australia to clarify that AS/NZS 4474 *Performance of household electrical appliances – refrigerating appliances* does not cover wine storage cabinets.

3. The next stage will depend on when an internationally accepted energy test standard for wine storage cabinets becomes available.

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Contents

Introduction

The NAEEEP

This report has been commissioned by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) to explore the potential for energy and greenhouse savings through measures to increase the energy efficiency of wine storage cabinets in Australia. NAEEEC is the administering body for the National Appliance and Equipment Energy Efficiency Program (NAEEEP) which comprises representatives from the following government agencies:

- State and Territory regulatory agencies responsible for administering the mandatory energy efficiency labelling and performance standards called into legislation in their respective jurisdictions; and

- Commonwealth, State and New Zealand agencies with a mandate to encourage sustainable energy use and reduce greenhouse gas emissions.

NAEEEC reports to the Ministerial Council on Energy (MCE) through the Energy Efficiency and Greenhouse Gas Working Group. The activities of NAEEEP flow from the requirements in the National Greenhouse Strategy (NGS 1998) to improve the energy efficiency of energy-consuming household appliances, and industrial and commercial equipment.

The NAEEEP publishes work programs covering three year periods. In 2002, the NAEEEP published a document signalling its future activities, *Work Plan and Policies 2002 to 2004* (NAEEEP 2002). The Work Plan for the next triennium (2005 to 2007) is currently being finalised.

One of the principles of the NAEEEP is to maintain competitive neutrality between competing product types and energy forms. The adoption of mandatory energy efficiency measures for a product category usually imposes some costs on the suppliers and purchasers of those products, resulting in a slight increase in purchase prices, even though the benefits in terms of energy savings far outweigh the costs (otherwise the mandatory measure would not be adopted). To avoid distorting the market, it is desirable that any directly competing products also be considered for energy efficiency measures, so that similar benefits (and costs) can be realised.

This principle has been applied to the issue of electric vs gas water heaters, and electric storage water heaters vs other electric types. The draft work program for 2007 envisages applying the same principle to wine storage cabinets, in relation to other, potentially competing, household refrigeration products.

Accordingly, NAEEEC regulators have given a commitment to review the market for wine storage cabinets and to consider the case for applying the same mandatory energy efficiency measures - energy labelling and minimum energy performance standards - as currently apply to household refrigeration equipment.

Purpose of this study

The purpose of this study is to

- Describe the functions and the technology of wine storage cabinets;
- Give an overview of the Australian market for wine storage cabinets;
- Assess the availability of testing standards;
- Estimate the total national energy consumption of wine storage cabinets and the potential for reducing these, and also for reducing associated greenhouse gas impacts;
- Recommend energy-efficiency measures for further investigation.

This paper is the first stage in the NAEEEC's consideration of these issues. Its publication marks the beginning of consultations with wine storage cabinet suppliers and other stakeholders on whether the measures proposed are feasible and desirable.

The following stages are envisaged:

1. NAEEEC will invite comments from stakeholders on the measures proposed in this study, up to the end of December 2004. Comments should be directed to the officer named in the Summary of this report, by the date indicated. Information sessions for industry participants can be arranged during the comment period if requested,

2. If warranted after consideration of comments, NAEEEC will proceed with development of the selected energy efficiency measures during 2005. This will involve

   the modification of AS/NZS 4474 *Performance of household electrical appliances – refrigerating appliances* to incorporate appropriate definitions, test methods and energy rating algorithms for wine storage cabinets; and

   the preparation of a Regulation Impact Statement (RIS) formally assessing the costs and benefits of implementing mandatory energy labelling for wine storage cabinets.

   The industry would obviously participate in any standards development, and there would be formal consultations with industry and other stakeholders during the preparation of an RIS.

3. If the RIS finds that the implementation of mandatory energy labelling for wine storage cabinets would be in the national interest, the matter would be considered by the Ministerial Council on Energy (MCE), which is the ultimate decision-making body in this area.

4. If MCE decides to implement the measure, there would normally be a lead time of about a year before the measures take effect.

The product function

Wine storage

There are two important storage considerations in relation to wine: storage for ageing and storage for serving.

The optimum ageing conditions for the styles of wine commonly consumed in Australia are modelled on those in underground storage caverns in France, historically the origin of most of the modern commercial grape varieties and winemaking methods used in Australia and in other winemaking countries:

- Constant temperature in the range 12-15°C;
- Humidity in the range 70-75%:
- Darkness or low light (to prevent light-induced chemical changes in the wine);
- Stillness (to prevent vibration-induced chemical changes in the wine).

Ideally, the bottles should be stored on their sides or slightly neck-down to prevent cork drying and shrinkage.

Producers of bottled wines have storage facilities which maintain their stock at the desired conditions before sale. Purchasers who wish to continue the ageing process after they purchase the wine, or prevent deterioration of the wine, will need to match these storage conditions as closely as possible.

The proportion of the Australian housing stock where it is possible to replicate ideal wine storage conditions is probably falling, while the consumption of wine and the demand for home storage and ageing of high quality wines is increasing. The number of dwellings with cellars or with accessible, enclosed under-floor storage is declining, because of the prevalence of concrete floored houses and multi-storey apartments. On the other hand, more of each vintage (wines produced in a given year) is being retained by winemakers and wholesalers for later distribution after its initial release, so it is less necessary for consumers to buy and hold large stocks of favourite vintages.

Consumer demand for home wine storage has been met by the introduction of powered wine storage cabinets, which can maintain optimum wine storage conditions internally even if ambient temperature and humidity varies widely. Some manufacturers claim that the target conditions can be maintained throughout an ambient temperature range of 0-35°C, while others claim effective operation at ambients as high as 43°C. Where the ambient is lower than the target temperature, the cabinet will need to heat the contents.

In practice, few wine storage cabinets will be exposed to very high or very low ambients. Most buyers install them inside dwellings (eg in kitchens or laundries) or in garages, including lockable basement garages in multi-storey apartment blocks.

Restaurants and hotels which keep large stocks of wine and need to maintain its quality for long periods comprise another major market for wine storage cabinets.

Wine serving

The long term storage conditions described in the preceding section suit all varieties of wine equally, but different wine styles have different optimum serving temperatures (Table 1).

Table 1 Preferred wine serving temperatures

Temperature	Wines
6-10°C – 'very cold'	Sparkling wines, light wines, sweet whites and dessert whites
10-14°C – 'chilled'	Light reds and rosé; fuller-bodied whites
14-20°C – cooler 'room temperature'	Fuller-bodied red wines and fortified wines

Source: Cerexhe (2003)

When serving wines, most consumers simply move the bottle/s from the long term store (which may be a wine storage cabinet) to the refrigerator or ice bucket (in the case of wines that need to be served chilled or very cold) or allow it to reach the ambient temperature, which in Australia may well be well above the ideal 'room temperature'.

However, some consumers prefer to control the wine's transition to serving temperature more closely. Most wine storage cabinets allow the storage temperature to be adjusted anywhere between 6°C and 18°C. This would allow the entire contents to be either chilled or brought to ideal 'room temperature' for serving. However this is not likely to be useful unless:

- All the wines are of the same variety and so need the same serving temperature; and

- All the bottles are to be consumed within a relatively period (for example, wines should not be kept 'very cold' for more than about three weeks, or they lose flavour).

These conditions are more likely to be met in a commercial than in a household setting. Restaurants and hotels often have several wine serving cabinets set to different temperatures. A householder with a single wine storage cabinet, who wants better control of serving temperatures than the refrigerator and room ambient can give, will find it useful to have separate zones in the cabinet (with the larger set to long term ageing conditions and the smaller to serving conditions) or a 'multi-zone' cabinet in which the temperature is graduated from cold at the bottom to room temperature at the top.

The product

Technology

Wine storage cabinets are similar in appearance to refrigerators. The door may be solid or double-glazed. They usually have shelving systems to allow bottles to be accessed more easily, although some users forgo the shelves in order to maximise the storage capacity.

Vapour compression systems

Most wine storage cabinets use vapour-compression refrigeration systems to keep the wine at the correct temperature. However, there are several important differences from conventional refrigerators. The throughput of the food load is far higher in a refrigerator than in a wine storage cabinet. Refrigerator users add room-temperature food and drinks almost daily, and open the door dozens of times on an average day. By contrast, wine cabinets may be accessed only once a day, and on many days not opened at all.

The internal temperature of a wine storage cabinet (say 15˚C) would be only 5˚C lower than a typical year-round indoor ambient temperature of, say, 20˚C. By contrast, the internal temperature of the fresh-food compartment of a refrigerator (3˚C) would be 17˚C lower than ambient, and the freezer (-15˚C) would be 35˚C lower.

Because the refrigeration load is so much lower, wine storage cabinets use lower-power compressors which run for much less of the time, and so use much less energy for the same cabinet storage volume. Wine storage cabinet suppliers also tend to use thicker cabinet insulation in order to minimise temperature fluctuations and so reduce the refrigeration load still further (although glass door models have a slightly higher heat gain). This allows the use of low-speed compressors, which helps meet the objective of minimising vibration. In all, the energy consumption of a wine storage cabinet is about one quarter to one third of that of a refrigerator of similar volume.

Other important differences from a conventional refrigerator include:

- Condensate management: wine storage cabinets re-vaporise and recirculate the condensate in order to maintain cabinet humidity. Refrigerators tend to capture more condensate because of their large, very cold heat exchange surfaces. This is then released outside the cabinet, with the result that cabinet humidity is well below the optimum for wine storage;

- Heating capability: even in Australia, there may be periods of the year when ambient temperature is *below* the wine cabinet internal temperature, so many models have resistance heaters.

For these reasons, wine storage cabinets are not suitable for use as substitutes for refrigerators, although some models can be set to maintain the internal conditions of Group 2 refrigerators. This is discussed in a later section.

Peltier systems

A thermoelectric Peltier device is a ceramic plate that become cold on one side and hot on the other when a low voltage electric current is applied to it. The technology was originally developed for cooling computer chips and other electronic equipment. It is used in the only Australian-made wine storage cabinets (Kitchener).

The great advantage of Peltier-based refrigeration systems is that they have no moving parts and hence no noise or vibration (although the cabinets still need a small air circulating fan). They are less energy-efficient than conventional vapour compression refrigeration systems, but for the limited cooling task required in a wine storage cabinet the energy penalty is low.[1]

Suppliers

Research has identified 6 brands of wine storage cabinet on the Australian market in September 2004, comprising nearly 40 separate models. These are listed in Appendix 1.
The main suppliers are:

- Kitchener Wine Cabinets, based in Melbourne. This is the only Australian manufacturer of wine storage cabinets, and uses Peltier technology, so the storage temperature range is limited (13-16˚C). The model range comprises two large cabinet sizes (252 and 410 bottles capacity), designed specifically for long term ageing.[2]

- Liebherr (distributed by Andi-Co, which also distributes Liebherr refrigerators). These wine storage cabinets use vapour compression technology, and have capacities ranging from 43 to 267 bottles . The storage temperature range may be adjusted from 5˚C to 18˚C (up to 22˚C in some models), making them suitable for chilling as well as for long term ageing;

- Transtherm, based in Sydney, imports several ranges of wine storage cabinet, which it sells under the Transtherm and Vintec brands (for which it holds the Australian rights). The Transtherm range has 4 cabinet sizes (under-bench, small, medium and large); all but the under-bench model are available as either single-zone (10-14˚C adjustable) or multizone (8-18˚C). The supplier claims that the selected temperature can be maintained against an ambient range of (0-35˚C). Transtherm cabinets are manufactured by Eurocave in France, and are also sold under the Transtherm brand in Europe, the USA and elsewhere. The Vintec range comprises three basic model ranges: under-bench models made in China, and small and medium models made in Denmark.

[1] The efficiency of a well-designed household refrigeration compressor is about 45% of the theoretical limit of the Carnot (vapour compression) cycle. The efficiency of a Pelter devices is 5-8% Carnot, ie the Peltier device would use 6 to 9 times as much energy for the typical household refrigeration task. (www.coolchips.gi/technology/ccalc.shtml). However, the wine storage cabinet cooling task is much less demanding, and so the energy penalty is low.
[2] Still larger units can be made up by pairs of these two basic units.

Other suppliers include Access (one model) and Haier (two models). These are all small glass-fronted under-bench models made in China.

Testing, Standards and Labelling

There is no Australian or joint Australia/New Zealand Standard explicitly covering wine storage cabinets, and hence no standard definition of the product. This appears to have created difficulties for some suppliers of wine storage cabinets, and possibly been of advantage to others.

Some suppliers are of the view that retailers and buyers will not have confidence in the product unless they see an energy label on it, especially if the unit is displayed for sale alongside refrigerators and freezers, all of which are labelled.

Alternatively, some suppliers may designate a unit as a wine storage cabinet in order to avoid labelling it, both as a cost saving and to advantage it in competition with labelled refrigeration products. This is most likely in very small units, the geometry of which can lead to high heat loads and where there may be direct market competition between small bar fridges and small wine storage cabinets.

AS/NZS 4471 *Performance of household electrical appliances – refrigerating appliances* groups products into three main categories: refrigerators, freezers and refrigerator-freezers (with sub-categories determined by door arrangement and mode of defrost). Recently a fourth category was introduced – 'cool appliances' – for products that did not meet the performance criteria for the three main categories. This is because 'refrigerator', 'freezer' and 'refrigerator-freezer' are considered commercially valuable designations that are understood by consumers to indicate that a product is capable of the common food storage and/or freezing tasks, so products not able to perform those tasks should be separately classified.

Under the same logic wine storage cabinets, which are also unable to perform common food storage and/or freezing tasks, should not be classified as refrigerators (as they do not have freezing compartments, there is obviously no possibility of classification as a refrigerator-freezer or freezer). Nevertheless, three models have been tested in accordance with AS/NZS 4471, and registered as Group 1 refrigerators on the www.energyrating.gov.au website (two of these models are no longer available).

However there is some uncertainty about whether those models, or indeed any other model of wine storage cabinet, actually come within the scope of AS/NZS 4474. This defines three main types of compartment for non-frozen storage[3]:

- **chill type compartments** intended for the storage of highly perishable foodstuffs. The temperature range is -2˚C to 3˚C, to be achievable at an ambient temperature of 32˚C;

[3] It is understood that AS/NZS 4474.1 is currently under revision, and that one of the issues to be resolved is the treatment of wine storage cabinets. The discussion here is based on the current version AS/NZS 4474.1:1998 and amendments 1 and 2, with the intention that the matters raised can help clarify the issues and asssist with the revision of AS/NZS 4474.1.

- **fresh food compartments** intended for the storage of fresh food. The temperature range is 0.5˚C to 5˚C, to be achievable at ambient temperatures of 10, 32 and 43˚C (as fresh food storage is the primary function of a 'refrigerator' it is important that the task can be achieved across a wide range of ambient conditions); and

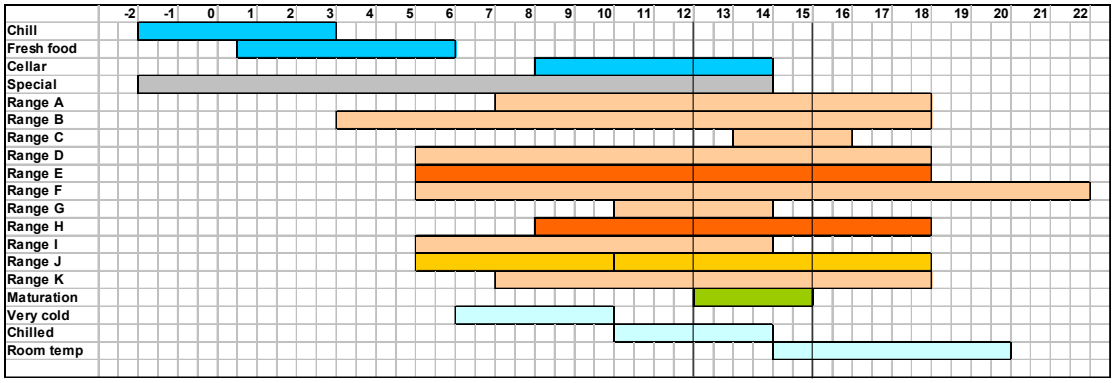
- **cellar compartments** intended for the storage of food and beverages at higher temperatures than the fresh food compartment. The temperature range is 8˚C to 14˚C, to be achievable at an ambient temperature of 32˚C.

The standard also allows for a "**special (unfrozen food) compartment**" and states that "the claimed maximum temperatures of any special (unfrozen food) compartment shall not be warmer than 14°C, its claimed minimum shall be warmer than -2°C and the difference between its claimed maximum and its claimed minimum shall not exceed 6°C."

AS/NZS 4471 also defines a "multi-use type compartment" intended for use as two or more of the compartment types defined above and capable of being set by a user to maintain continuously the operating temperature range applicable to each compartment type claimed. In other words, a multi-use compartment could at various times be a chill type, a freshfood type, a cellar type or a special type.

Figure 1 illustrates the compartment temperature ranges for non-frozen food storage in household refrigerators (bright blue, grey), the recommended temperature range for wine maturation (green) and for serving (light blue). It also illustrates the ranges (marked A to K) of temperature settings claimed for the 37 wine storage cabinets listed in Appendix 1. The buff-coloured bars apply to single-compartment units where the user can select a set point anywhere along the band. The actual temperature range around the set point and the stratification (the temperature range from the top to the bottom) would be different from model to model, and are not known. The yellow bar is a two-compartment unit where the smaller compartment can be set for cold serving and the larger compartment for ageing. The orange bars are 'multi-zone' cabinets where the temperature range represents the stratification in the cabinet at the one time.

Figure 1 Temperature ranges for refrigeration and wine storage



Only one of the wine storage cabinet temperature ranges shown appears to fully meet the criteria for one of the designated compartments (Range G is within the cellar compartment zone). On the face of it, none of the others meet the AS/NZS 4471

designations, even for 'special (unfrozen food) compartment' since they violate one or both of the criteria that:

- 'compartment shall not be warmer than 14°C, its claimed minimum shall be warmer than -2°C': most have a claimed maximum setting well above 14°C; and

- 'the difference between its claimed maximum and its claimed minimum shall not exceed 6°C: most have a far wider adjustment range.

However, if the 'special (unfrozen food) compartment' criteria were modified to reflect the characteristics of wine storage cabinets, some would be capable of a temperature setting low enough to qualify as a 'fresh food' compartment, so could qualify as a Group 1 or Group 2 refrigerator (depending on method of defrost), should the supplier wish. Of those that could not, most could still achieve the temperature conditions of a 'cellar compartment' and so qualify as Group 1 or Group 2 'cooled appliances'.

Given that most wine storage cabinets do not meet the criteria for testing under AS/NZS 4474, they can lawfully be sold without labels and without meeting any MEPS requirement (provided they meet all other statutory requirements, including electrical safety).

The issues are:

1. How can wine storage cabinets be defined more clearly, so that that there is no ambiguity about the coverage by (or exclusion from) a given standard?

2. Is it in the interests of consumers and of national energy efficiency objectives that wine storage cabinets should be energy labelled, meet some MEPS level, or both?

3. If so, what energy tests, labels and/or MEPS should be adopted?

4. Where should those energy tests, labels and/or MEPS be specified – in AS/NZS 4474, or some other standard?

Until now the issues have not been addressed directly. Some suppliers have believed it in their own interests to have their products labelled, and given that there is no standard they (and the regulators) have used AS/NZS 4474 for that purpose, even though such a use requires interpretations that are at least ambiguous and probably incorrect.

With regard to point (3) above, the current methods of test and performance requirements in AS/NZS 4474 are not appropriate for wine storage cabinets, so simply revising the standard so that it covers wine storage cabinets is not a desirable option.

The main ambient temperature for testing to AS/NZS 4474, 32°C, is significantly higher than average ambient temperature in Australian dwellings, but was deliberately chosen in order to simulate the additional heat load from multiple daily door openings without the cost and complexity of performing actual door-opening tests (as is done in some countries). It would inconsistent with this rationale to test wine storage cabinets to the same high ambient, since the frequency of door openings in use will be far lower.

Also, AS/NZS 4474 includes a pull-down tests and extreme operation tests (at 43°C), which are appropriate for refrigerators, where food could spoil if the unit did not meet these criteria. However, these tests are not just unnecessary for wine storage cabinets, they are actually inappropriate: a compressor with a large enough capacity to meet the pull-down and extreme ambient tests will probably operate at very low ratio of its capacity in a wine storage cabinet, and so lead to higher energy use than a smaller capacity compressor.[4] Indeed, a Peltier refrigeration system could may well be unable to meet the performance criteria without the support of an auxiliary vapour-compression refrigeration system, so if the tests were made mandatory the only Australian-made wine storage cabinet would be excluded from the market.

The Market

Wine storage cabinets have been available on the Australian market for less than 5 years. Estimates of current year sales range from 10,000 to 20,000. It is assumed that most of these are sold for household use, although there will be some purchases by small commercial users as well. Large commercial users will probably use commercial refrigerated display cabinets or coolrooms for chilled wine storage and specially built insulated cellar rooms for ageing and maturation.

Most of the units sold are medium and large, and are purchased by wine collectors for long term wine storage and ageing. It is possible that many of the smaller, under-bench units are purchased by apartment developers for building into kitchens, in the same way as 'European appliances' are used as a marketing point. The extent of actual use of these developer-supplied units, and the preferred temperatures (eg whether set for chilling rather than ageing) is unknown.

The size of the household market, the growth rate and the ultimate saturation levels are all uncertain, but some preliminary estimates can be made on the assumption that ownership follows a classic S-shaped curve, and saturates around the 10% level about 25 years after the product is introduced. This would be consistent with other discretionary products such as swimming pools, which are saturated at about the 10% level. Under these assumptions annual sales would stabilise at about 40,000 per annum around 2020 (see Figure 2, Figure 3 and Figure 4).

[4] One supplier states prominently on its website that its wine storage cabinets "are rated 'SN-T'. This means that the unit will efficiently and effectively operate at ambient tempertures up to 43˚C." The 'SN-T' rating does not relate to AS 4744. It may be an ISO standard rating. Apart from the question of whether this is a desirable attribute for a wine storage cabinet, it is not possible to verify the claim because the the models are not registerd for energy labelling, so there is no record of the internal temperature during test and it is not clear whether the units can sustain their full calimed (5 to 22 ˚C) temperature range at 43˚C ambient or only the upper bound.

Figure 2 Projected annual sales of domestic wine storage cabinets, Australia

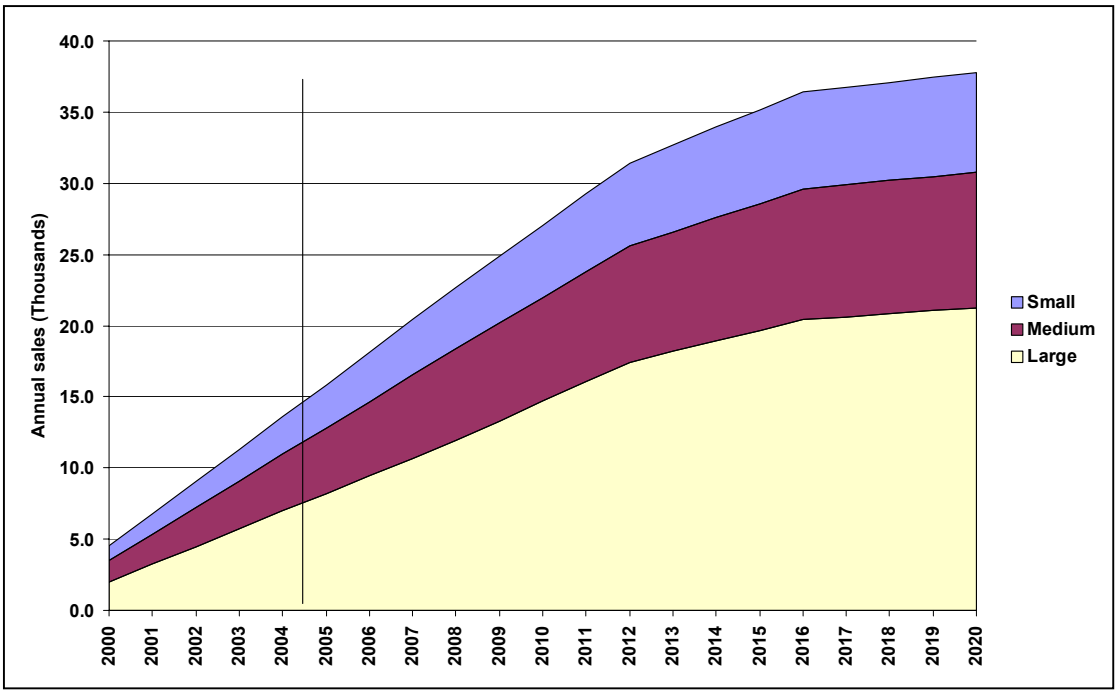


Figure 3 Projected total stock of domestic wine storage cabinets, Australia

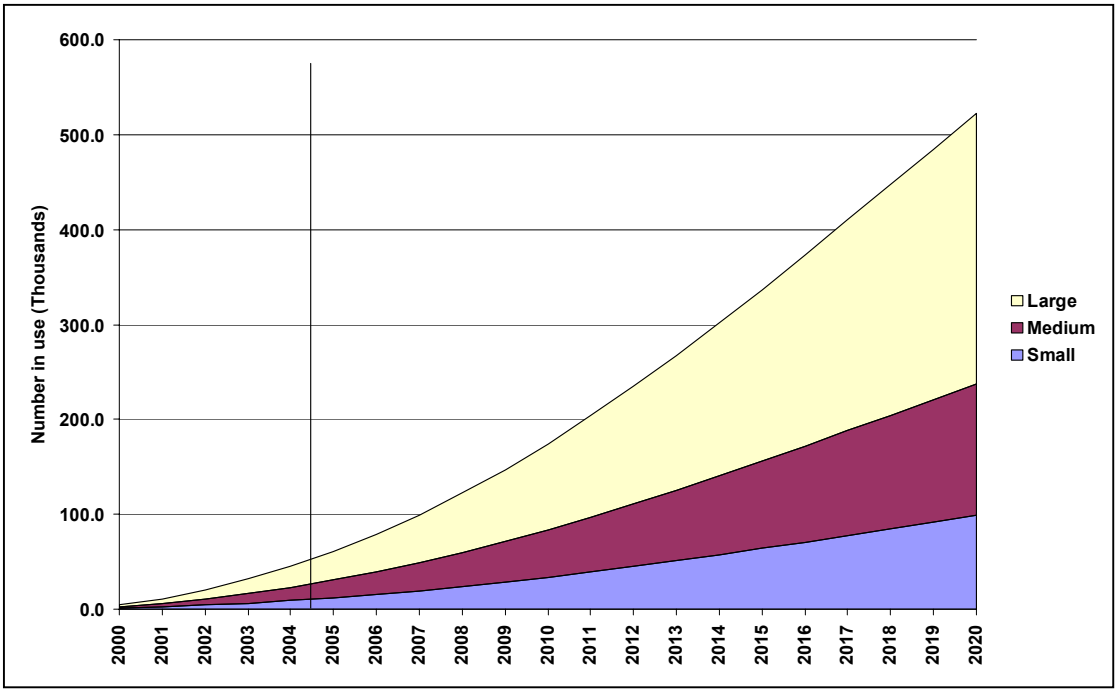
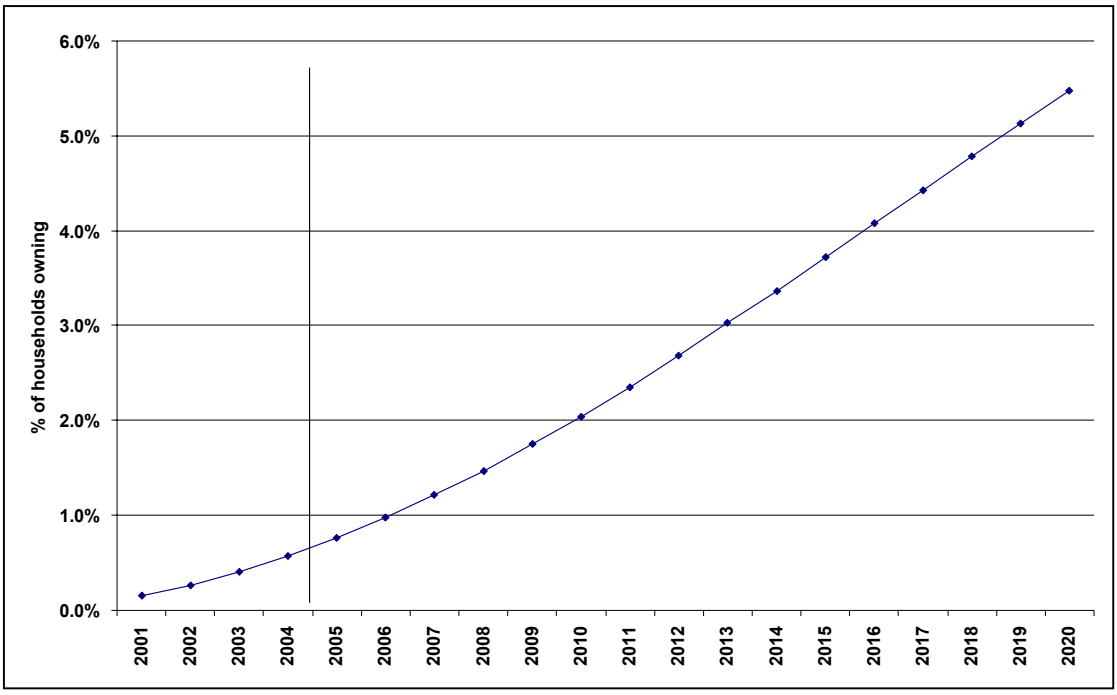


Figure 4 Projected ownership of domestic wine storage cabinets, Australia



Resource impacts

Energy use per unit

Several suppliers publish kWh per 24 hrs energy consumption values for their models. These are listed in Appendix 1. While these values are used as the basis for this energy analysis, they must be treated with caution. The energy tests are not documented; different suppliers could well be using different methods of test. Also, the ambient and internal temperatures used in the tests may not reflect conditions in use. All wine storage cabinets allow temperature adjustment, and it is not known whether users select warmer or colder temperatures than the ones used as the basis of testing.

The only currently available wine storage cabinet listed on www.energyrating.gov.au is claimed to use 673 kWh/yr. some 2.3 times the claim for the same model on the supplier's own website (0.8 kWh/24 hrs, corresponding to 292 kWh/yr). The difference appears to reflect the energy penalty of testing at an ambient temperature of 32˚C in accordance with AS/NZS 4474 compared with what is probably an ISO test at an ambient of 25˚C.[5]

Table 2 summarises the claimed energy performance characteristics for the 29 of the 37 wine storage cabinet models listed in Appendix 1 for which data are available. The units are sorted into three capacities – up to 80 bottles (up to about 200 litres internal volume), 80-180 bottles (up to about 400 litres internal volume) and larger.

[5] If the model were tested at its highest claimed temperature setting (14˚C, the maximum for a cellar compartment in AS/NZS 4474) at 32˚C ambient, the temperature gradient would be 16˚C, compared with 9˚C against the ISO ambient of 25˚C. All else being equal, the steady state energy demand under AS/NZS 4474 would be 1.8 times that under the ISO test. Two other models by the same supplier are rated on the energyrating site. Although these are no longer available in Australia, the data suggest that their ratio of AS/NZS to ISO energy use would be 1.7 and 2.1.

The typical annual energy use of a wine storage cabinet (about 300 kWh) is comparable to a small refrigerator or a dishwasher, clothes dryer or clothes washer (on cold wash). Smaller wine storage cabinets actually use more energy than larger cabinets. This could be due to their higher surface to volume ratio, and possibly to thinner insulation, since there is a commercial imperative to maximise storage capacity in relation to external cabinet volume in small units, especially under-bench models.

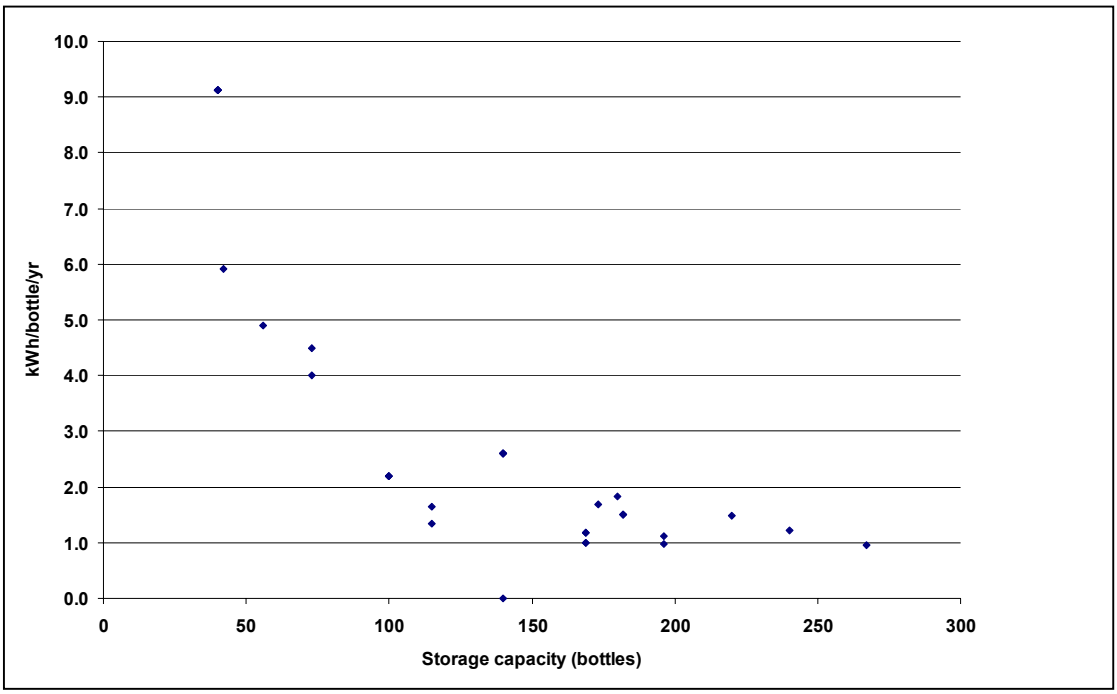
The most appropriate measure of energy efficiency for a wine storage cabinet is energy used per bottle capacity. Efficiency is much lower for smaller units (averaging 7.0 kWh per bottle per year) than for medium and large cabinets (averaging 2.6 and 1.5 kWh per bottle per year respectively). Energy efficiency rises with capacity (see Figure 5) but there is also a range in apparent energy efficiency for cabinets of comparable size, with a ratio of about 2 to 1 from most to least efficient.

Table 2 Energy characteristics of wine storage cabinets on the Australian market

	Small	Medium	Large	All
Bottle capacity (maximum)(a)	<80	80-180	>180	
Models with kWh/24 hr stated	8	14	7	29
Models with no energy data	5	1	2	8
Total models	13	15	9	37
Model average kWh/day	0.89	0.68	0.72	0.75
Model average kWh/yr	325	247	262	272
Average kWh/bottle/yr (a)	7.0	1.8	1.2	2.1
Maximum kWh/bottle/yr (a)	9.1	2.6	1.5	9.1
Minimum kWh/bottle/yr (a)	4.0	1.0	1.0	1.0
kWh/yr at minimum energy	187	139	218	206

Source: Appendix 1 (a) Where variable bottle capacity is given the highest value is used.

Figure 5 Energy efficiency vs capacity, wine storage cabinets

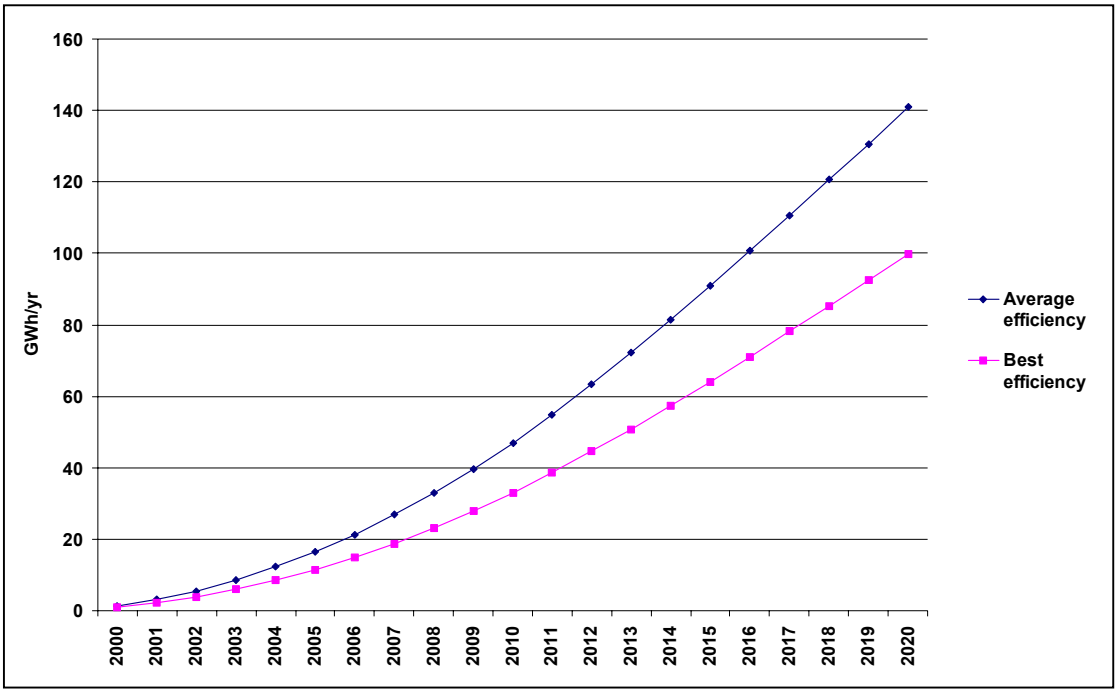


Total energy use

A 'Business as Usual' (BAU) energy trend for wine storage cabinets has been projected on the assumption that the average energy consumption of the small, medium and large cabinets sold to the period to 2000 to 2020 (Figure 2) is the value indicated in Table 2 (ie 325, 247 and 262 kWh/yr respectively).

A 'best efficiency' scenario has been projected by assuming that the energy efficiency of each size category moves to the best on market (ie the minimum kWh per bottle capacity). Under this assumption the average energy consumption of the small, medium and large cabinets sold to the period to 2020 would be 187, 139 and 218 kWh/yr respectively. Figure 6 illustrates the difference between the two scenarios. Under the BAU scenario the total energy consumption by wine storage cabinets is projected to reach about 140 GWh per year by 2020. Under the 'best efficiency' scenario it is projected to reach about 100 GWh per year by 2020, a reduction of about 30%. At a marginal greenhouse coefficient of 0.8 kg CO_2-e/kWh delivered, this would be a greenhouse reduction of about 30 kt CO_2-e per year by 2020. This is a relatively small amount by the standard of other NAEEEP measures.

Figure 6 Projected energy use by wine storage cabinets, Australia - BAU and Best Efficiency projections



Conclusions and Recommendations

The issues

Wine storage cabinets are relatively new to the Australian market. Sales are growing strongly from a low base, but given the specialist nature of the product it is difficult to envisage an ultimate ownership rate above about 10%. The energy consumption of individual cabinets is comparable to the major household appliances that are energy labelled (dishwashers, clothes washers and clothes dryers), although the projected national energy impact is much lower because ownership is expected to remain low.

Currently there is no Australian Standard applicable to wine storage cabinets, and hence no basis for energy testing, labelling or MEPS. Nevertheless there is some interest in the market in indicating the energy consumption of models. Many suppliers are publishing values without specifying the method of test or the test conditions, although given that most models are imported from Europe the most likely test is an ISO standard. The available data suggest that there is a strong correlation between capacity and energy efficiency, and also differences in efficiency for models of similar capacity, of which prospective buyers should be made aware.

At least one supplier has had models tested under AS/NZS 4474 *Performance of household electrical appliances – refrigerating appliances,* even though a rigorous application of the standard suggests that the models did not meet the criteria for refrigerating appliances. The tests in AS/NZS 4474 are not appropriate for wine storage cabinets because the test ambient is too high and the extreme performance test is unnecessary. In fact, applying these tests could give a lower apparent energy rating – or exclude altogether – those wine storage cabinet designs which are likely to be more energy-efficient in use.

Conclusions

- Wine storage cabinets are not a high priority in terms of national energy efficiency objectives, because of their relatively low sales.

- Nevertheless, the public interest would be served by the provision of consistent energy efficiency information for wine storage cabinets. Most suppliers are already making statements about energy consumption, but without substantiation and not necessarily to a common standard.

- Australia should support the development of an internationally accepted energy test standard for wine storage cabinets, preferably based on or linked to the ISO refrigerator test standards which are used for refrigerator testing in Europe. This is appropriate as most of the wine storage cabinet models sold in Australia are imported from Europe.

- Once an accepted international test standard is available, NAEEEC should consider using it as the basis for energy labelling of wine storage cabinets in Australia.

- AS/NZS 4474 is designed to test the energy performance of refrigerators, freezers and 'cold appliances', which perform quite different tasks from wine storage cabinets. It should not be used for testing and labelling wine storage cabinets. If a wine storage cabinet meets the definition of a refrigerator or a cold appliance (as some may) and its supplier opts to have it tested accordingly, then it should be energy labelled and marketed as a refrigerator or a cold appliance, not as a wine storage cabinet.

- Until wine storage cabinets are brought within the scope of energy labelling regulations, the only control on the veracity and verifiability of their suppliers' statements about their energy use is general consumer protection legislation.

- The total energy consumption of wine storage cabinets is projected to remain relatively low, so measures that restrict the range of models on the market (eg Minimum Energy Performance Standards) are not likely to be warranted.

Recommendations

It is recommended that

1. NAEEEC should support the development, by ISO, of an internationally accepted energy test standard for wine storage cabinets, preferably based on or linked to the ISO refrigerator test standards.

2. If and when the new test becomes available, NAEEEC should consider its adoption for energy labelling of wine storage cabinets in Australia.

3. In the meantime, AS/NZS 4474 should be clarified to state that it only covers the defined categories of products (refrigerators, freezers and cold appliances) and that any products energy tested in accordance with those categories must be labelled and marketed accordingly (ie a product tested as a cold appliance cannot be marketed as a wine storage cabinet).

4. NAEEEP should contact the suppliers of wine storage cabinets to alert them of the need to ensure that any statements they may make about energy performance must be capable of substantiation under consumer legislation, and should not be presented as derived from or based on Australian standards or energy labelling.

5. The market for wine storage cabinets be reviewed at not more than 3 yearly intervals to reconsider the case for mandatory energy labelling and minimum energy performance standards.

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References

AS/NZS 4471.1:1997 *Performance of household electrical appliances – refrigerating appliances. Part 1: Energy consumption and performance* (with Amendment 1:2001 and Amendment 2:2004)

Cerexhe, Peter (2003) *The Choice Wine Buying Guide 2003*, Choice Books 2003

NAEEEP (2002) *National Appliance and Equipment Energy Efficiency Program (NAEEEP) Work plan and policies for 2002 to 2004*, April 2002

NAEEEP (2004) *National Appliance and Equipment Energy Efficiency Program (NAEEEP) - Coverage of the Residential, Commercial and Manufacturing Sectors,* George Wilkenfeld and Associates for the Australian Greenhouse Office, August 2004

Appendix 1 Wine Storage Cabinets available in Australia, Sept 2004

Brand	Model	Country of origin	Capacity Bottles	Internal vol litres	Door	Storage Zones (a)	Storage temp range ˚C	Stated kWh/24 hr (b)	Stated kWh/yr (c)	Labelled kWh/yr
Access	Winekeeper	China	34	NS	Glass	1	7-18	NS	NS	NS
Haier	JC112	China	26	110	Glass	1	3-18	NS	NS	NS
	JC152GBB	China	42	152	Glass	1	3-18	NS	NS	NS
Kitchener	K252	Australia	252	NS	Solid	1	13-16	NS	NS	NS
	K410	Australia	410	NS	Solid	1	13-16	NS	NS	NS
Liebherr	WKSr5700	Germany	267	560	Solid	1	5-18	0.70	256	NS
	WKr4677	Germany	196	456	Glass	1	5-22	0.60	219	NS
	WKr4677	Germany	196	456	Solid	1	5-22	0.52	190	NS
	WKes4176	Germany	169	401	Solid	1	5-22	0.46	168	NS
	WKr4177	Germany	169	401	Glass	1	5-22	0.55	201	NS
	WKr4176	Germany	169	401	Solid	1	5-22	0.46	168	NS
	WKes4177	Germany	169	401	Glass	1	5-22	0.55	NS	NS
	WKr2977	Germany	115	285	Glass	1	5-22	0.52	190	NS
	WKr2976	Germany	115	285	Solid	1	5-22	0.42	153	NS
	WKr1802	Germany	68	174	Glass	1	5-18	NS	NS	NS
	WKUes1800	Germany	56	180	Solid	1	5-18	0.75	274	NS
	WTUes1653	Germany	43	180	Glass	2	5-18	NS	NS	NS
	WTes4177	Germany	182	410	Glass	Multi	5-18	0.75	274	NS
	WTr4177	Germany	182	410	Glass	Multi	5-18	0.75	274	NS
Transtherm	Studio	France	36-42	NS	Solid	1	10-14	0.68	248	NS
	MAS 1	France	65-73	NS	Solid	1	10-14	0.80	292	NS
	Manoir	France	137-173	425	Solid	1	10-14	0.80	292	NS
	Ermitage	France	179-240	539	Solid	1	10-14	0.80	292	673(d)
	MAS MT	France	65-73	NS	Solid	Multi	8-18	0.9	329	NS
	Cellier	France	132-180	425	Solid	Multi	8-18	0.9	329	NS
	Reserve	France	168-220	539	Solid	Multi	8-18	0.9	329	NS
Vintec	40 SG'E'	China	40	100	Glass	1	5-14	1.0	365	NS
	40 SG'E'SS	China	40	100	Glass	1	5-14	1.0	365	NS
	40 SG'2E'SS	China	40	100	Glass	2	5-10,10-18	1.0	365	NS
	40 SG'2E'	China	40	100	Glass	2	5-10,10-18	1.0	365	NS
	120 SG	Denmark	80-100	274	Glass	1	7-18	0.6	219	NS
	120 SPSS	Denmark	80-100	274	Solid	1	7-18	0.6	219	NS
	120 SP	Denmark	80-100	274	Solid	1	7-18	0.6	219	NS
	160 CG	Denmark	120-140	338	Glass	1	7-18	NS	NS	NS
	160 SG	Denmark	120-140	338	Glass	1	7-18	1.0	365	NS
	160 DP/SPSS	Denmark	120-140	338	Solid	1	7-18	1.0	365	NS
	160 SP	Denmark	120-140	338	Solid	1	7-18	1.0	365	NS

NS = Not stated. (a) 1 = single compartment, with one (adjustable) temperature; adjustment range given. 2 = two separate compartment, with (adjustable) temperature ranges given (may be same range for both). multi = single compartment in which there is a range of temperatures. (b) kWh/24hr energy consumption indicated in supplier brochures. (c) kWh/24hr value multiplied by 365. (d) This is the only current model listed on www.energyrating.gov.au: the two other Transtherm models listed are no longer sold in Australia.