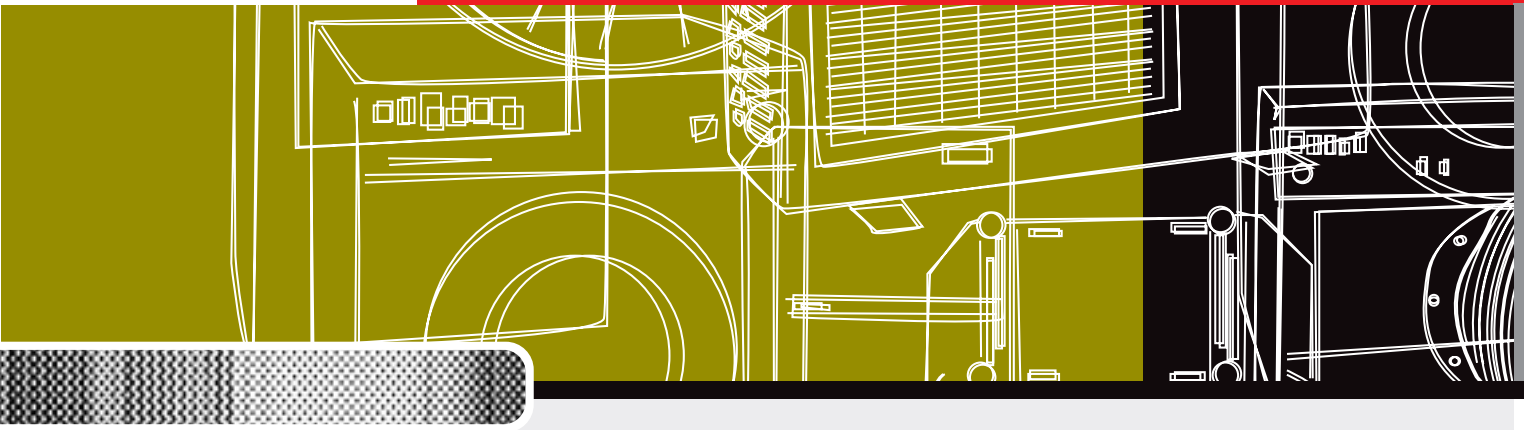


**NATIONAL APPLIANCE AND EQUIPMENT
ENERGY EFFICIENCY PROGRAM**

**VOLUNTARY ENERGY LABELLING POSSIBILITIES FOR
EVAPORATIVE & REFRIGERATIVE AIR CONDITIONERS**



FINAL REPORT

January 2002

PREPARED FOR AUSTRALIAN GREENHOUSE OFFICE

BY ENERGYCONSULT PTY LTD

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INTRODUCTION

Background

The Australian Greenhouse Office (AGO) is the leading Commonwealth agency on greenhouse matters, responsible for both the coordination of domestic climate change policy and for managing the delivery of major new and existing Commonwealth greenhouse programs.

The National Appliance and Equipment Energy Efficiency Committee (NAEEEC) comprises officials from the Commonwealth, State and Territory government agencies, together with representatives from New Zealand is responsible for implementing product energy efficiency initiatives in those jurisdictions. NAEEEC's role is to coordinate the National Appliance and Equipment Energy Efficiency Program (NAEEEP). Through this program, the various Governments work together to develop and introduce measures that improve the energy efficiency of appliances and equipment used by households and business.

While three-phased packaged air conditioners were regulated on 1 October 2001, to levels stipulated in the Australian and New Zealand Standard 3823:2001, evaporative air conditioners are currently under consideration for the Voluntary Best Practice Program. A voluntary program will promote better practice for improving the selection of high efficiency equipment by consumers and support other measures to improve the sales of the best available and most efficient products.

As packaged refrigeration air conditioners are already subject to either mandatory labelling or proposed minimum performance standards (MEPS), NAEEEC does not consider development of MEPS for evaporative air conditioners to be effective for the following reasons:

- evaporative air conditioners result in modest greenhouse gas emissions equivalent to approx 0.4% of energy sector emissions in 1998 (NGGI 2000)
- industry sources believe that the market share of evaporative air conditioners will fall over forthcoming years

- an examination of overseas standards has revealed that MEPS for evaporative coolers are not prescribed elsewhere in the world
- greater greenhouse gas savings could be obtained through the substitution of refrigerative units by evaporative coolers in appropriate climate zones, compared to increasing the average efficiency of evaporative units by regulation.

Objectives of this Study

The AGO commissioned EnergyConsult Pty Ltd to identify and report on the what options may exist for a voluntary energy labelling program that could assist consumers and improve the sales of the most efficient cooling products.

This study aims to:

1. Conduct desktop research that assesses what approaches have been implemented overseas.
2. Compile a list of possible approaches based on overseas experience and formulate an assessment of the advantages and disadvantages of these approaches.
3. Conduct interviews with relevant Australian stakeholders to determine the most appropriate direction and mechanisms for cooperation to ensure program effectiveness and success.

It should be noted that this report is exploratory only and can be considered as an investigation into possible labelling options and not the final recommended program. The objective of this report is to inform the reader of the range of potential labelling program options and our assessment of which are the most appropriate, based on the research conducted. The report also provides draft recommendations on the way forward for potential evaporative air conditioner labelling programs.

Of course, the report does not represent the views of the Australian Greenhouse Office nor any particular stakeholder.

Methodology

The research focused on obtaining information on international labelling programs for evaporative air conditioners and how such a program might be applied within Australia. Techniques used included:

- comprehensive search via the Internet
- telephone interviews with key stakeholders.

Research of Labelling Programs

A comprehensive search on the Internet and printed reference material was conducted to research existing international programs that label evaporative coolers. In particular, the search aimed to solicit:

- specific characteristics of labelling programs including the type of strategies, the intended or targeted market and major players
- the evidence and reasoning supporting labelling programs.

Following from this research a list of labelling programs that could be applied to the Australian market place was established. This allowed these program options to be discussed during stakeholder interviews.

Telephone Interviews with Key Industry Stakeholders

To ensure that the views of Australian stakeholders were included in this Study, telephone interviews were conducted with key industry stakeholders including:

- Carrier (Bravis)
- Seeley (Braemar, Breezair, Coolair and Convair)
- Climate Technologies (Bonaire & Celair)
- University of NSW (Ian Maclaine-Cross, Senior Lecturer, recommended by Professor Graham Morrison).

The aims of conducting interviews with industry stakeholders were to:

- determine their views on options for a voluntary labelling scheme
- seek stakeholders' opinions on those factors that will enhance or inhibit the introduction of such a program
- discuss how governments, manufacturers and market intermediaries may be able to cooperate to ensure program success.

Analysis and Recommendations

Following the compilation of the research, and an assessment of the possibilities for a voluntary energy labelling scheme, recommendations were developed.

RESULTS

Research of Labelling Programs

There are currently no voluntary labelling programs covering evaporative air conditioners. Additionally, no comparative or endorsement labels that include both evaporative and refrigerative AC have been implemented internationally.

Iran is the only country that conducts a mandatory comparative labelling program for evaporative air conditioners (see example of the label to the right). The label design is based on European concept but as a mirror image with efficiency grades in numbers rather than letters (Fassi script). It shows efficiency grades from 1 (most efficient - the shortest bar, which appears in green on the original label) down to 7 (least efficient - the longest bar, which appears as red).

The aim of the Iranian program is to encourage local manufacturers to improve the efficiency of their products. Studies conducted in cooperation with manufacturers revealed that there are a variety of design changes possible, such as the use of more efficient fans, pad density and improved water circulation rate. These changes would make a considerable impact on energy consumption without requiring major investment. Hence the labelling scheme was launched in 1999 to encourage these changes.

The scheme is run by the Standards and Industrial Research Organisation. It consists of a comparative label similar in design to the European label. Being the first country to introduce labelling and MEPS has meant that Iran has had to develop its own test methods and rating levels. The units are rated using an EER (Energy Efficiency Ratio) measurement to compare products. Thresholds are shown in Table 1. Promotion of the energy label is largely done by manufacturers who have found it be a useful marketing tool.

IRANIAN ENERGY LABEL FOR HOUSEHOLD REFRIGERATOR-FREEZERS



TABLE 1 EFFICIENCY THRESHOLDS FOR IRANIAN ENERGY LABEL

Rating	EER	Value
1	≥ 65	
2	< 65	≥58
3	< 58	≥50
4	< 50	≥42
5	< 42	≥34
6	< 34	≥26
7	< 26	

Possible Approaches for Labelling Program

VOLUNTARY LABELLING OPTIONS

As there is currently only one international labelling program for evaporative air conditioners, the development of possible options for such a program in Australia will rely on generalised labelling theory rather than overseas experience. There are three types of energy labels currently in use: Comparative labels which rank products; Endorsement labels that identify only the most efficient products; and Information labels that simply present product data to consumers. Any voluntary labelling program for evaporative air conditioners launched in Australia would be the first of a kind. There are five options for such a program:

1. Comparative label for evaporative air conditioners only.
2. Common comparative label for evaporative and refrigerative air conditioners.
3. Endorsement label for evaporative air conditioners only.
4. Common endorsement label for evaporative and refrigerative air conditioners.
5. Information label for evaporative air conditioners only.

COMPARATIVE LABEL FOR EVAPORATIVE AIR CONDITIONERS ONLY

POSITIVES

- *Easy identification of most efficient models* - a comparative labelling scheme would enable consumers to easily identify the most efficient evaporative coolers in the market
- *Consumer familiarity* - comparative labelling for other appliances has existed in Australia since the late 1980's. Studies have shown that consumers have a very high level of recognition and understanding of these labels. This familiarity would suggest that the introduction of such a label for evaporative coolers would need minimal explanation and is likely to be highly successful.

BARRIERS

- *Need to establish test procedure* - any attempt to establish a comparative labelling scheme for evaporative coolers in Australia would require the establishment of standard test procedures. Currently the Australian standard requires performance information be recorded for airflow, evaporation efficiency, noise levels and electricity consumption. This information may be able to be used to form the basis of a rating system or alternatively a new approach may be required such as that used in Iran where EER determines the energy rating
- *Low participation* - some programs that have used voluntary comparative labels find that only the most efficient models use the labels making comparison difficult and more or less rendering the program an endorsement label.



COMMON COMPARATIVE LABEL FOR EVAPORATIVE AND REFRIGERATIVE AIR CONDITIONERS

POSITIVES

- *Easy identification of most efficient cooling* – a label that compares all types of cooling equipment will empower consumers to install the most energy efficient product irrespective of the method used to reduce room temperature
- *Increased potential to reduce energy consumption* – evaporative air conditioners typically have energy costs up to 80% less than refrigerative models. A Common label has the potential to sway customers toward this method of cooling thereby having greater impact on energy consumption than two separate labels
- *Consumer familiarity* – see above.

BARRIERS

- *Indication of suitable climates* - evaporative air conditioners are not suitable for humid climates. There is some debate regarding which geographic areas in Australia are the most appropriate for installation. There would need to be some clarification of appropriate zones. Additionally any labelling system would need to be able to communicate this
- *Need to establish Australian Standard and Rating Algorithms* – a standard for testing evaporative Coolers in a way that would allow a comparison with refrigerative air conditioners e.g. EER would need to be established. Evaporative and refrigerative air conditioners both reduce room temperature however an evaporative cooler reduces temperature by decreasing the amount of 'sensible' heat i.e. decreases temperature whilst increasing humidity. A refrigerative air conditioner removes both 'sensible' and 'latent' heat, thereby decreasing both temperature and humidity. These differing techniques mean that the development of a common label will be faced with the challenge of finding attributes that enable a strict comparison whilst overcoming any perceptions of bias due to comparing different

products. Refrigerative air conditioners in Australia are currently rated using EER as a measurement

- *Energy Service* – refers to the benefits the consumer receives from an appliance. This needs to be taken into account when establishing a labelling program. While both evaporative and refrigerative air conditioners lower the room temperature they provide differing types of comfort i.e. increasing or decreasing humidity. According to the research room temperature is just one aspect of successful cooling. Comfort zones as assessed by consumers also include upper and lower humidity levels. This aspect of performance may need to be considered in a common label
- *Information overload* – the current air conditioning labelling program includes information on heating performance where applicable. By increasing this information to include comparison with evaporative coolers may decrease the effectiveness of the labels
- *Low participation* – see above.

ENDORSEMENT LABEL FOR EVAPORATIVE AIR CONDITIONERS ONLY

POSITIVES

- *Simplicity* – an endorsement label simply identifies the best models. Consumers don't need to understand information just look for the label.

BARRIERS

- *Setting the Standard* – setting an efficiency level for an endorsement label may in some ways be less complicated than establishing a rating system. However, a rigorous test procedure would still need to be established
- *Fewer energy gains* – endorsement labels only highlight the most efficient products. If these products correspond with the most expensive there will be smaller gains if these are beyond most consumers financial limits. In order to have overall improvement

consumers need to be able to differentiate the energy efficient models in price ranges

- *Unfamiliar to consumers* – endorsement labels have had limited use in Australia, with the exception of the newly introduced energy star for electronics. An education program would have to be conducted to assist consumers in identifying the label as an independent endorsement rather than another marketing tool.

COMMON ENDORSEMENT LABEL FOR EVAPORATIVE AND REFRIGERATIVE AIR CONDITIONERS

POSITIVES

- *Reduce confusion with current mandatory scheme* – by using an endorsement label the program will clearly distinguish that it is voluntary and different from the mandatory rating label. This will avoid any negative impacts on either scheme
- *Simplicity* – see above.

BARRIERS

- *Comparison Difficulties* – see above
- *Setting the Standard* – see above
- *Unfamiliar to consumers* – see above.

INFORMATION LABEL FOR EVAPORATIVE AIR CONDITIONERS

POSITIVES

- *No need to develop a rigorous test procedure* – an information label could provide consumers with information currently tested for energy consumption and evaporation efficiency. Such a label could also indicate suitable climate where evaporative air conditioners out perform refrigerative models and include general advice on potential savings
- *Encourage evaporative instead of refrigerative* – by providing independent information,

consumers may be encouraged to choose evaporative cooling ahead of refrigerative thereby reducing future energy consumption.

BARRIERS

- *Difficult to distinguish efficient models* – whilst an information label could inform consumers when an evaporative cooler is more efficient than a refrigerative air conditioner there would be no means of identifying the most efficient models. This may actually cause an increase in the installation of inefficient models
- *Unfamiliar to consumers* – see above.

Interviews with Australian Stakeholders

Telephone interviews were undertaken with 4 Australian stakeholders. They included representatives from:

- Brivis (owned by Carrier)
- Braemar, Breezair, Coolair and Convair (owned by Seeley)
- Bonnaire and Celair (owned by Climate Technologies)
- University of NSW (Ian Maclaine-Cross, Senior Lecturer in School of Mechanical Engineering).

The interviewed respondents from the major evaporative air conditioner cooler makers/suppliers in Australia represent an estimated 70-80% of the Australian market. While Ian Maclaine-Cross, from the University of NSW, School of Mechanical Engineering, has extensive research and industry experience with evaporative cooling cycles

Appendix A (available from the Australian Greenhouse Office) provides a summary of the responses for each interview.

INTERVIEW SUMMARY

The respondents were asked to comment in a number of areas, including the following:

- appropriateness of a voluntary labelling scheme for evaporative air conditioners
- common scheme covering both evaporative and refrigerative air conditioners
- comparative or endorsement labels and Voluntary vs Mandatory
- technical or market issues
- how governments can cooperate with stakeholders
- willingness to support a scheme.

The general summary of the respondents is presented below.

VOLUNTARY LABELLING SCHEME

There was general agreement that a voluntary energy labelling scheme for evaporative coolers would be useful, but the exact purpose would need to be defined (i.e., to promote more efficient evaporative units or to promote evaporative units over refrigerative). In addition the following issues would need to be addressed:

- the accuracy of information
- testing, which has been problematic with the industry
- comparison between evaporative units may not allow for significant running cost differences, as the running costs are naturally low and the efficiency differences may be less than 25%.

Support for a voluntary label that allows the evaporative coolers to be promoted over refrigerative AC was seen as the most important factor.

COMMON LABELLING SCHEME FOR EVAPORATIVE AND REFRIGERATIVE

A common scheme for both evaporative and refrigerative AC was not supported by the industry, as there are many difficult technical issues that do not allow them to be directly compared, including:

- evaporative and refrigerative test standards use different test conditions
- evaporative coolers are climate and operationally sensitive, while refrigerative coolers can work effectively in many conditions.

COMPARATIVE OR ENDORSEMENT LABELS

The industry representatives thought a comparative label would not be generally appropriate at this stage, as:

- the accuracy of some of the measured parameters required for a comparative label algorithm are in question, i.e., output capacity

- the differences in the current efficiency of evaporative units are not large, hence the advantage of comparison is reduced.

However, Dr Maclaine-Cross of UNSW believed that comparative labelling was technically possible and the testing measurements should be sufficiently accurate if implemented correctly.

An endorsement label was considered to be technical suitable, but the marketing effectiveness of the label would be lower than a comparative label (with energy consumption information). It was suggested that an information label, which shows annual energy consumption of an evaporative cooler, would be valuable, particularly for marketing in competition to refrigerative units.

Generally, a voluntary label would be preferable, however if a comparison label was introduced, then mandatory options may need to be investigated.

TECHNICAL OR MARKET ISSUES

The major technical issues associated with voluntary labelling of evaporative coolers relate to the current testing standard and results from various laboratories. The industry representatives generally agreed that further investigation is warranted of the accuracy, reliability/repeatability and interpretation of the testing standard by the major labs. The objective would be to determine if improvements to the testing standard or test facilities/equipment (or the interpretation of the testing standard) are necessary.

The provision of accurate information to the consumer and market intermediaries was identified by the industry as a major market issue, including:

- load calculations and guidelines for use in the sizing of evaporative coolers (particularly for the larger residential and small commercial facilities)
- provision of energy consumption data that can be used to "sell" the low running cost benefits of evaporative air conditioning compared to refrigerative air conditioning
- government endorsed information on the benefits of evaporative cooling and how to use it effectively

- provision of information on the appropriate climates/areas for evaporative cooling.

HOW GOVERNMENTS CAN COOPERATE WITH STAKEHOLDERS

The respondents were keen to cooperate with the government in the development of any program and would be willing to review or comment on other ideas. The general ideas from the respondents were:

- target and consult with the four major manufacturers
- work with the contractors and dealers who sell the products to the consumers.

Specific ideas to investigate from the industry were:

- develop an information label that shows the annual energy consumption for evaporative coolers, so that comparison with the refrigerative units can be made
- assist the industry to address the uncertainty with the testing standard
- provide an information campaign that promotes the benefits of evaporative AC.

WILLINGNESS TO SUPPORT A SCHEME

All the respondents were keen to support an appropriate scheme and would be personally interesting in being kept up-to-date with the future developments. They were highly supportive of information based labels/programs that demonstrated the relative benefits of evaporative AC compared to refrigerative AC.

INTERNATIONAL AND AUSTRALIAN SITUATION

International Situation

There are currently no voluntary labelling programs covering evaporative air conditioners. Iran is the only country that conducts a mandatory labelling program for evaporative air conditioners. Hence, there is very little guidance on the appropriateness of labelling schemes for evaporative air conditioners from the international community.

The Iranian labelling program for evaporative air conditioning provides some ideas on what may work for comparative labels and can be investigated further if a comparative scheme is introduced in Australia. The Iranian algorithms used to develop the comparative scale and their testing standards provide an excellent starting point for the development of a comparative label in Australia.

Australian Situation

MARKET CHARACTERISTICS

The annual sales of evaporative air conditioning in the domestic sector was estimated to be 70,000 pa by Mark Ellis and Associates in the report Potential for MEPS for Evaporative Air Conditioners, 2001. This figure was confirmed by the industry interviews. The market share of the 4 largest suppliers was estimated to be over 90%, with Seeley estimating their market share as the largest in the range of 45%.

The industry members interviewed also noted that Victoria was a rapidly increasing market with sales into the eastern suburbs of Melbourne. The established markets for evaporative air conditioning were South Australia, northern Victorian and southern NSW and Perth. Very few units are being installed in Sydney, according to the industry.

TECHNICAL STANDARDS

The new Australian Standard for the measurement and testing of evaporative air conditioners is AS 2913—2000 Evaporative air conditioning

equipment. This standard allows data published in relation to any particular equipment are sufficiently accurate to ensure that equipment can be selected correctly for the individual application. The information required for proper selection concerns the unit's airflow, its evaporation efficiency, its electrical power consumption, its nominal rating and its sound power output, and appropriate methods for the determination of each are described.

The type tests described by the standard are:

- airflow
- evaporation efficiency
- sound output level
- electricity consumption.

The standard specifies the conditions and calculation of the rated cooling performance. The specified conditions are

- (a) Inlet dry bulb temperature – 38°C.
- (b) Inlet wet bulb temperature – 21°C.
- (c) Room dry bulb temperature – 27.4°C.

Energy consumption is measured at the same conditions specified for measuring evaporator efficiency, that is:

The air entering the test appliance shall have a dry bulb temperature of between 30°C and 40°C, with a wet bulb depression of between 14K and 18K.

The evaporation efficiency is determined by the following equation:

$$e = \frac{t_i - t_o}{t_i - t_{wi}} \times 100\% = \% \text{ efficiency Evaporative}$$

where:

t_i = air inlet dry bulb temperature, in °C

t_o = air outlet dry bulb temperature, in °C

t_{wi} = air inlet wet bulb temperature, in °C

RECOMMENDED PROGRAM DIRECTION

The objective of this report is to provide recommendations on the most practical voluntary/mandatory measures for encouraging an energy rating label for evaporative/refrigerative air conditioners. The following ideas are based on the research and interviews of industry members.

COMMON LABEL FOR EVAPORATIVE AND REFRIGERATIVE AIR CONDITIONERS

1. **A common label for evaporative and refrigerative air conditioners based on the current refrigerative air conditioning label should not be considered.**

The current testing and performance measurement specifications for evaporative and refrigerative air conditioners do not allow a direct comparison of the units cooling ability and hence measurement of comparative energy consumption. There are many more variables involved in the satisfactory performance of evaporative units compared to refrigerative units, such as local climate, operation and maintenance.

LABELLING FOR EVAPORATIVE AND AIR CONDITIONERS

2. **Comparative energy rating label for evaporative air conditioners is not appropriate at this stage due to the technical uncertainties associated with measurement of various parameters and potential market confusion.**

The industry representatives noted that the current measurements of evaporative air conditioning performance were still uncertain. It was noted that recent tests to the new standard were not repeatable and hence, the technical infrastructure for a comparative label is still being established. Also the differences between the worst and best efficient evaporative unit may be at most 25% which – when translated into running costs – does not provide significant differentials.

It is also possible that a comparative energy rating label for evaporative air conditioning that is in the same format as the current refrigerative label may

confuse consumers. For instance, a hypothetical 2 star evaporative air conditioner may be more than four times more efficient than a 2 star refrigerative air conditioner. This may cause confusion in the market, especially as the suppliers of evaporative air conditioning are trying to sell the lower running cost benefits of their units compared to refrigerative units.

3. **The appropriateness of a comparative energy rating label for evaporative air conditioners should be reviewed with the industry in 12 months. The results of industry testing that may improve the technical uncertainties and further investigations of the potential market acceptance of an Australian comparative Energy Rating are required.**

Although the new Australian Standard for the measurement of evaporative air conditioners provides an excellent basis for the establishment of a comparative energy label, there are a number of uncertainties with the repeatability of the test. These uncertainties may be due to the set-up of the various test rigs or the accuracy limits of measurement devices, however this will need to be further investigated by the industry.

Further investigations into the market perceptions of a comparative label for evaporative air conditioning is required if a comparative label is eventually supported by the industry. This will need to quantify the possibility that consumers do not confuse a separate comparative label for evaporative air conditioners with a common comparative label for both evaporative and refrigerative units.

4. **An endorsement label for evaporative air conditioners is not currently considered to effectively assist the marketing of these units.**

An endorsement label alone is not considered the most effective mechanism for encouraging efficient air conditioning. The endorsement label may be the easiest label to implement under the current technical regime, as the levels of efficiency chosen for obtaining the label can be selected with wide margins for error, however this type of label may only assist those consumers who are already

considering the purchase of evaporative air conditioning.

The endorsement label also has difficulties with awareness, as no such label exists in Australia, except for the Energy Star. Greenhouse benefits would be greater if evaporative air conditioning is promoted instead of refrigerative air conditioning (where appropriate). Hence, the endorsement label is not considered appropriate.

5. A discussion paper should be prepared to provide options for the development of an information sheet that lists the estimated energy consumption of evaporative air conditioners under different climate zones.

A number of factors need to be considered with labelling evaporative air conditioners. Clearly the objective of the scheme needs to be defined, and in the case of evaporative air conditioners, the major objective should be to encourage their installation where appropriate in preference to refrigerative units. In addition, the appropriateness of the scheme to the market needs to be considered, where the purchasers rarely see evaporative units on display, a label may not be the best way to convey the information.

The industry representatives suggested that information demonstrating the low running costs of evaporative units compared to refrigerative units would assist with marketing and prepare the industry for a comparative label at some stage in the future. As most evaporative air conditioners are sold through dealers and with brochures and personal visits to locations, an information sheet that lists the evaporative air conditioning energy consumption would be more appropriate. Other information regarding the choice, location and correct use of the evaporative air conditioner can also be provided.

INFORMATION PROVISION

6. The AGO could facilitate an information program targeting the benefits of evaporative air conditioners and describe their benefits compared to refrigerative air conditioning in different climate zones.

The benefits of evaporative air conditioning should be clearly promoted to consumers with information on the choice of air conditioning, operation of evaporative air conditioning, running costs, suitable climate conditions and other benefits.

This scope and delivery of the information program should be developed in consultation with the industry, and with various options provided in a discussion paper for comment by key industry stakeholders.

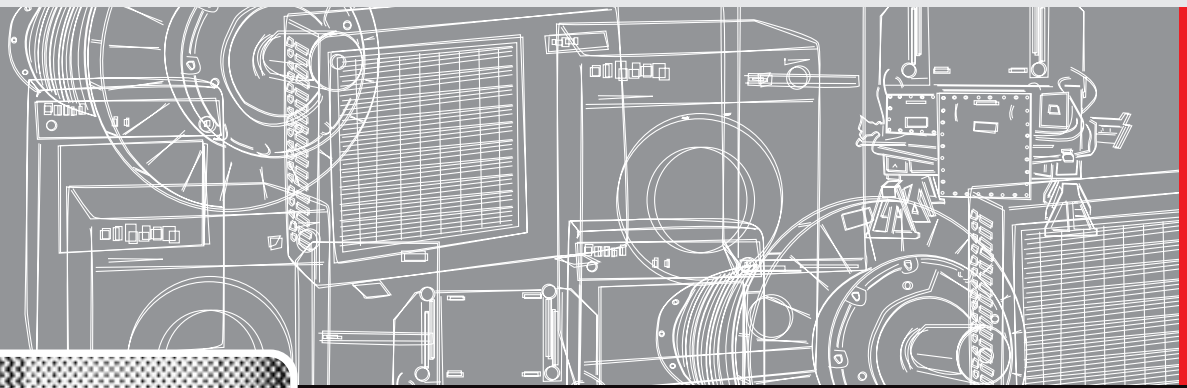
TECHNICAL ISSUES

7. Targeted assistance to the industry to help resolve the technical uncertainties associated with the performance measurement of evaporative air conditioners could be provided by the AGO.

Options that could be put to the industry stakeholders that assist with improving the performance measurement of evaporative air conditioners, such as:

- technical advice by academic professionals to the testing facilities to improve the repeatability of results
- analysis of the technical issues contributing to the uncertainty with performance measurement
- establishing a technical committee of industry and academic members to propose an approach for the resolution of uncertainty in the measurement.

These options could also be included in the discussion paper proposed earlier for industry comment.



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