

AWARE and Environmental Labeling Programs: One Step Closer to a Sustainable Economy

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Introduction

Consumer product manufacturers are beginning to find it necessary to label their products with stickers that claim adherence to certain environmental impact production standards. Labels allow consumers to choose products based on environmental characteristics, thus signaling their preferences to the producer through marketplace purchasing. However, labeling programs have many shortcomings and are not a panacea for driving sustainable production. Recently, University of Michigan engineers developed a handheld device named AWARE that can scan product barcodes and display product information in a format chosen by each consumer. AWARE solves some of the problems that labeling programs cannot. And by giving the consumers greater flexibility, AWARE brings us a step closer to driving us toward a sustainable economy.

This paper examines international labeling programs, the state of labeling programs in the U.S., provides workable examples of the utility of AWARE, and highlights AWARE's benefits and shortcomings.

1 Review of International Environmental Labeling Programs

Internationally, consumers are increasingly demanding quantifiable information on the environmental impacts of the products they buy and governments are increasingly utilizing market-based policies to implement positive environmental change in the marketplace. These trends have led to the development of multiple labeling systems which notify customers of the environmental characteristics of the products they are purchasing (Appendix I). The majority of labeling programs are limited to products that have published Environmental Product Declaration (EPD) reports that quantify their life cycle impacts on the environment. For the most part, EPD programs have similar characteristics and constraints.

The labeling programs set out to achieve the same end: create a market driven move toward sustainability. In order to accomplish this, labeling programs lay out objectives very

similar to those of Sweden's EPD program¹; credible, neutral, comparable, open to all products and services, open to all interested parties, environmental impact oriented, instructive, and continuously updated. In order to meet these objectives, the programs set up environmental standards for products with the help of multiple stakeholder groups, including industry. For example, in Canada's Environmental Choice Program, criteria for products go through a stringent review process by industry, consumer groups, environmental groups, and government². In addition, labeling programs require ISO 1400 pre-certification for industry involvement.

The majority of EPD systems set environmental criteria for products through the same stringent step-by-step process. Initially, industry must perform a Life Cycle Assessment (LCA) with the boundaries of the assessment agreed upon by all the stakeholder groups. Once all the information is gathered, the stakeholders must agree to a set of cut off criteria over which products can be eligible for the label. For example, for a refrigerator to qualify for an EU eco-label it must have an ozone depletion potential of zero and a global warming potential of 15 or under. These key criteria normally fall under pre-determined ecological criteria set by the labeling organization for each group of products. Under the EU system, ecological criteria include the reduction of ozone-depleting and global warming creating substances³.

In order to notify the customer of product approval, labeling programs brand themselves differently. Ecolabel Denmark has a swan while the EU Ecolabel has a flower. Customers know, when they see a label, it implies that a product surpasses certain standards. However, there are shortcomings to these labeling programs that need to be highlighted.

Labeling programs require industry buy in, limit consumer preferences, and often set differing criteria for products. Because labeling programs require extensive LCAs, it is imperative to have industry involved in every step of the process or it is likely they would choose to disengage from the program all together. However, one must question the setting of criteria and the transparency of the LCA if industry is helping to decide where to draw the boundaries of

¹The Swedish Environment Management Council, Environmental Products Declaration. Available at: <http://www.environdec.com/whatisepd/characteristics.asp>

² Canada's Environmental Choice Program. Available at: <http://www.environmentalchoice.ca/index.cfm?fuseaction=main.DspDivision&PageID=28&fkMainPage=0>

³ Official Journal of the European Union. 2004. Establishing a revised ecological criteria for the award of the Community eco-label to refrigerators. European Commission Decision, April 6.

LCAs and where to set the criteria limits. It is often in their best interest to keep certain environmental risks under wraps.

In addition, labels give a generic stamp of approval for limited and specific criteria, making it impossible for a consumer to signal if he or she has different environmental preferences than those set by the program. If a consumer is more concerned with landfill waste than energy usage, but labeling programs only consider energy usage, that consumer is not able to choose a product according to his or her preferences.

Moreover, labels are often chosen for their design appeal and not for their educational value. The lack of information on a label further negates consumer preferences by making it unclear what the environmental criteria really are. This problem is compounded, specifically in the European Union where labeling programs abound and each program sets criteria differently. The INTEND project, funded by the EU commission's Life and Environment Program until 2005, is trying to rectify this problem through harmonizing schemes across countries but it is currently unclear how successful they will be.

Perhaps the biggest set-back to these programs is that they are what the International Standards Organization (ISO) names "Type III" programs. Type III programs label products with a published EPD with quantifiable information based on an LCA. While useful in their own right, Type III programs do not allow direct comparisons or the weighting of products against one another, they only allow for criteria to be set. The customer can then make his or her own comparisons based on the published criteria. This creates an incentive for more industry partners to buy into the programs, knowing that their products will not specifically be chosen against. However, it does not give the consumer the ultimate information that he or she really needs: all else being equal, which product is the best environmental choice?

2 Environmental Labeling Programs in the U.S.

The U.S. product market is dominated by ISO Type I and Type II programs. Type I programs are run by independent third party interests like the Forest Stewardship Council, the Marine Stewardship Council, and LEEDS. In these programs, the third party creates the criteria with no or little industry input. In Type II programs, labels are created by industry setting their

own standards. For example, Sony set its own standards for an “eco-info” label that means, among other things, that the product was built with lead-free solder and packaging is made from 100% recycled paper⁴. In addition the EPA runs a Type III program called “energy star” which, with industry input, labels appliances that are energy efficient.

Like Type III programs, Type I and II programs have their own inherent problems. Often Type I programs suffer from limited information availability, specifically when they are trying to get started. Type II programs, completely company driven, have no system for external auditing and the incentives for a company to reveal limited information are high.

3 How AWARE Fits In

Unlike Europe, the labeling systems in the U.S. are somewhat limited which means, with enough foresight, we can develop a plan that aims for customer empowerment, sidelines the problems of unclear criteria, and maximizes consumer education potential. Consumer use of AWARE is the first step in achieving these goals.

AWARE is a portable device used to scan product UPC and barcodes and automatically retrieve product and producer information. Data in AWARE can be updated easily by connecting it through a USB port to a home computer.

Like EPD labeling systems, AWARE sets out to create a market driven move toward sustainability with many of the same objectives; credible, neutral, comparable, open to all products, open to all interested parties, environmental impact oriented, instructive, and continuously updated. However, AWARE bypasses some of the problems of traditional labeling systems and expands labeling capability.

AWARE will override the difficulty of ignoring consumer preferences. With AWARE consumers will be able to indicate their preferences for avoiding certain environmentally destructive methods over others. Accepted environmental metrics will be weighted automatically by AWARE based on the consumer’s preference choices, which can be easily inputted and changed by the consumer as they see fit. (see slide 1) AWARE can then suggest the

⁴ Sony CSR Report 2004. Available at:
www.sony.net/Sonyinfo/Environment/environment/communication/report/2004/index.html

preferred product based on the customer's preference (see slide 2). For example, if a customer chooses water conservation over landfill waste the AWARE will rate certain aspects of disposable diapers over cloth diapers. In addition, consumers can choose to rate all environmental impacts equally or leave some impacts out completely.

Rankings can be calculated by taking weighted averages based on the consumer's preferences and measurements on environmental impacts from previously finished EPDs (See next section for detailed explanation). The "Average Environmental Impact Score" can be translated into simple A-B-C rankings (see slide 2 and 7). Purchasers who would like to know more information on how the rankings were calculated for a specific product can hit the product button and be taken to a detailed list on what numbers went into the rankings. If customers would like to know all the environmental impact scores, AWARE can display as little or as much information as the consumer would like to see (see AWARE interface section below). In addition, product attributes such as cost, size, or color can be directly displayed on the AWARE to minimize the consumers need to look in multiple locations for product information (see slide 2).

Because consumers are given more choice with AWARE, education on environmental issues can be better targeted toward their interests. For example, consumers can press the waste generation button for more information on types of waste generation (see slides 4 and 5). For consumers who give high scores for energy use, an "energy calculator" can calculate how much energy savings they will accrue by purchasing a low energy product over the course of its use. Consumers will not be overburden with information they find useless. And consumers will not have to remember what different labels mean and which criteria correspond to which labels. AWARE will present them with all the information they need to make educated decisions on the spot.

Moreover, because AWARE is electronic it can pull LCA information from various different sources increasing transparency and uniformity across the U.S.

AWARE Product Test Cases

3.1 Milk and Juice Packaging

Initially, we chose to exhibit how AWARE could work by displaying the different environmental impacts from various milk and juice packaging. Milk and juice packaging was chosen for several reasons.

For the most part, milk and juice are indistinguishable from each other. This allows consumers to choose mainly on environmental preferences. For more complex products, like blenders, product design plays a larger role in consumer choice, perhaps minimizing the affect AWARE can have on purchasing decisions. Additionally, milk and juice are purchased weekly, allowing AWARE to be utilized to its maximum educational and practical capacity.

Juice boxes also allow us to look at a simple model for AWARE, a product with fewer environmental impacts, to ensure the model's efficacy before we look at more complex products with numerous environmental impacts.

The available metrics for juice boxes fall into two categories; energy and waste. Energy includes the accumulated MJ/1000 gallons delivered for trippage, total life cycle, and material production. Waste is simply the container mass thrown away after use. The average environmental impact score is an average of energy use and solid waste generation⁵. According to the Average Environmental Impact score, flexible pouches are the least impacting choice. But if a consumer had a preference for solid waste minimization the A rating would default to HDPE refillable bottles (see Appendix 2).

For consumers who do not necessarily want to buy the "A" rated product, AWARE highlights an "X Rating" (see slide 2 and 3). An X rating is given to the product that is the most harmful within a product scan session. In this case, a gable top carton would receive an X rating. If consumers want more details on a specific AWARE score they can press on the appropriate buttons and it will take them to a screen that displays the environmental impact scores.

⁵ Spitzley, Keolian, McDaniel. 1997. Project Summary: Life Cycle Design of Milke and Juice Packaging. EPA Project Summary. EPA/600/SR-97/082

3.2 Refrigerators

There is one major shortcoming to the juice box test case: as of now, companies do not readily put out information on their packaging materials, making it impossible to come up with accurate environmental impact scores. It is for this reason that we chose refrigerators for the other test case example. EPDs and LCAs for refrigerators are widespread. The Swedish Environmental Management Council breaks the environmental impacts of refrigerators into the following categories; resources, emissions, recyclable resources, and wastes which are then broken down into numerous subcategories. For the purpose of AWARE we chose to divide the impact categories into; nonrenewables, renewables, energy use, green house gasses (GHG), other air emissions, and wastes. We did this so that we could include all the impacts into the AWARE calculations and allow consumers to set preferences for GHGs that are currently a popular environmental topic.

Consumers can chose to prioritize the following impacts; nonrenewables, energy use, green house gases, and waste and AWARE will calculate the environmental impact scores accordingly (see Appendix 3). In the attached example three similar refrigerators manufactured by Electrolux are compared.

4 AWARE Interface and Metrics

The AWARE interface is designed to be both user-friendly and educational. A balance must be struck between providing the user with the information needed to make an informed decision and the limitations of screen size and clutter. Enough data must be presented to answer the user's questions while still being clear and concise.

In order to best strike this balance, we've designed a user-adjustable graphic interface which allows for varying amounts of data to be displayed. The following options can be selected (see slide 1):

How much product information do you want AWARE to display?

- Summarize it for me

When selected, numeric values for environmental impacts will be converted into bar-graph form. Sequentially scanned product options will appear next to each other for easy visual comparison.

- Give me all the numbers

This presents the user with numeric values for the various product options. Intended for the more informed shopper, many of these numbers will be meaningless to casual users.

Which environmental impact do you value the most?

- Energy Consumption

Choosing this option places a weighting factor on the energy consumption environmental impact data.

- Waste Generation

Choosing this option places a weighting factor on the waste generation environmental impact data.

The above options allow AWARE a degree of user customizability. In addition to these user-defined variables, additional weighting factors will also be available from local municipalities for download during regular update sessions. These reflect local weightings of environmental impact factors to account for a geographic predisposition to smog formation, landfill shortage, or other issues which are of direct local concern.

On the product comparison screen, a checkbox is available to allow the user to select whether or not they intend to recycle the product or its packaging once its useful life is over (see slide 2). Since both solid waste generation and energy use are affected by the end of life (EOL) strategy, knowledge of this variable is important to accurately determine a numeric value for a product's environmental impact.

Finally, an overall AWARE rating is provided. This is an average of the various environmental impacts weighted to reflect the user's indicated preferences as well as any additional factors provided by local governments. Additional research must be done to determine the correct weighting factors to apply to the raw data; however, for the purposes of our study we selected the weighting factors such that no score was modified up or down by more

than a factor of 4. As shown in Appendix 2 and 3 in both the refrigerator and the milk/juice packaging examples, the most heavily favored impacts have a factor of 4 applied to them while the least favored impacts have a factor of ¼ applied to them. The equation used to calculate the AWARE rating is:

$$R_{AWARE} = \frac{(R_{1_raw} F_{1_user} F_{1_gov}) + (R_{2_raw} F_{2_user} F_{2_gov}) + \dots + (R_{n_raw} F_{n_user} F_{n_gov})}{n}$$

Here, F_{user} is the user-supplied valuation factor that varies between ¼ and 4, and F_{gov} is a weighting factor that reflects local concerns supplied by a local municipality. In our example this factor was set to 1 in all cases.

Any practical implementation of an AWARE device should include a standardized metric as much as possible. This will help prevent corporate exploitation of the rating system to hide product deficiencies. Even so, there will likely be situations that arise where different metrics are necessary to make a meaningful comparison. In these instances, the AWARE display will automatically adjust to reflect the different metric. In our two examples, different metrics were used to evaluate the products from each category. This was done largely because of a lack of standardized LCA data. The milk/juice packaging study evaluates the impact of selected products based on (Appendix 2):

- Energy Use
- Waste Generation

The refrigerator study includes (Appendix 3):

- Waste Generation
- Energy Use
- Renewable Resource Consumption
- Non-Renewable Resource Consumption
- Greenhouse Gas Emissions
- Other Emissions

Of the above six categories, only Waste Generation, Energy Use, Non-Renewable Resource Consumption, and Greenhouse Gas Emissions had user-defined weighting factors applied to them since these are the impacts for which consumers are likely to have the strongest opinions.

8 AWARE Shortcomings

Although AWARE offers great educational and consumer preference flexibility, it still has shortcomings that need to be highlighted.

AWARE does not negate the need to have company buy-in into the development of the program. LCAs and EPDs will still need to be developed with the help of the manufacturers creating the products, limiting the transparency of the information. Moreover, because AWARE does the work of comparing the products for the consumer, companies may have less of an incentive to cooperate with an AWARE program if it means that it will choose against its products. However, in the long run, once AWARE is widely used, companies that do not choose to contribute information to AWARE may be chosen against by the customer, moving the market one step closer to transparent information and sustainable products.

Once companies begin to cooperate with AWARE and share product information, there is a need to standardize the metrics. As of now, there are no metric programs that have accomplished this successfully. Programs like EcoIndicator99 are based on limited information and numerous assumptions. To a large extent, assumptions are made because scientific and production impact information is not available. In order to rectify the situation, government policy or consumer pressure will need to force companies and institutions to develop a metric solution. This should be done now, before fragmented U.S. labeling programs that use differing metrics begin to sprout up. Hopefully, AWARE will bring this problem to light.

Like other labeling programs, industry buy-in needs to be coupled with a third-party auditor, either an independent institution or a government body, to ensure accurate reporting and realistic impact metrics. Currently, the U.S. does not have a clear answer on which this should be, limiting the scope and usefulness of the information stored in AWARE in the short term. Perhaps the EPA, under its Energy Star program can take a lead on audits. AWARE, once

introduced into the marketplace can act as an impetus for the government to take the lead on instituting a blanket program.

As of now, there are no AWARE models that label consumer services, limiting the ideal of a blanket program. Whereas labels exist for green hotels, restaurants, and dry cleaners it is not clear how this information can be incorporated into AWARE. This minimizes the benefits of a one-stop source of information for consumers. But in the future, if consumer demand for this information continues to increase, ID numbers, like telephone numbers, could be associated with each company, allowing the customer to type in the ID number and retrieve environmental impact information.

The future is yet unclear and it is not known if customers will find AWARE bothersome to carry around and use. Arguably, customers shopping for relatively cheap items, like supermarket food, will not want to spend much time in the store choosing their goods. This may make AWARE more useful for large, high-priced items that consumers tend to spend more time collecting information on. But if current environmental trends continue then customers will put increasing concern into environmental purchasing and find more value in utilizing the AWARE.

It is only once AWARE reaches widespread use that it will have a real effect on the production of goods. In the early stages of the AWARE program, when customer use is limited, producers may not receive any market signals, negating the purpose of AWARE and turning away interested consumers and capitol investors.

9 Conclusion

AWARE offers consumers unprecedented capabilities to compare products on environmental impacts and product attributes. However, AWARE will not be 100% effective until there is more transparency in the marketplace, more thorough and evaluative LCAs, and a third party auditor to ensure LCA reporting standards and derive true metrics. Hopefully, as AWARE becomes popularized it will help drive the changes needed for its own success.

Appendix 1

Canada

Environmental Choice Program



www.terrachoice.ca

Denmark

Dk-Teknik Energy & Environment Type III

<http://www.dk-teknik.com/index.asp>

European Union

European Union Eco-Label



http://europa.eu.int/comm/environment/colabel/index_en.htm

Japan

JEMAI Type III Program



<http://www.jemai.or.jp/english/ecoleaf/outline.cfm>

Norway

The NHO Type III Program

www.NHO.no

Sweden

The EPD System

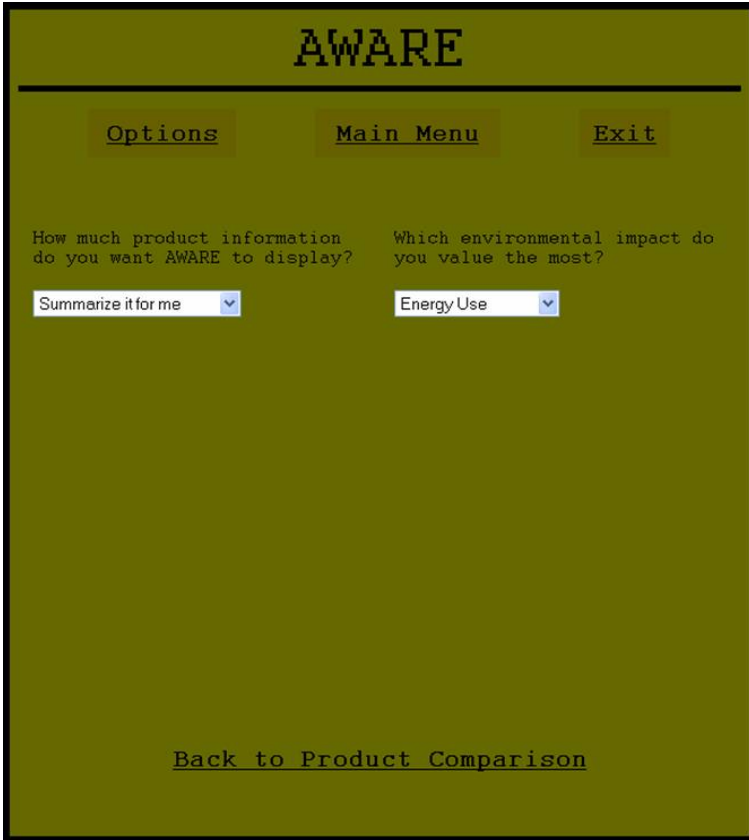


<http://www.environdec.com/>

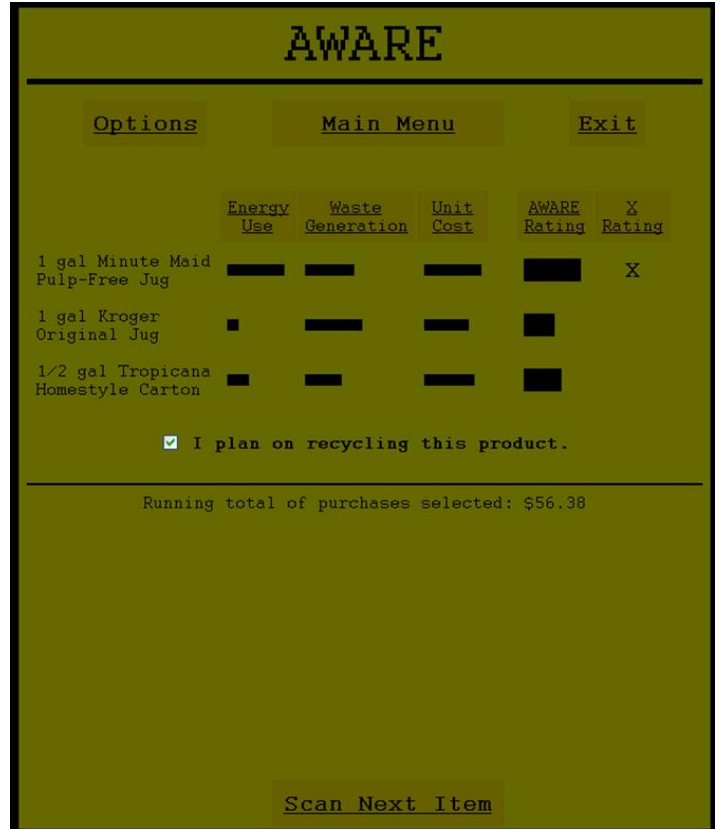
South Korea

Korea Environmental Labeling Program

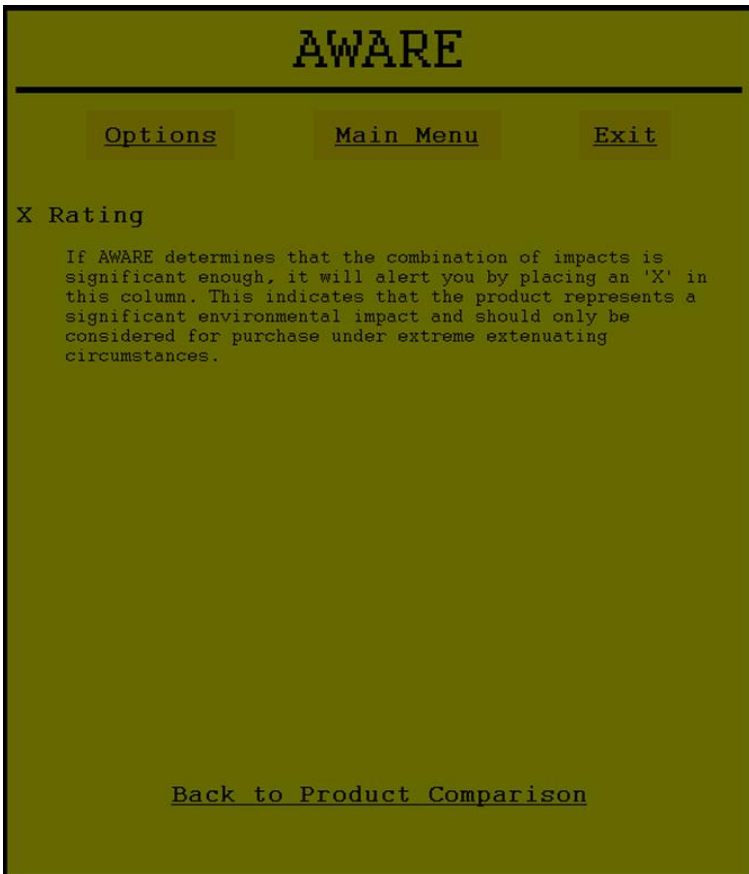
<http://www.kela.or.kr/english/>



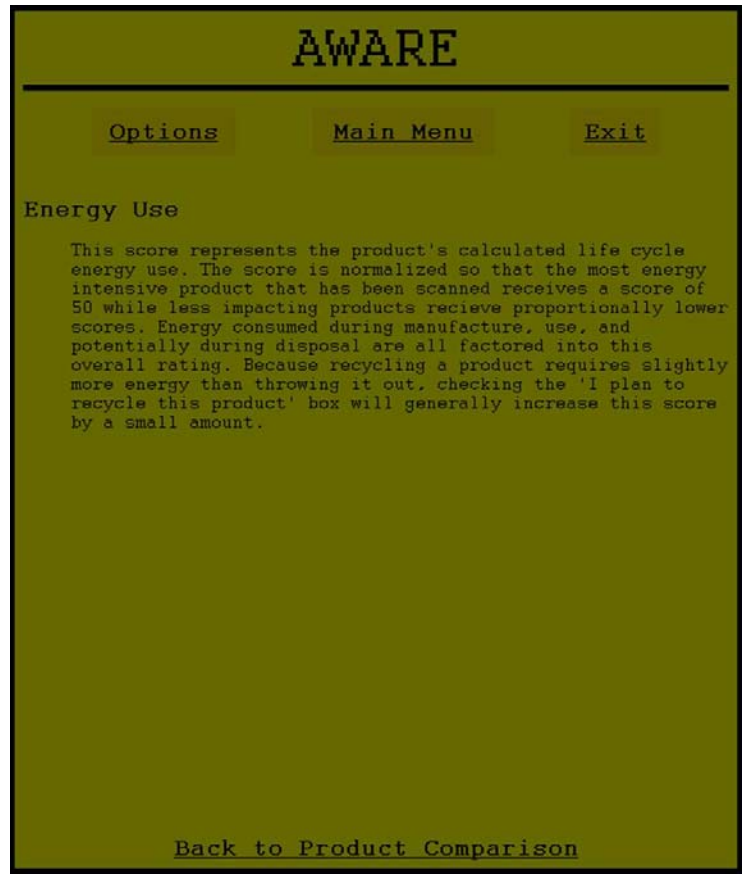
Slide: 1



Slide: 2



Slide: 3



Slide: 4

AWARE

[Options](#)

[Main Menu](#)

[Exit](#)

Waste Generation

This score represents the amount of waste that is generated throughout the life cycle of the product. The score is normalized so that the most impacting product that has been scanned receives a score of 50 while less impacting products receive proportionally lower scores. Waste generated during manufacture, use, and disposal are all factored into this overall rating. Because recycling a product can often significantly reduce the amount of waste it generates at the end of its life, checking the 'I plan to recycle this product' box will generally reduce this score.

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Slide: 5

AWARE

[Options](#)

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Unit Cost

This is the product's cost per unit to the consumer. The score is normalized so that the most expensive product that has been scanned receives a score of 50 while cheaper products receive proportionally lower scores.

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Slide: 6

AWARE

[Options](#)

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AWARE Rating

This score represents the overall rating of the product. The score is normalized so that the most impacting product that has been scanned receives a score of 50 while less impacting products receive proportionally lower scores. While the scores in other categories represent the 'raw data,' this score is weighted to reflect preferences selected in the 'Options' menu as well as any additional factors your local government might specify.

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