

EXPERIENCE WITH A VOLUNTARY ENERGY LABELLING SCHEME FOR REFRIGERATED DISPLAY CABINETS

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ABSTRACT

A proposal for energy labelling of refrigerated display cabinets was submitted to the European Commission in November 1995. However, as the priorities in European energy labelling schemes are focused on electric appliances for the consumer market, a directive for compulsory energy labelling of refrigerated cabinets has not been prepared.

Still, an energy labelling scheme for refrigerated display cases is being used throughout Europe. The driving force is a subsidy on energy efficient display cases provided by Dutch energy distribution companies - together with an tax deduction possibility for investments in energy efficient refrigerated display cases in The Netherlands.

“Energy efficient display cases” are defined as display cases with an “A” or “B” energy efficiency class (energy consumption of more than 45% below market average for class A or between 25% and 45% below market average for class B). The determination of energy efficiency is based on the original energy labelling proposal, which has been revised as of January 1998 on the basis of amendments made by the European committee of air handling, air conditioning and refrigeration equipment manufacturers.

Physical energy labels - in the form of adhesives attached to the products - are absent in the energy labelling scheme in use. Instead a list is prepared monthly on which those display cases are listed that fulfil - according to data received from manufacturers or importers - the energy efficiency criteria. A verification scheme is operated to verify the data supplied by manufacturers and importers. The results of the verification measurements are presented.

1. INTRODUCTION

Is a refrigerator which has an energy consumption of 300 kWh/year energy efficient? That's impossible to say without additional information. One has to know what the energy consumption for comparable refrigerators is, in order to reach a conclusion.

An energy label is an item of product information, that gives “quick” information to the potential buyer about the energy efficiency of a product. European energy labels use a system with letters A, B, C, G printed on the energy label to indicate the energy efficiency. The letter “A” is marked on products which are very energy efficient, the letter “G” is marked on products which have a poor energy efficiency. With an energy label, the potential buyer can select an energy efficient product easily, without a need to know the energy consumption of comparable products.

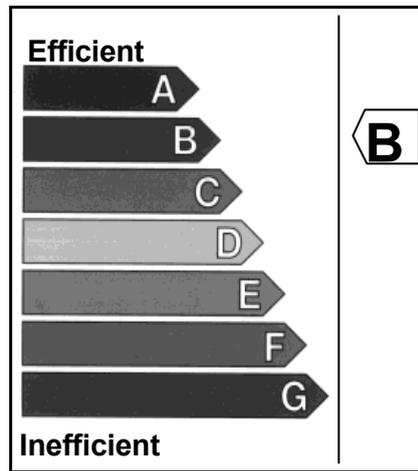


Fig.1. The indication of energy efficiency (here efficiency class B) as it appears on the physical European energy label, with the unmistakable “arrows”.

The idea behind energy labelling is that many consumers would, at their own free will, rather buy energy efficient products than inefficient products. There is a public awareness that energy consumption must be reduced, even if only to reduce individual energy costs.

The European Community (EC) has chosen to facilitate the consumers’ choice for energy efficient products, by issuing directives stating that certain groups of consumer products (household refrigerators, washing machines and dryers) must carry an energy label (EC, 1994)

The energy label must be supplied by the manufacturer, based on product information that is available to him. The methodology is explained in the EC appropriate labelling directive. For some product groups (especially in the field of refrigeration), TNO has been involved in creating the methodology for energy labelling.

Each member state has the obligation, under the EC directives, to check the information given by the manufacturer on the energy labels for correctness. For The Netherlands, TNO is involved in verification testing of household refrigerating and washing equipment, under assignment of the Dutch government.

That the presence of energy labels will stimulate the consumer to select energy efficient products, is still an assumption. However, the obligation to provide energy labels on their products, has prompted manufacturers to produce more energy efficient equipment. In figure 2, the average energy efficiency index (energy consumption / standard consumption) of refrigerator sales in the Netherlands, evaluated by TNO (van der Sluis, 1998), is shown over a period of 5 years.

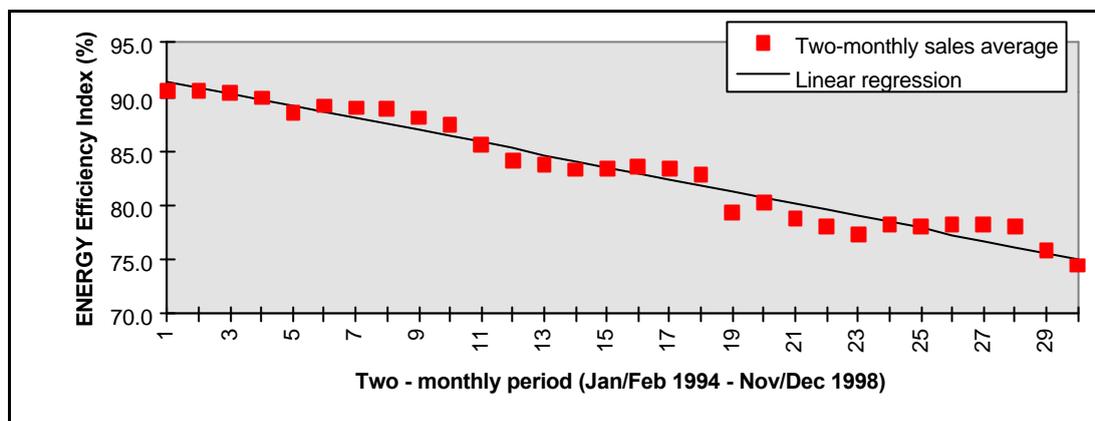


Fig.2. Trend in energy efficiency index of freestanding household refrigerators sold in The Netherlands from January 1994 to December 1998.

In this period, the energy efficiency index has improved by 3,3 % per year. Before energy labelling was introduced, “autonomous” efficiency improvements ranging from 1 % to 2,5 % per year were found, according to the GEA report on energy efficiency standards (1993).

The success of energy labelling schemes has prompted the European Community to apply energy labelling to more and more product groups in the range of consumer products. An EC energy labelling directive for commercial products has however not yet been issued.

2. ENERGY LABELLING OF REFRIGERATED DISPLAY CABINETS

After the involvement in preparing European energy efficiency standards for household refrigerators, TNO has proceeded to prepare an energy labelling scheme for supermarket refrigerated display cabinets, together with Bristol University and the Danish Energy Agency. This work has resulted in a proposal to the EC for an energy labelling method of refrigerated display cabinets (TNO, 1995 and Evans et al, 1998)

In supermarket refrigeration the refrigerated display cabinets (which contain, in terms of the refrigeration cycle, the evaporator and expansion device) are located in the shopping area, whereas the machinery (compressors and condensers) are located in a separate machine room. The energy labelling scheme devised is only applicable for the refrigerated display cabinets, and not for the refrigerating machines (which are not commonly produced in series).

When applying energy labelling to refrigerated display cabinets, there are two inputs of energy to take account of when evaluating the total energy consumption (T.E.C):

- the direct electrical consumption (D.E.C) for lighting, evaporator fans, electrical defrost circuits and other direct electrical consumers.
- the consumption of liquid refrigerant, produced by the condensing unit. This input, the refrigeration energy consumption (R.E.C), is represented in the energy labelling scheme by the energy consumption of an imaginary condensing unit:

$$\text{R.E.C.} = t_r * \Phi_0 * (T_c - T_0) / (0,34 * T_0) \quad (1)$$

Formula (1) for the calculation of R.E.C. is simply based on a unit with a fixed Carnot efficiency of 0,34. It is evaluated at a fixed condensing temperature T_c of 35 °C, over a period t_r of one day -but excluding the defrost periods.

The exact formulations to calculate D.E.C. and R.E.C. are given in a recommendation issued by Eurovent/Cecomaf (Eurovent/Cecomaf, 1997). The underlying data for these calculations (D.E.C, t_r , heat extraction rate Φ_0 , evaporation temperature T_0) must be measured according to the European Standard EN 441, at climate class 3 (25 °C / 60 % r.h.).

To arrive at the energy efficiency of a refrigerated display cabinet, the cabinet's total energy consumption T.E.C. must be related to its display area and storage temperature - which are the "functional" parameters of the cabinet. In the original labelling method prepared for the EC (TNO, 1995), the functionality was expressed as a function of temperature and display opening area. In the method which is now in use in the Dutch energy labelling scheme, a simpler approach has been chosen in agreement with the European manufacturers. This method introduces the total display area (T.D.A) as functional parameter. The total display area is the sum of the product surfaces seen from a vertical and from a horizontal perspective perpendicular to the cabinet, as illustrated in figure 3. A precise definition and calculation method of T.D.A. is given in the Eurovent/Cecomaf recommendation (Eurovent/Cecomaf, 1997).

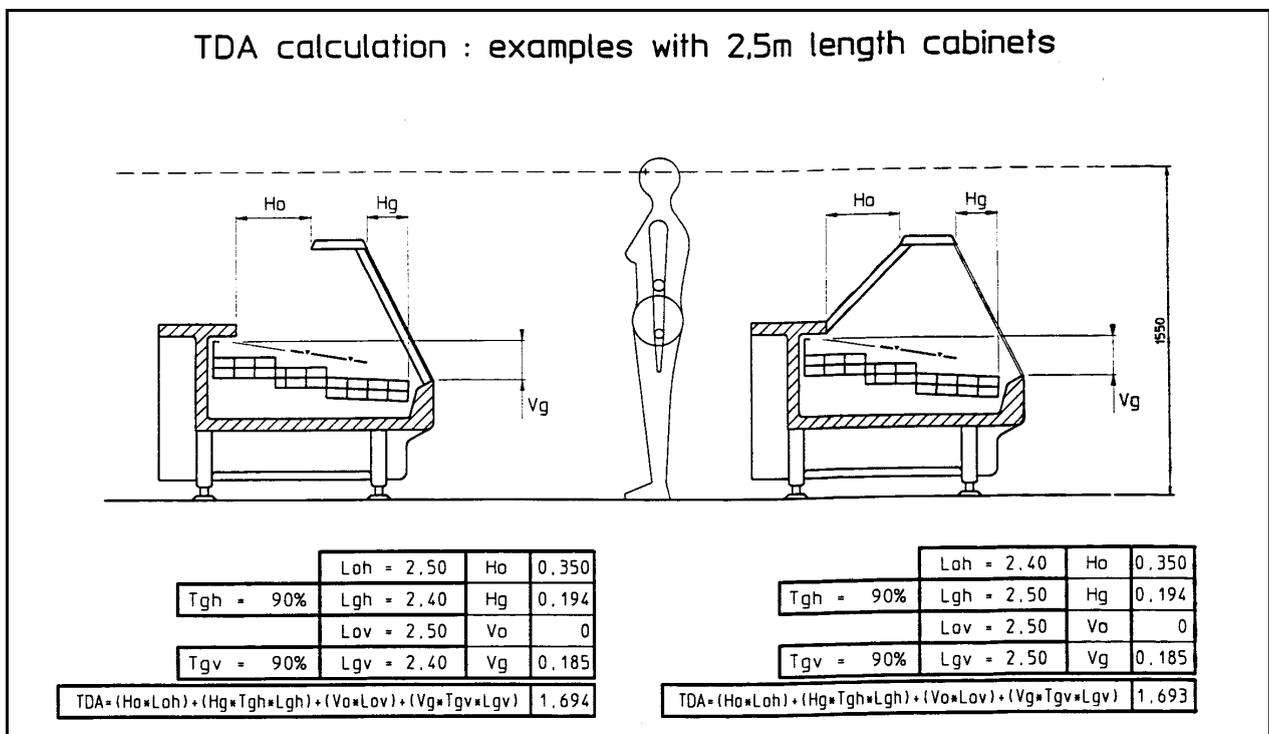


Fig.3. Evaluation of total display area (T.D.A) for a refrigerated service counter.

The quotient T.E.C. / T.D.A. gives the total energy consumption of the cabinet per square metre of display area (in kWh/m²/day). To evaluate the energy efficiency of cabinets, we still need to include in the evaluation the temperature of stored products and the "category" of display cabinet (categories are e.g. freezer islands, glass door cabinets, multidecks, serve over counters, etc).

This last step is performed by specifying European average figures for T.E.C. /T.D.A. for different product categories and at different product temperature classes (table 1).

Table 1: European average figures for TEC / TDA for "positive temperature" product categories at different product temperature classes, acc. to the Eurovent/Cecomaf recommendation [5].
Class 3H: test package temperatures (EN 441) between +1 °C and +10 °C

Class 3M2: test package temperatures (EN 441) between -1 °C and +7 °C

Refrigerated Display Cabinet product category	TEC / TDA (kWh/m ² /day) at temperature class 3H	TEC / TDA (kWh/m ² /day) at temperature class 3M2
Serve over counter	6.2	6.7
Chest (positive temperature)	5.5	5.8
Multi-deck (positive temperature)	10.1	12.3
Roll-in	13.8	

Each single cabinet can be compared against the appropriate European average figure, to give the energy efficiency index of the cabinet:

$$\text{Energy Efficiency Index} = \frac{(\text{TEC} / \text{TDA}) \text{ cabinet}}{(\text{TEC} / \text{TDA}) \text{ european average}} \quad (2)$$

A “low” energy efficiency index indicates an energy efficient refrigerated display cabinet, whereas a “high” energy efficiency index indicates a cabinet that consumes more energy than average. For ease of representation, and to fall in line with other EC labelling directives, a lettering system has been attached to this energy labelling methodology which translates the energy efficiency index into efficiency classes indicated by a single letter, ranging from “A” to “G” (with an “A” for the most efficient cabinets).

Table 2: energy efficiency classes for energy labelling of refrigerated display cabinets.

Energy Efficiency Index (I)	Energy Efficiency Class
I < 55	A
55 ≤ I < 75	B
75 ≤ I < 90	C
90 ≤ I < 100	D
100 ≤ I < 110	E
110 ≤ I < 125	F
I ≥ 125	G

3. USE OF THE ENERGY LABELLING SCHEME IN THE NETHERLANDS

The energy labelling scheme for refrigerated display cabinets, as discussed in the preceding paragraph, has been chosen in The Netherlands as a basis for a stimulation program for energy efficiency in supermarkets (the STIMECK scheme). Under this scheme, a rebate is given by the Dutch energy distribution companies for the purchase of energy efficient refrigerated display cabinets. The rebate itself is modest (85 ECU for class A cabinets and 40 ECU for class B cabinets per kW of installed refrigeration capacity), and is paid for from energy taxes in The Netherlands.

As the energy labelling scheme is not regulated by an EC directive, there is no obligation for energy labelling placed and for attaching “physical” energy labels (in the form of adhesives) to the refrigerated display cabinets. To overcome this practical problem, TNO prepares a list (the “Stimeck list”) each month of refrigerated display cabinets with energy efficiency labels A and B. The list is based on declarations of data presented to TNO by European manufacturers (table 3).

Thus, the voluntary energy labelling scheme used in the Netherlands - underlying the Stimeck rebate scheme - is supported Europe wide by manufacturers of refrigerated display cases.

Table 3: Major European manufacturers, represented on the Stimeck list

ARNEG	Italy
BONNET NÉVÉ	France
COSTAN	Italy
ELECTROLUX	Sweden
KOXKA	Spain
LINDE	Germany
TASSELLI	Italy

The placement of cabinets on the Stimeck list is subject to a set of regulations [6]. In principle, cabinets can only be placed when the manufacturer underwrites these regulations, and states that the data supplied for the cabinets are correct and true. Listing of cabinets is performed without prior verification of the data supplied, but the Stimeck regulations include a verification scheme. In the verification scheme, cabinets are randomly selected from the list and tested under EN 441 to verify the data supplied. When the data supplied prove incorrect, the cabinet is removed from the list. When however - for one manufacturer - two verifications have shown a negative outcome, all cabinets from this manufacturer are removed from the list, and future listings for this manufacturer can only be made when the cabinet data supplied are verified a priori.

Table 4: Stimeck verifications performed per April 1999

Verification outcome	number of verifications
conformity of declarations and test results	4
non-conformity	5

Due to these verifications, the quality of data on the Stimeck list improves over time. Especially manufacturers which have already experienced a verification with a negative outcome, are keen on presenting only data that is “fail proof”. With 5 more verifications due in 1999, the verifications will have covered all major manufacturers.

4. EXPECTED FUTURE DEVELOPMENTS

The success of the Stimeck list in The Netherlands, and especially the support by European manufacturers, can be an impulse for introducing the voluntary energy labelling scheme in other EC countries. This must not necessarily be performed on the basis of a rebate scheme, but may also be based on a “quality mark” (like the german ‘Blaue Engel’) or on a “list of recommended energy efficient products”. The Stimeck scheme also acts as a pilot for a refrigerated display cabinet “directory of certified products”, such as is already in existence for air conditioners (Eurovent/Cecomaf, 1998).

5. REFERENCES

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 - (6) van der sluis, S.M., 1998, *Regulations Stimeck refrigerated display cabinet list, version 3*, TNO-MEP, Apeldoorn, 9 pages.
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EXPERIENCE DANS LE DOMAINE DE L'ETIQUETAGE ENERGETIQUE VOLONTAIRE SUR DES MEUBLES FRIGORIFIQUES DE VENTE

RESUME : Une proposition pour l'étiquetage énergétique des meubles frigorifiques de vente a été présentée à la Commission Européenne a 1995. Mais, comme les priorités pour l'étiquetage énergétique en Europe sont dirigées surtout sur les appareils domestiques, une directive Europeenne pour l'étiquetage énergétique des meubles de vente n'a pas été préparée.

Néanmoins, l'étiquetage énergétique pour les meubles frigorifiques de vente est utilisé en Europe. La force motrice est une aide pour les meubles efficaces sur le plan énergétique données par les fournisseurs d'énergie néerlandais, ainsi que des déductions fiscales au Pays-Bas pour des meubles frigorifiques efficaces sur le plan énergétique.

Les meubles frigorifiques de vente efficaces sur le plan énergétique sont définis par un classement A ou B (consommation énergétique inférieur de plus de 45% à celle des meubles de la classe A présents sur le marché et comprise entre - 25% et -45% pour les meubles de classe B. La détermination du rendement énergétique est fondée sur un label énergétique, qui a été révisé en janvier 1998 sur la base des rendements proposés par Comité européen des fabricants d'équipements de distribution, de conditionnement d'air et de matériel frigorifique.

Les labels énergétiques, qui se présentent comme des étiquettes adhésives posées sur le produit, sont absents de l'étiquetage utilisé. Au lieu d'utiliser ces labels, une liste mensuelle sur des critères d'efficacité énergétique désigne les meubles de vente répondant (selon les données fournies par les fabricants ou importateurs) aux critères d'efficacité énergétique. On vérifie des données fournies par les fabricants et importateurs ; les résultats de ces mesures sont présentés.

DISCUSSION

A. SHARP (Australia) - Is the cabinet assessed against a stationary European means or the current means as updated?

S. VAN DER SLUIS - The mean European TEC/TDA values have been established in 1995. An update of these values will probably be performed in the next two years.

H. F. TH. MEFFERT - The scheme has a principle flaw, it does not consider the quality of the conditions produced by the energy used. The industry succeeded to have classes of equipment standardised in temperature ranges, which have little to no relation to the requirements of sensitive products.

S. VAN DER SLUIS - The scheme in principle contains the same product temperature classification that is given in the European Standard EN441. These temperature classes do not provide a continuous range, but are sufficient to cover practical use in the field.