D2.2 - Topten ACT Criteria Paper

Refrigerated Commercial Display Cabinets

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Topten ACT aims at transforming the European market of energy-using products towards higher energy efficiency.

Topten ACT identifies the top energy-efficient products in 16 European countries, and makes this information available to consumers and large buyers on tailored national websites. The most energy efficient models in different product categories (such as household appliances, lighting, office equipment, consumer electronics, cars) are presented with comprehensive product information based on official labels and standardized declarations. Topten works with manufacturers and thus increases both market offer and consumer demand of high energy efficiency products. Topten is strictly neutral and independent from manufacturers and retailers, its selection criteria are always published online.

Topten ACT is supported by the European Commission's research and innovation programme Horizon 2020, and many national organisations (energy agencies, environmental and consumer organisations, research institutes). The Topten ACT project involves 17 partners in 16 European countries. It is coordinated by ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie).

More information and access to all national websites on the European site: www.topten.eu

1. Topten.eu: current selection criteria and products selected

Topten.eu selection criteria (August 2018):

- Natural refrigerant with global warming potential (GWP) ≤ 3 (e.g. R290/propane, R600a/isobutane, R744/CO2)
- Energy efficiency index (EEI) not higher than given in the following table (calculated according to the latest working document EU energy labelling for refrigerated commercial display cabinets; download under: http://www.topten.eu/uploads/File/CF_draft%20Energy_label_DG%20ENER%20Lot%2012%20refrigerated%20commercial%20display%20cabinets%20(2).docx)

Category	Energy efficiency index	Energy efficiency class
Beverage coolers (with refrigerant R744	<=30 <=50)	to be defined in final EU regulation
Ice cream freezers	<=50	
Supermarket freezers (horizontal frozen cabinets)	<=50	
Vertical frozen cabinets - Counter top (TDA < 0.33 m^2) - Medium* (0.33m^2 ≤ TDA < 2.0m^2) - Large cabinets* (TDA ≥ 2.0 m^2)	<=10 <=30 <=60	
Horizontal chilled cabinets	<=50	
Vertical chilled cabinets	<=50	
Refrigerated Vending machines	<=75	

* no display area on side walls

Numbers of models currently on Topten.eu according to energy efficiency index (August 2018):

Category	< 10	< 20	< 30	< 50	< 60	< 75	Total
Beverage coolers	1	5	12	(2)			20
Ice cream freezers	0	0	0	5			5
Supermarket freezers (horizontal frozen cabinets)	0	0	9	19			28
Vertical frozen cabinets - Medium (0.33m^2 ≤ TDA < 2.0 m^2) - Large cabinets (TDA ≥ 2.0 m^2)	0 0	0 0	2 1	------ 0	------ 2		2 3
Horizontal chilled cabinets	0	0	0	1			1
Vertical chilled cabinets	0	0	3	9			12
Refrigerated vending machines	0	0	0	0	0	1	1
Total	**1**	**5**	**27**	**36**	**2**	**1**	**72**

Similar models have not been counted if from the same brand.

There are 72 models of 12 different brands in the Topten.eu product lists:
AHT, AcraBoa, Carrier, Docriluc, Fogal Refrigeration, Frigoglass, Gamko, JBG2, Liebherr, Novum, Sielaff, Vestfrost

2. Expected selection criteria in 2016

Topten.eu selection criteria expected for 2019:

New draft EU regulations are currently being circulated for the Interservice Consultation and hopefully the final regulations will be adopted in the next months. The selection criteria for the existing categories will then be aligned with the final label classes. No significant tightening of the selection criteria is concrete at this point – the last tightening of criteria took place in July 2017. The upcoming regulation should trigger significant technological advances at which point a further tightening of selection criteria can be determined. Most likely is the tightening of selection criteria for horizontal frozen cabinets from EEI $\leq$ 50 to EEI $\leq$ 30.

3. Technical background

The draft EU regulations divide refrigerated commercial display cabinets into eight categories which the ProCold project largely follows:
1. Beverage coolers
2. Small ice-cream freezers
3. Vending machines
4. Soft scoop ice-cream cabinets
5. Vertical, semi-vertical and combined supermarket freezer cabinets
6. Horizontal supermarket freezer cabinets
7. Vertical, semi-vertical and combined supermarket refrigerator cabinets
8. Horizontal supermarket refrigerator cabinets

Beverage coolers and small ice-cream freezers are procured in large numbers by the food and beverage industry. The cabinets are branded and loaned or leased to retailers, kiosks, take-aways, canteens, sport facilities etc. Electricity costs are paid by the users not by the owners. Good to know:
- Central feature of beverage coolers is the capacity to "pull down" temperatures within maximum 4 hours after a refill with room-temperature cans (definition as in the EN 16902 standard).
- Since beverages do not go bad the cooler can be switched off after opening hours. Energy management systems (so-called EMS or EMD for energy management device) can learn opening hours, or be triggered by door openings, and do this automatically. Saving potential: 15-45%. For example Coca-Cola and Heineken already use this technology. See ProCold factsheet on smart controls for beverage coolers and vending machines (http://www.topten.eu/uploads/File/Smart-controls-beverage-coolers.pdf).
- The definition for small ice-cream freezers as in EN 16901 only comprises the most common form: chest freezers with lid and maximum 600 litres net volume. Vertical freezers and open freezers are classified as supermarket freezer cabinets (vertical, semi-vertical and combined or horizontal), even if they are intended for selling ice cream.

Vending machines are covered only if for refrigerated foodstuffs; not covered are vending machines for coffee and other hot beverages or microwave-equipped vending machines. Industry has been using EVA's (European Vending Association) voluntary labelling scheme for many years but the adjustment to EN 50597:2015 is slow going.

Soft scoop ice-cream cabinets are typically operated at -10°C (warmer than small ice-cream freezers). Stock and sales are negligible. Nonetheless the EU energy label will give the

Topten team a base to work with this product category. EU data shows differences in energy efficiency of factor 2-3.

The four categories of supermarket cabinets are, as the name says, typically used in supermarkets and retail, however they are also used in canteens, bakeries etc. They can be self-service cabinets (direct access for customers) or serve-over counters, vitrines etc. where employees will access the foodstuffs. Important definitions from EU regulation drafts:

- „Multi-temperature cabinet" means a cabinet including at least one compartment exclusively intended for use as refrigerator, and at least one compartment exclusively intended for use as freezer
- „Multi-use" means that a cabinet or compartment can be set to either chilled or frozen temperatures
- For display cabinets „combined cabinet" means a cabinet which combines vertical/semi-vertical and horizontal openings. Not to be confused with the definition for professional refrigerated storage cabinets where „combined cabinet" means a cabinet including two or more compartments with different temperatures for the refrigeration and storage of foodstuffs (e.g. refrigerator-freezers).

Products with green refrigerants (R600a and R290) are currently available for almost all cabinet types in all sizes, even though HFCs (hydrofluorocarbons) like R134a and R404A are still the most commonly used refrigerants for some categories. Notable exceptions are vending machines, where the use of green refrigerants is less progressed, and large, 2.5 meter, open plug-in cabinets and open freezers because their cooling capacity is too high; they can use green refrigerants when fitted with glass doors and thus improve cooling capacity. Explanation: The use of isobutane (R600a) and propane (R290) is restricted to 150g per cooling circuit because they are flammable. CO_2 is more commonly used for remote cabinets and is not flammable / restricted.

R134a and R404A have very high global warming potentials (GWP). With the revised F-gas regulation of 2014, the EU decided to phase out these climate-damaging refrigerants in commercial refrigerators and freezers by 2020 / 2022 (Table 1).

10. Domestic refrigerators and freezers that contain HFCs with GWP of 150 or more		1 January 2015
11. Refrigerators and freezers for commercial use (hermetically sealed equipment)	that contain HFCs with GWP of 2 500 or more	1 January 2020
	that contain HFCs with GWP of 150 or more	1 January 2022

Table 1: Prohibitions for placing on the market in the f-gas regulation (excerpt)

Beverage coolers

Small ice-cream freezers

Vending machines
Soft scoop ice-cream cabinets
Supermarket cabinets

Table 2: Exemplary images of the different types of refrigerated commercial display cabinets

4. Policy measures, standards and labels

The EU energy label and Ecodesign requirements are still being worked out. The Interservice Consultation was scheduled for August 2018, the vote is to take place before the end of 2018. This chapter shall be updated when the final EU regulations are published.

Energy label
The 2015 draft of the EU energy label was proposed to become mandatory from 1 July 2017; energy class thresholds in the draft will be adjusted before the final vote in 2018.
The label would show the following quality aspects:
- the energy efficiency class, determined in accordance with Annex II; the head of the arrow containing the energy efficiency class shall be placed at the same height as that for the relevant energy efficiency class;
- the annual electricity consumption in kWh in terms of final energy consumption per year, calculated in accordance with Annex IX and rounded to the nearest integer;
- the sum of the net volumes or total display areas of all chilled operating temperature compartments; and

- the sum of the net volumes or total display areas of all frozen operating temperature compartments.

Draft energy efficiency classes of refrigerated commercial display cabinets:	
Energy efficiency class	**EEI**
A	EEI < 10
B	10 ≤ EEI < 20
C	20 ≤ EEI < 35
D	35 ≤ EEI < 50
E	50 ≤ EEI < 65
F	65 ≤ EEI < 80
G	80 ≤ EEI

Figure 1: Draft EU energy label for refrigerated commercial display cabinets

Ecodesign requirements

The currently proposed Ecodesign requirements would phase out most open cabinets except the most energy efficient ones in 2023 at Tier 2. Proposed are:

1 January 2020: EEI < 110
1 January 2023: EEI < 80

Measurement standards

Product information and declarations on the energy label are based on measurements according to five EN standard:

1. EN 16902 (beverage coolers)
2. EN 16901 (small ice-cream freezers)
3. EN 50597:2015 (vending machines)
4. EN 16838:2015 (soft scoop ice-cream cabinets)
5. EN ISO 23953-2:2015 (supermarket cabinets)

4.1. Market analysis

There are 12 times more household refrigerators and freezers (304 million units) in the EU than there are plug-in commercial and professional refrigerated cabinets (25 million units). Nonetheless the commercial and professional cabinets use nearly as much energy (43 TWh/year) as the household refrigerators and freezers (84 TWh/year). Size and cooling capacity notwithstanding, the main reason commercial and professional cabinets use much more energy is that they are not energy efficient. Household refrigerating appliances have improved tremendously over the past 20 years thanks to the EU energy label and ecodesign requirements. Energy consumption was reduced by more than 70% (currently required class A+ compared to class G). Similar improvements can be expected for commercial products. Product comparison shows that:

- Typical products with doors use twice as much energy as best models
- Open products use 6 times more energy than best models with doors

The biggest barrier for both manufacturers and buyers of commercial refrigerated cabinets is that no standardised product information is available to compare the energy costs of different models. Energy consumption values are currently only found sporadically in catalogues and not suited for comparison because testing conditions are unknown. Figure 2 shows standardised energy consumption values compared to catalogue data for the same models. It becomes clear that energy consumption values declared in catalogues are typically lower

than standardised energy consumption. Manufacturers have little incentive to declare standardised data because the values would be considerably higher.
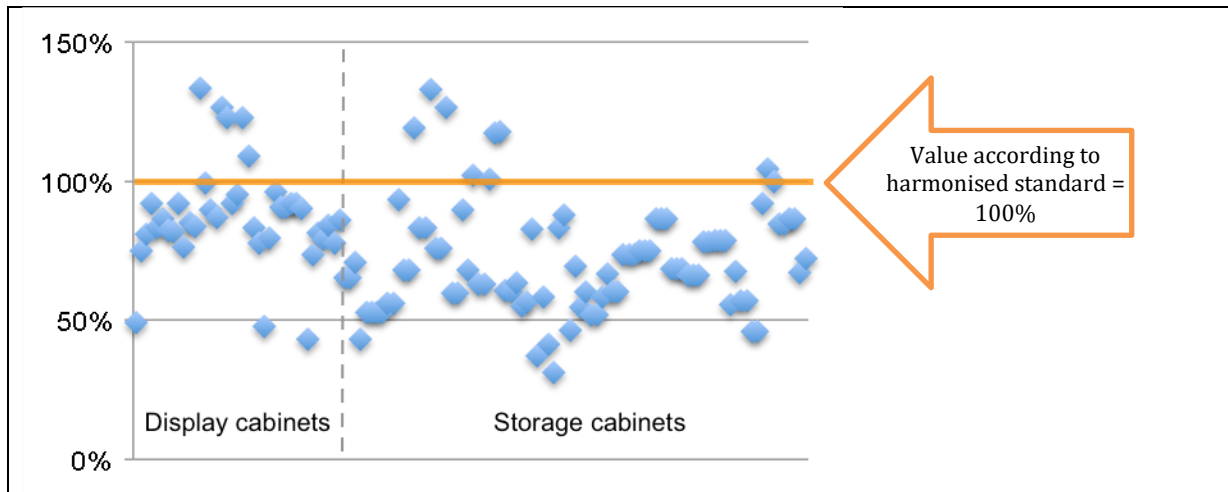

Figure 2: Energy consumption values found in catalogues in relation to data according to harmonised standards

Since the ecodesign and energy labelling regulation for professional refrigerated storage cabinets came into effect in 2016, significant technological advances could be observed. The first A+ model entered the market less than one year after the regulation came into effect despite the energy classes having been tightened several times before the adoption. Similar advancements can be expected for commercial refrigerated display cabinets.

5. References and links

Useful links

Topten.eu refrigerated display cabinets product lists:
- http://www.topten.eu/?page=beverage-coolers-1
- http://www.topten.eu/?page=ice-cream-freezers
- http://www.topten.eu/?page=supermarket-freezers

Topten.eu refrigerated display cabinets selection criteria:
- http://www.topten.eu/?page=beverage-coolers-2&fromid=
- http://www.topten.eu/?page=ice-cream-freezers-2&fromid=
- http://www.topten.eu/?page=professional-display-refrigerators-crit&fromid=

Publications:
- Commercial and Professional Refrigeration Products: Promoting Energy Efficiency with Legislation, Empowered Stakeholders and Rebates. Eva Geilinger, Eric Bush. EEDAL 2015. Presentation: http://www.topten.eu/uploads/File/EEDAL15_Eva_Geilinger_Presentation_Commercial_and_Professional_Refrigeration_Products.pdf
Paper: http://www.topten.eu/uploads/File/EEDAL15_Eva_Geilinger_Commercial_and_Professional_Refrigeration_Products.pdf

References

- Commission delegated regulation (EU) XXXX/XXXX ... supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of refrigerated commercial display cabinets:
  to be added when available

- Commission Regulation (EU) XXXX/XXXX ... implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for refrigerated commercial display cabinets:
  to be added when available

- Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006