

Blast cabinets

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ENTR Lot 1 Second Stakeholder Meeting
Brussels, Belgium, June 4th 2010

A study being conducted for DG ENTR by BIO Intelligence Service



10:00 – 10:20	Welcome, “Tour de table”
10:20 – 10:30	Introduction to the Ecodesign Directive
10:30 – 10:45	Horizontal session: Progress update and selection of Base Cases
10:45 – 11:30	Product focus: Walk-in cold rooms
11:30 – 11:50	COFFEE BREAK
11:50 – 12:30	Product focus: Service cabinets
12:30 – 13:10	Product focus: Blast cabinets
13:20 – 14:20	LUNCH BREAK
14:20 – 15:00	Product focus: Remote condensing units
15:00 – 15:40	Horizontal session: Refrigeration systems
15:40 – 16:00	COFFEE BREAK
16:00 – 16:40	Horizontal session: Refrigerants
16:40 – 17:20	Product focus: Chillers
17:20 – 17:30	Conclusions, next actions and AOB

Product description

- Blast cabinets are to used bring down the temperature of hot food rapidly so it can be stored safely, either chilled or frozen, there are different configurations available on the market.
- Not meant for storage, but they can serve in this way. Not designed for display of chilled and frozen foodstuff, they have at least one door or lid.
- Largely used in food-service establishments, such as restaurants, hotels, catering and cafeterias and frozen foodstuff industry.
- Average capacity of 12kg.

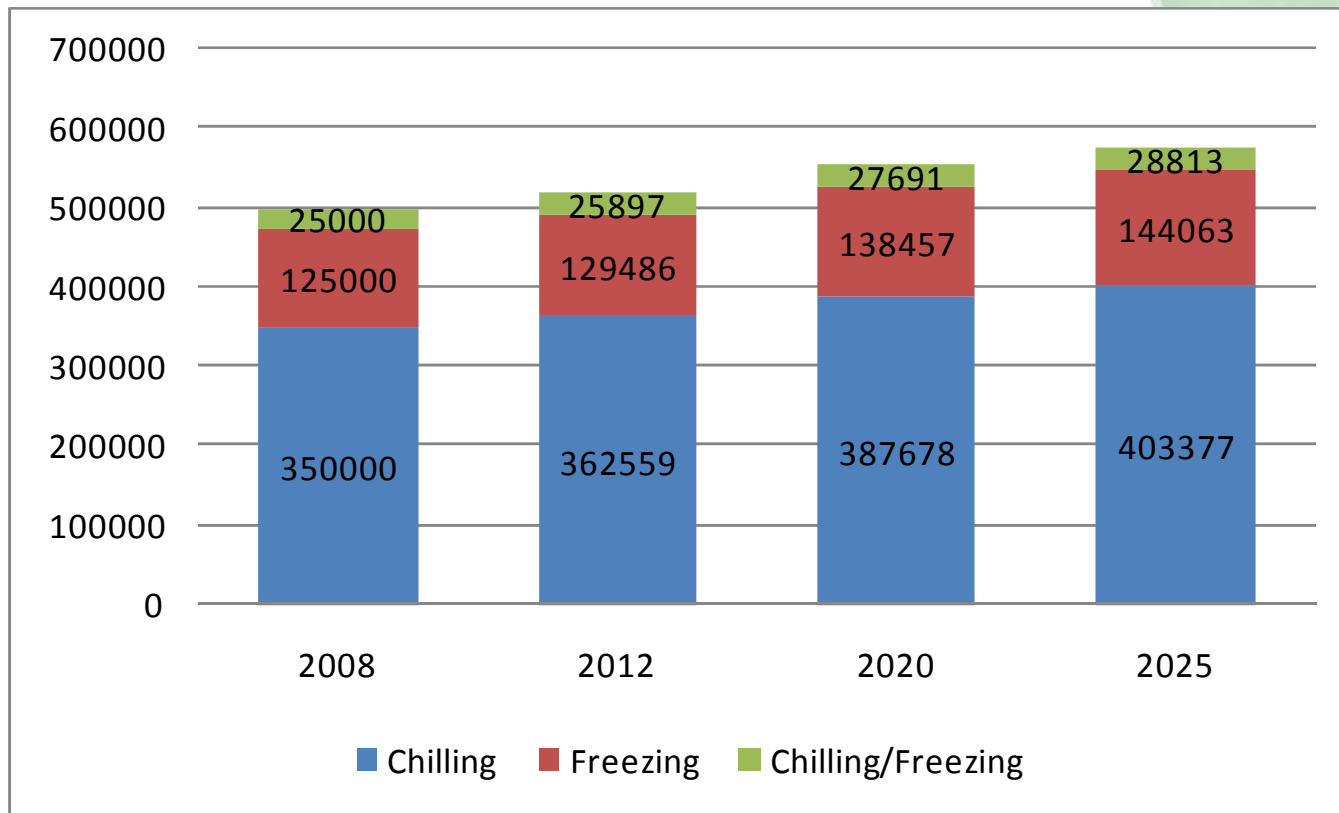


Functional Unit

- One kilogram of foodstuff frozen from +70°C to -18°C in 240 minutes

Estimated sales forecast of blast cabinets until 2025 in EU (units)

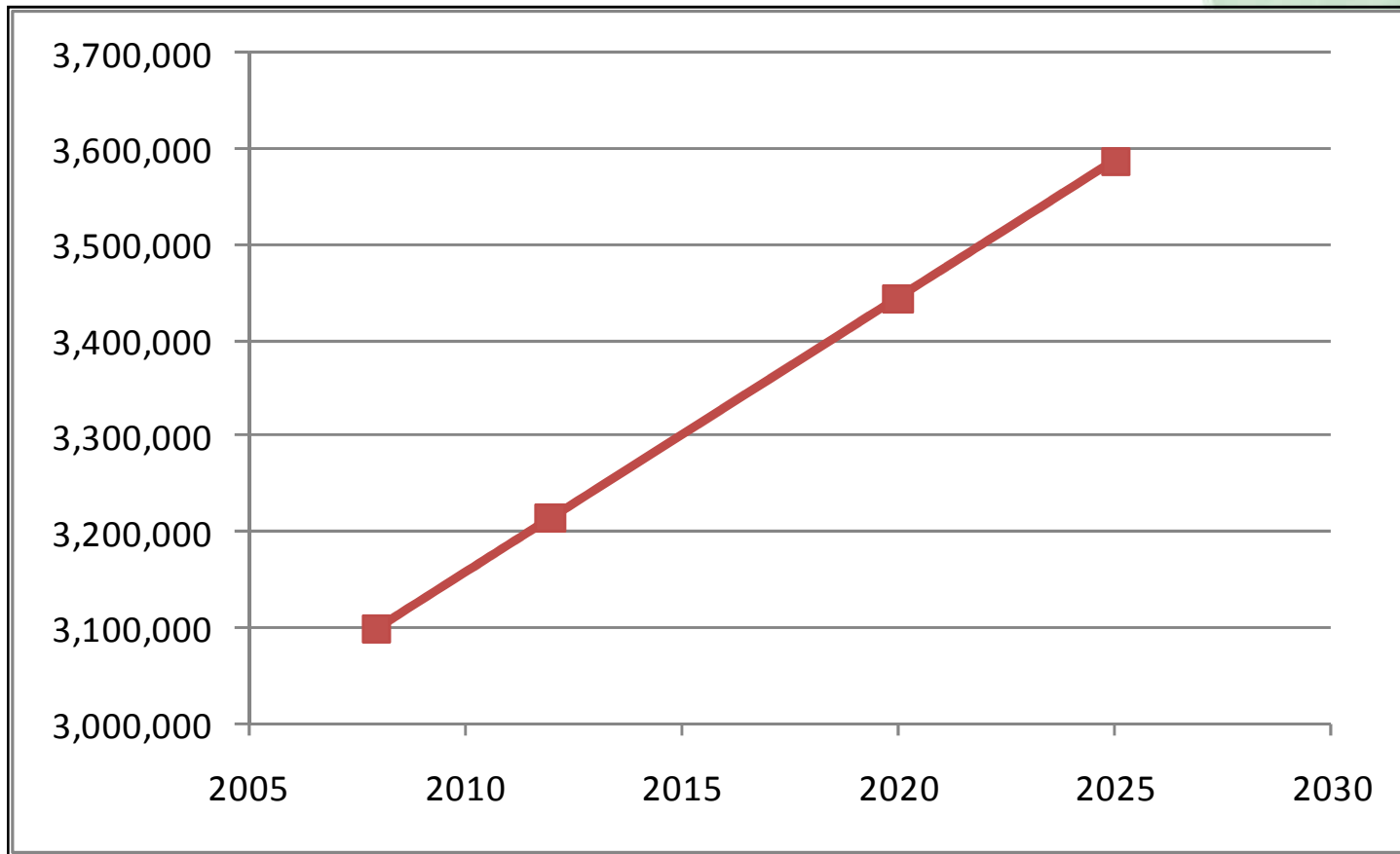
*Extrapolation of figures provided by stakeholders



Too high?

Estimated stock forecast of blast cabinets until 2025 in EU (units)

*Extrapolation of figures provided by stakeholders





Classification

1. Operating temperature: chiller, freezer or chiller/freezer
2. System: plug-in, remote packaged (+PCU) or remote (+ central plant)
3. Configuration: vertical or undercounter
4. Capacity (kg of foodstuff): 15, 30, 50, 80, 160 (300?)

Do you agree with these categories for classification?

Suitable classification from manufacturing or purchasing scope?

What is the capacity upper limit to be considered?

- CWA 15596:2006 (European level) and NSF/ANSI 7:2009 (USA)
Current standards only related to use and food safety
- DIN 8953/8954
This German standard was withdrawn, it is still commonly used by manufactures. It does not deal particularly to Blast Cabinets, but to general refrigeration equipments
- EN 328
Determines the performance of forced heat exchangers. This standard is an option for testing these products

Need for developing a testing standard. It should consider ways to evaluate /determine the time to reach temperatures during a single cycle, the initial and final temperature of the testing load and, the functioning (chilling, freezing or chilling/freezing)

ISO 23953 (Display Cabinets) framework could be considered for setting conditions of testing, but the test itself should be modified/adapted.

- No existing legislation, voluntary agreements or MEPS at EU level or 3rd countries level

This may be due to the current focus on cooling performance (to meet food hygiene requirements) rather than energy efficiency.

What should consider a performance evaluation standard or MEPS for Blast Cabinets?



User Behaviour

- 1440 hours/year (180 days/year, 8hrs/day) – there are 2 freezing cycles of 240 minutes each (8 hours in total) over 180 (approximated) working days.
- Consumption over the course of a year is the sum of the consumption of the components within the unit.

Do you agree with this use pattern?

What is the average energy consumption/use-time per component?



Average product characteristics

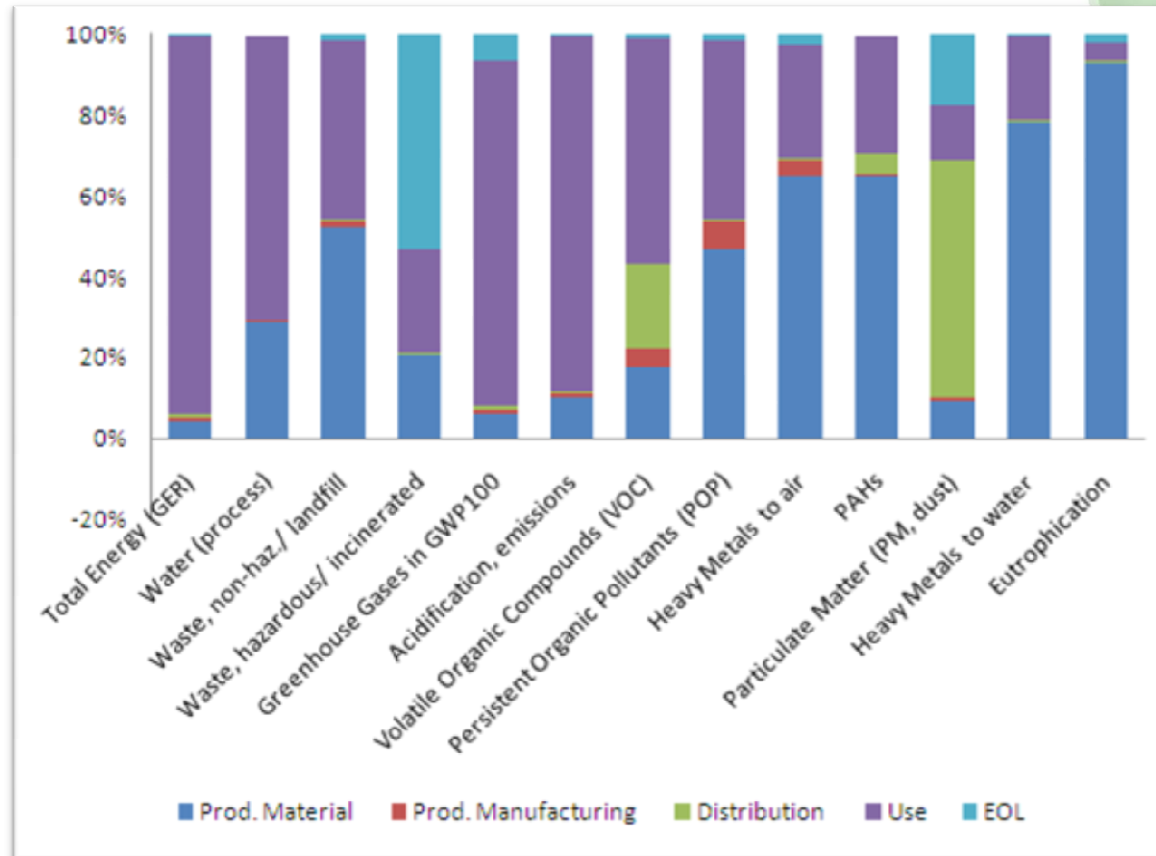
- Vertical model with one door
- Refrigerators (70%) or freezers (25%), with a minority of refrigerator/freezers (5%)
- The capacity corresponds to 12kg of foodstuff
- Lifetime is estimated to be between 8 and 9 years
- The operating cycle is chilling from +70°C +5°C in 240 minutes
- Stainless steel and insulated with 55 mm thick polyurethane panels
- Cabinets run on HFCs such as R404a
- The net volume (internal capacity) is 0.10 m³
- The compressor is hermetic reciprocating, power of 720W, weight 12.5kg

Parameter	Base Case
Design	Vertical
Cooling cycle:	freezing from +70°C to -18°C in 240 minutes
Capacity [kg]:	12
Net Total volume [m ³]:	0.10
Cooling capacity [kW]:	0.813
Power input [kW]:	1.35
Weight of product [kg]:	120
Price [€]:	6,000
Lifetime [year]:	8.5
Refrigerant:	R404a
Type of compressor:	Hermetic reciprocating
Capacity of compressor [W]:	813
Condenser cooling:	Air-cooling
Electrical consumption per cycle [kWh/cycle]:	4.24
Annual electricity consumption [kWh/year]:	1,526
Performance per cycle [kWh/kg/cooling cycle (freezing from +70°C to -18°C in 240 minutes)]:	0.353
Performance [kWh/kg of foodstuff from +70°C down to -18°C in 240 minutes/year (with the assumption of 360 freezing cycles per year*)]:	127.2

*Use pattern provided by Stakeholders: 2 freezing cycles of 240 min, 180 days per year

➤ Base Case: 500 €/kg of capacity, 7380 €/kW of cooling cap

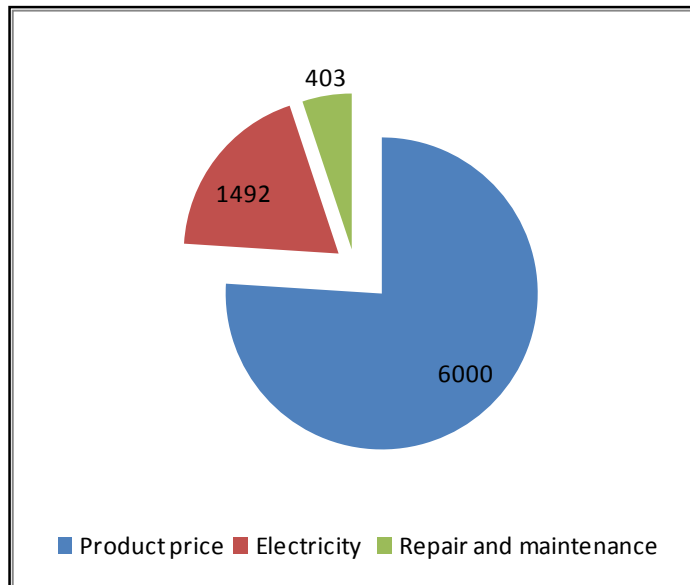
Total Energy (GER) = **1422.97** MJ/per kg of foodstuff over 360 freezing cycles from +70 C down to -18 C in 240 minutes, of which the use phase represents **94%**



* Impacts in the graph are given by Life Cycle

Economic Impact Results

Life cycle costs of blast cabinet: **7,895 EUR**



Blast Cabinet <i>Item</i>	total annual consumer expenditure in EU25
Product price	1500 mln.€
Installation/ acquisition costs (if any)	0 mln.€
Fuel (gas, oil, wood)	0 mln.€
Electricity	290 mln.€
Water	0 mln.€
Aux. 1: None	0 mln.€
Aux. 2 :None	0 mln.€
Aux. 3: None	0 mln.€
Repair & maintenance costs	77 mln.€
Total	1866 mln.€

What is the price per component?
What is the average profit margin?

Parameter	Base Case	BAT
Design	Vertical	Vertical
Cooling cycle:	freezing from +70°C to -18°C in 240 minutes	freezing from +70°C to -18°C in 240 minutes
Capacity [kg]:	12	36
Net Total volume [m ³]:	0.10	TBD
Cooling capacity [kW]:	0.813	1.5
Power input [kW]:	1.35	2.13
Weight of product [kg]:	120	155
Price [€]:	6,000	6,229
Lifetime:	8.5	TBD
Refrigerant:	R404a	R404a
Type of compressor:	Hermetic reciprocating	TBD
Capacity of compressor [W]:	813	TBD
Condenser cooling:	Air-cooling	TBD
Electrical consumption per cycle [kWh/cycle]:	4.24	5.6
Annual electricity consumption [kWh/year]:	1,526	2,016
Performance per cycle [kWh/kg/cooling cycle (freezing from +70°C to -18°C in 240 minutes)]:	0.353	0.156
Performance [kWh/kg of foodstuff from +70°C down to -18°C in 240 minutes/year (with the assumption of 360 freezing cycles per year*)]:	127.2	56

*Use pattern provided by Stakeholders: 2 freezing cycles of 240 min 180 days per year

BAT: 174 €/kg of capacity, 4150 €/kW of cooling capacity



Improvement options

Technology	Blast cabinets		
	Applic. Market pen. (%)	Energy savings. (% of TEC) ¹	Increase in price (€)
High efficiency compressor	Applicable, but not yet included in the product (might be common feature in 2-3 years)	10	10
ECM compressor motor		4	70
Variable-speed-drive (VSD) compressor	Applicable	15	100
Increase of the heat exchanger surfaces	Applicable, but not yet included in the product (might be common feature in 2-3 years)	5	3
Electronic Expansion Valve (EEV) <i>*when integrated with FHP</i>	Applicable	2-10	
Floating head pressure (FHP) <i>*when integrated to EEV</i>	Applicable		
ECM Fan Motor	Applicable, but not yet included in the product (might be common feature in 2-3 years)	14	40
Fan motor controllers	Applicable	4	3
High Efficiency Fan Blades	Applicable	3	1-2
Insulation Material/Thicker insulation	Applicable	8	40
Defrost Control	Applicable	3	10
Anti-condensation control	Applicable	5	
Zeolite Filter Cassettes	Applicable, but not yet included in the product (might be common feature in 2-3 years)	25	175
High efficiency light bulbs (e.g. LED)	Applicable, but not yet included in the product (might be common feature in 2-3 years)	minimal	30
Bubble expansion valve		10-20	

Applicable
 Applicable, but not yet included in the product (might be common feature in 2-3 years)

The best available blast cabinet within next 5 years could achieve energy savings of up to approximately 65% using the following:

- high efficiency compressor with the ECM motor and VSD
- electronic expansion valve integrated with the floating head pressure
- heat exchanger area increase
- ECM fan motor type
- fan motor controllers
- anti-condensation control
- defrost control
- insulation material and thickness

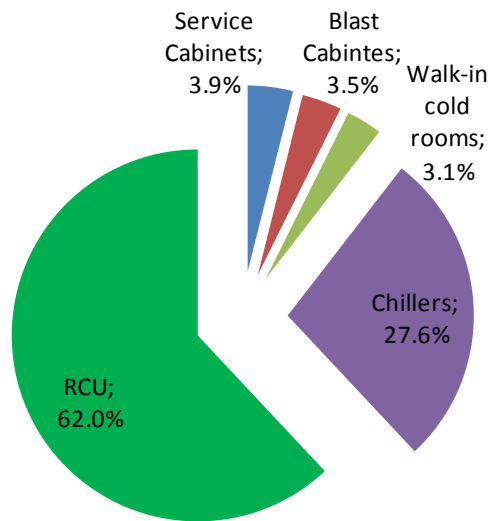
BAT potential energy savings

	Annual electricity consumption (kWh/year)	Capacity (kg)
Base Case model	1,526	12
<u>Current</u> available BAT model	2,016	36
<u>Theoretical</u> BNAT product model (available within 5 years)	458	12

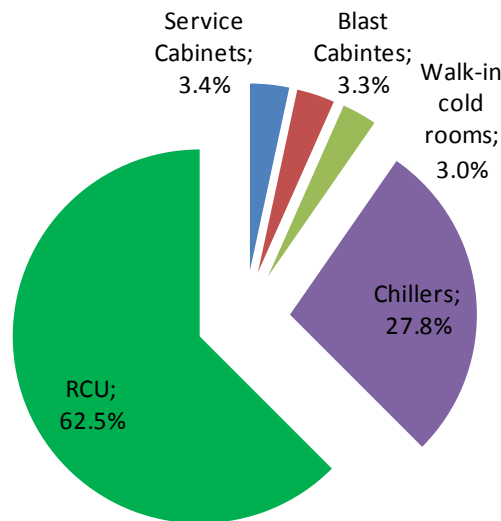
	Performance [kWh/kg/year (360 cycles from +70°C to -18°C in 240 minutes)]	Energy saving potential
Base Case model	127.3	-
<u>Current</u> available BAT model	56	44%
<u>Theoretical</u> BNAT product model (potentially available within 5 years)	38.2	70%

Impact calculation for the total stock (2009) per year of lifetime

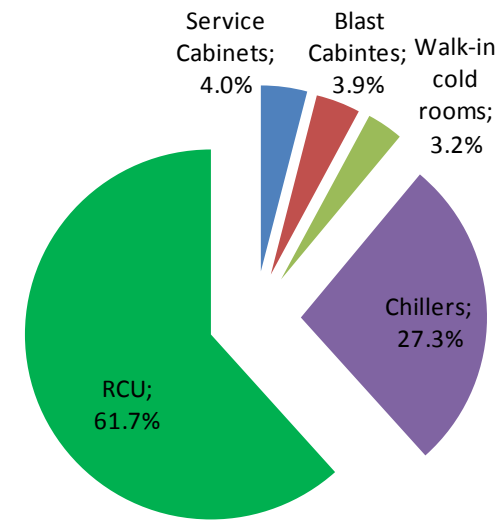
	Service cabinets	Blast cabinets	Walk-in cold rooms	Chillers	Remote condensing units	Total
Total Energy (GER) (PJ)	3.66	3.24	2.90	25.80	58.02	93.62
Electric. Consump (TWh)	0.30	0.29	0.26	2.45	5.51	8.81
GWP (mt CO2 eq.)	0.17	0.16	0.13	1.13	2.56	4.15



Total Energy (PJ)



Electricity Consumption (TWh)



GWP (mt CO2 eq.)



Gaps

- Categories for classification – clarification over operation temperatures, capacity, design and location of the condensing unit
- Market data
- Standards for performance evaluation and possible MEPS
- Component specifications for the average product
- New BOMs and technical data to improve the reliability and the relevance of the Base Case and its related environmental impacts
- Current BAT models