Blast cabinets

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ENTR Lot 1 3rd Stakeholder Meeting
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A study being conducted for DG ENTR by BIO Intelligence Service

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Agenda

10:00 – 10:20	**Welcome, explanation of the meeting structure and "Tour de table"**
10:20 – 10:30	**Short introduction to the Ecodesign Directive**
10:30 – 10:40	**Horizontal session: Progress update**
10:40 – 11:30	**Product focus: Walk-in cold rooms**
11:30 – 11:50	**COFFEE BREAK**
11:50 – 12:40	**Product focus: Service cabinets**
12:40 – 13:30	**Product focus: Blast cabinets**
13:30 – 14:20	**LUNCH BREAK**
14:20 – 15:10	**Product focus: Remote condensing units**
15:10 – 15:40	**Product focus: Chillers**
15:40 – 16:00	**COFFEE BREAK**
16:00 – 16:40	**Horizontal session: Refrigerants and Refrigeration systems**
16:40 – 17:30	**Conclusions, next actions to be taken 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 20kg

Functional Unit

➢ One kilogram of foodstuff cooled from +70°C to +3°C/-18°C in 90/240 minutes

Exclusions

➢ Industrial continuous equipment is not included in this study due to the difference in operation (mostly not related to foodstuff)

Market data

Year	Estimated sales forecast *	Estimated stock forecast *
2006	165,600	1,035,798
2007	170,000	1,292,529
2008	173,655	1,331,197
2012	189,078	1,478,884
2020	224,155	1,761,092
2025	249,310	1,958,727

*Extrapolation of figures provided by stakeholders

Main assumptions:

- Constant growth rate
- BSRIA report used
- CAGR (2010-2014): 2.31%

Type of equipment	(%)
Chiller	9
Freezer	1
Chiller/freezers	90
Reach-in / cabinet	85
Rolley (trolley)	10
Pass-through (trolley)	5
Small reach-in R (3 trays)	9
Medium reach-in R (5 to 10 trays)	80
Large reach-in R (14-15 trays)	6
Extra-large reach-in R (20 trays)	5
Small roll-in + pass–through T (up to 100kg)	55
Medium roll-in + pass-through T (100-150kg)	30
Large roll-in + pass-through T (150-240kg)	15

Market categories

Configuration	Operation temperature	Size	Location condensing unit
Reach-in	Chilling	Small	Plug-in
		Medium	Plug-in
		Large	Plug-in
		Extra-large	Remote
	Freezing	Small	Plug-in
		Medium	Plug-in
		Large	Plug-in
		Extra-large	Remote
	Chilling/Freezing	Small	Plug-in
		Medium	Plug-in
		Large	Plug-in
		Extra-large	Remote

Configuration	Operation temperature	Size	Location condensing unit
Roll-in (trolley)	Chilling	Small	Plug-in
		Medium	Remote
		Large	Remote
	Freezing	Small	Plug-in
		Medium	Remote
		Large	Remote
	Chilling/Freezing	Small	Plug-in
		Medium	Remote
		Large	Remote
Pass-through	Chilling	Small	Plug-in
		Medium	Remote
		Large	Remote
	Freezing	Small	Plug-in
		Medium	Remote
		Large	Remote
	Chilling/Freezing	Small	Plug-in
		Medium	Remote
		Large	Remote

Standards

- **AC D40-003** – French norm of function performance for Blast equipment
- EN 328:1999 – Test procedures for establishing the performance of forced convection unit air coolers for refrigeration.
- EN 327:2000 – Test procedure for establishing performance. Heat exchangers.
- DE DIN 8953/8954 – Withdrawn, but still commonly used by manufactures. Not particular to Blast Cabinets, but to general refrigeration equipments
- **EN ISO 23953:2005** – Testing of refrigerated display cabinets

- **EN 631-1:1993** – Gastronorm Kitchen equipment size standard
- Food safety and construction standards
  - **EN 1672 :1997**: Food processing machinery hygiene requirements
  - **EN ISO 14159:2002**: Hygiene requirements
  - **DE VDMA 11499**: Operation and use of refrigerated display cabinets
  - **US NSF/ANSI 7:2009**: minimum food protection and sanitation requirements

Legislation and voluntary agreements

- French commercial food preparation hygiene requirements law of 29/09/1997
- UK Department of Health Guidelines
- Austrian Hygiene Certificate Guideline

These do not deal with energy performance, but with the function within kitchens for food safety reasons

Need for developing a testing standard

AC D40-003 and **ISO 23953** can be considered when developing 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)

User behaviour

According to stakeholders, the following use patterns have been defined:

- **Cooling**

  5 90-minute cycles per day, 220 days per year => 1650 hours per year

- **Freezing**

  2 240-minute cycles per day, 220 days per year => 1760 hours per year

- **Combined**

  3 cooling cycle and 1 freezing cycle per day, 220 days per year => 1870 hours per year

Do you agree with this use pattern?

Base Case weighting

Type of equipment	Relative energy consumption
Chillers	X
Freezer	2.5*X
Chiller/freezers	1.8*X
Reach-in / cabinet	Y
Trolley	1.25*Y
Pass-through	1.25*Y
Small cabinets (3 trays)	0.6*Z
Medium cabinets (5 to 10 trays)	Z
Large cabinets (14-15 trays)	2.4*Z
Extra-large cabinets (20 trays)	4.75*Z
Small trolley + pass through (up to 100kg)	A
Medium trolley + pass through (100-150kg)	A*1.5
Large trolleys + pass through (150-240kg)	A*2
Plug-in	B
Remote	B*1.25

Sub-Base Case and Weighted Base Case

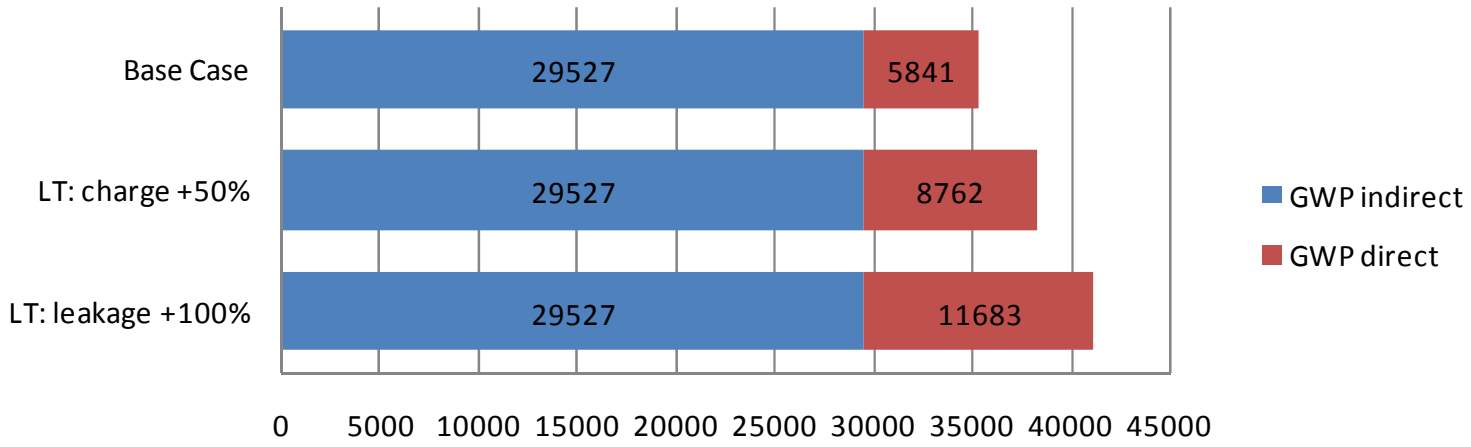
2 BOM received from industry

Product characteristics	Sub-Base Case (real product)	Weighted Base Case (abstract product)
Product type:	Vertical. Medium chilling/freezing plug-in reach-in blast cabinet	Weighted
Functional unit:	1kWh/1 kg of foodstuff (referred to material proposed by NF AC D 40-003)	1kWh/1 kg of foodstuff (referred to material proposed by NF AC D 40-003)
AEC [kWh/year]:	2,750	7,337
Use pattern:	8.5 hour/day, 220 days/year, in different cycles types	8.5 hour/day, 220 days/year, in different cycles types
Price (ex VAT) [€]:	3,400	8,393
Annual processing capacity [kg]	17,600	33,106
Lifetime [years]:	8.5	8.5
Shipping volume [m3] :	1.17	1.17
Weight of product [kg]:	120	120
Refrigerant:	R404A	R404A
Refrigerant charge [g]:	800	2,700
Refrigerant leakage [% per annum]:	6	6
Refrigerant dumped at EoL [%]:	5	5

Environmental impacts

Total Energy (GER) = 20.18 MJ/per kg of foodstuff per year, of which the use phase represents **96%**

Direct GWP represents about 17% of the TEWI



BAT models

Product characteristics	BAT	BAT
Product type:	Vertical. Medium chilling plug-in reach-in blast cabinet	Vertical. Medium freezing plug-in reach-in blast cabinet
Functional unit:	1kWh/1 kg of foodstuff (referred to material proposed by NF AC D 40-003) chilled from +70°C to +3°C in 90 min	1kWh/1 kg of foodstuff (referred to material proposed by NF AC D 40-003) chilled from +70°C to -18°C in 240 min
AEC [kWh/year]:	1,430	1,628
Use pattern:	7.5 hour/day, 220 days/year, in different cycles types	8 hour/day, 220 days/year, in different cycles types
Price (ex VAT) [€]:	3,800	3,900
Annual processing capacity [kg]	23,100	23,100
Performance [kWh/kg of foodstuff *]:	0.0619	0.176
Lifetime [years]:	8.5	8.5
Refrigerant:	R404A	R404A
Refrigerant charge [g]:	800	800
Refrigerant leakage [% per annum]:	6	6
Refrigerant dumped at EoL [%]:	5	5

*referred to testing material in AC D40-033

Product	Energy consumption (kWh/year)
Weighted Base Case	7,337
Weighted BAT	3,815

48% of saving potential based on real models (sub-Base Case vs. real BAT)

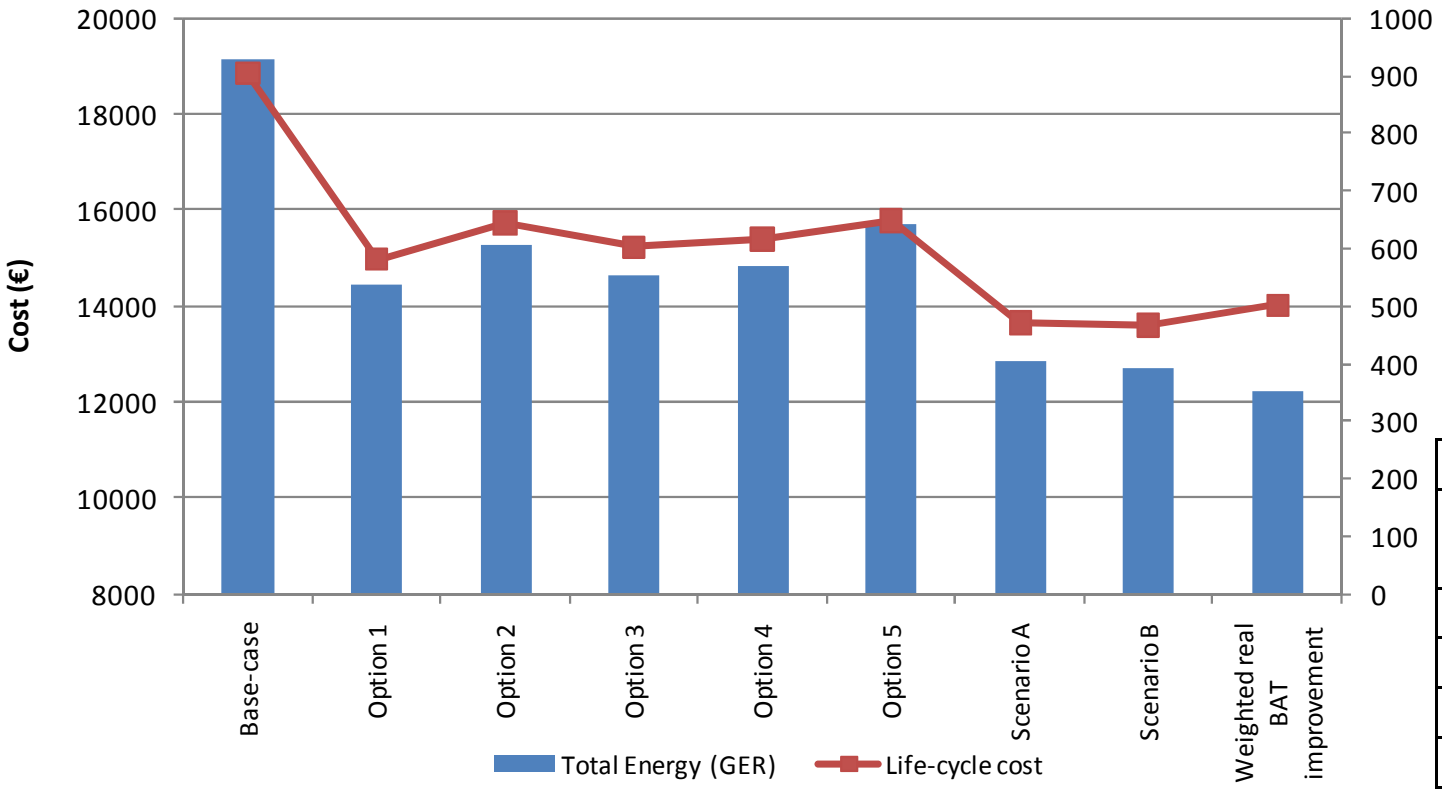
Improvement options

	Applicability (years)	Market penetration (%)	Savings (% TEC)	Increase in price of product (€)	Priority
Variable speed drive (VSD) compressor	Now	10	20	40	1
High Efficiency Fan Blades	Now	0	9	10	2
ECM Fan for evaporator	Now	20	17	84	3
Defrost Control	Now	15	3	50	4
Electronic Expansion Valve (EEV) when integrated with floating head pressure	Now	5	30	100	5
Electronic expansion valve	Now	N.A.	15	100	6
Insulation thickness	Now	5	4	100	7
Remote condensing	Now	Less than 1	15	1200	8
BNAT					
Full baffling	Now	Negligible	6	Negligible	1
ECM compressor	2 to 3 years	0	10	100	2
Improved heat exchanger*	Now**	5	5	6	3
Refrigerant HFO blends	1 to 2 years	0	0***	300	4

Priority based on cost increase, energy saving potential and applicability

LLCC - BAT

Primary Energy Consumption and LCC



Options	
1	Variable speed drive (VSD) compressor
2	High Efficiency Fan Blades
3	ECM Fan for evaporator
4	Electronic expansion valve
5	Insulation thickness

Scenario A: includes options 1 + 2 + 3

Scenario B: includes options 1 + 2 + 4

	Energy consumption (kWh/year)	Savings	Product price (€)
Weighted Base Case	7,337	-	8,390
LLCC = Scenario B	4,255	-40%	8,613
BAT = Weighted BAT	3,815	-48%	9,396

BNAT

The “best” blast cabinet within next 5 years could achieve energy savings of up to approximately 75% using the following:

- high efficiency compressor with the ECM motor and VSD;
- electronic expansion valve integrated with the floating head pressure;
- heat exchanger area increased;
- full baffling,
- adaptability of R744 (already in use for remote equipment, but only two manufactures identified)

	Estimated average AEC (kWh/year)
Weighted Base Case	7,337
Weighted BAT	3,815
Weighted BNAT	1,834

MEPS (1/3)

Assumptions:

- Short-term MEPS: LLCC
- Long-term MEPS: BNAT
- Improvement potentials applied to all categories in the same proportion
- Standards to be considered: French AC D40-003, ISO 23953
- Calculation of performance (kWh/kg of food stuff) considers:
  - Energy consumption during cycle
  - Stated capacity according to cycle type
  - E.g. Reach-in chilling medium size: 2.5 kWh per chilling cycle, having a capacity of 20kg of foodstuff =>

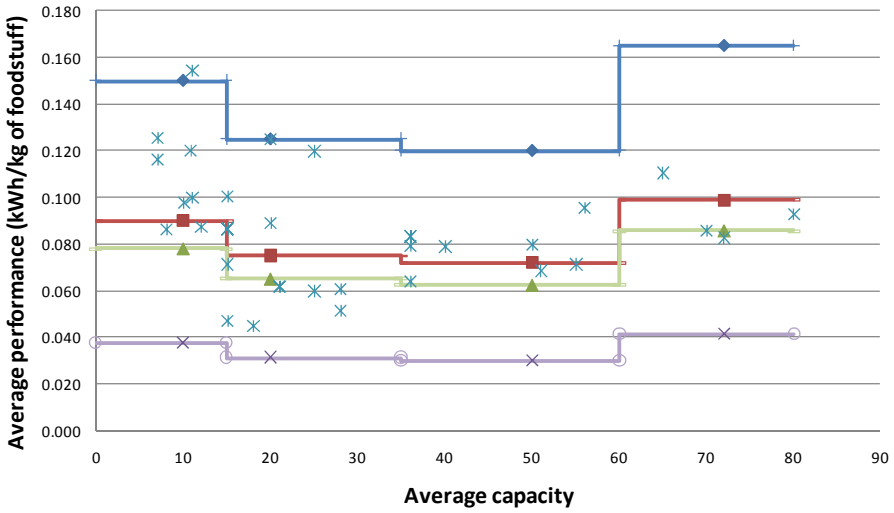
    0.125kWh/kg of foodstuff chilled from +90°C to +3°C in 90 minutes
- Energy levels considering LLCC (-40%), BAT (-48%) and BNAT (-75%): e.g. for reach-in

Operation temperature	Size	Average performance (kWh/kg of foodstuff)	Average performance LLCC (-40%) (kWh/kg of foodstuff)	Average performance BAT (-48%) (kWh/kg of foodstuff)	Average performance BNAT (-75%) (kWh/kg of foodstuff)
Chilling / Freezing*	Small	0.206	0.124	0.107	0.052
	Medium	0.172	0.103	0.089	0.043
	Large	0.165	0.099	0.086	0.041
	Extra-large	0.227	0.136	0.118	0.057

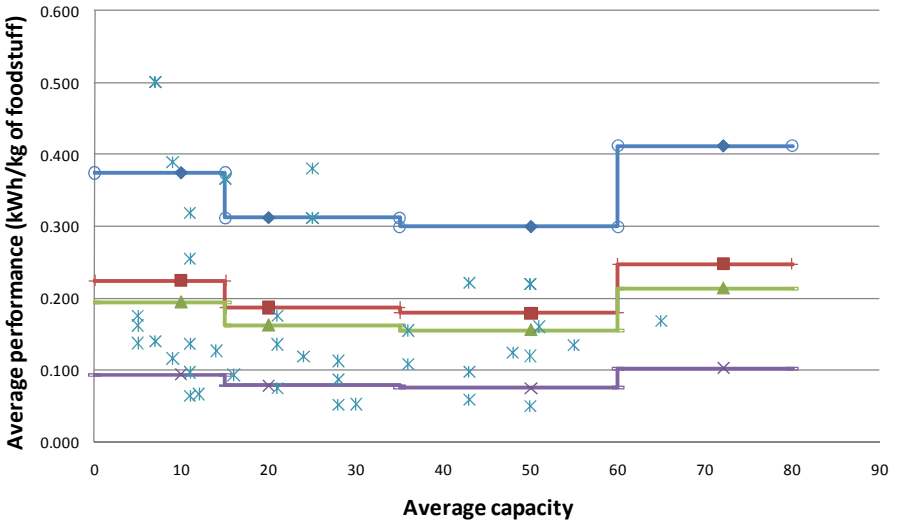
MEPS (2/3)

Small to extra-large reach-in equipment

Chilling cycle



Freezing cycle

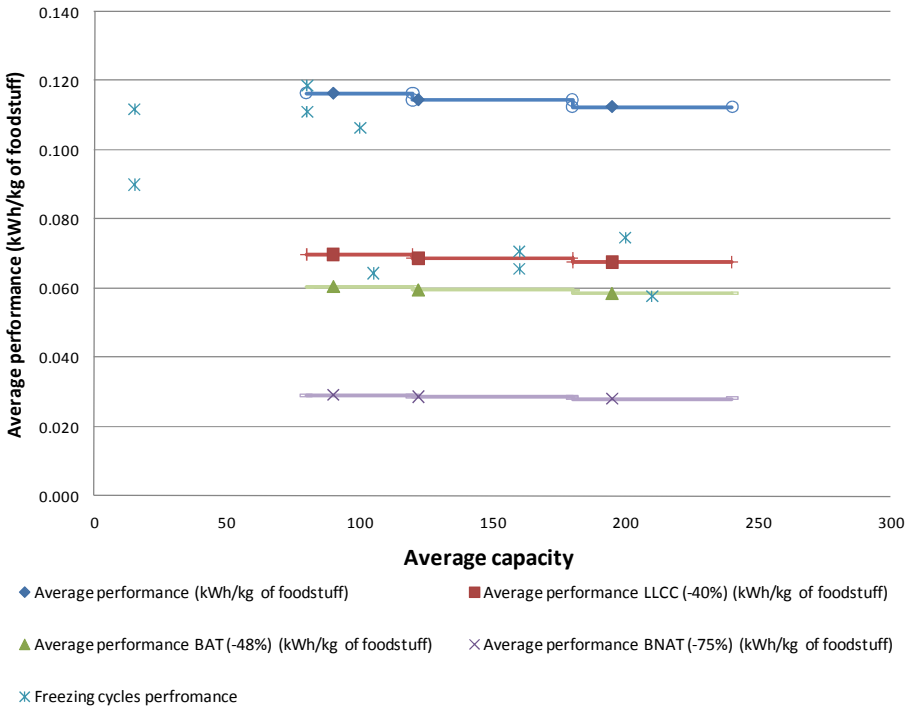


	Chilling		Freezing	
Capacity (kg)	Short term MEPS (kWh/kg)	Long term MEPS (kWh/kg)	Short term MEPS (kWh/kg)	Long term MEPS (kWh/kg)
0 to 15	0.090	0.038	0.225	0.094
15 to 35	0.075	0.031	0.188	0.078
35 to 60	0.072	0.030	0.180	0.075
60 to 80	0.099	0.041	0.247	0.103

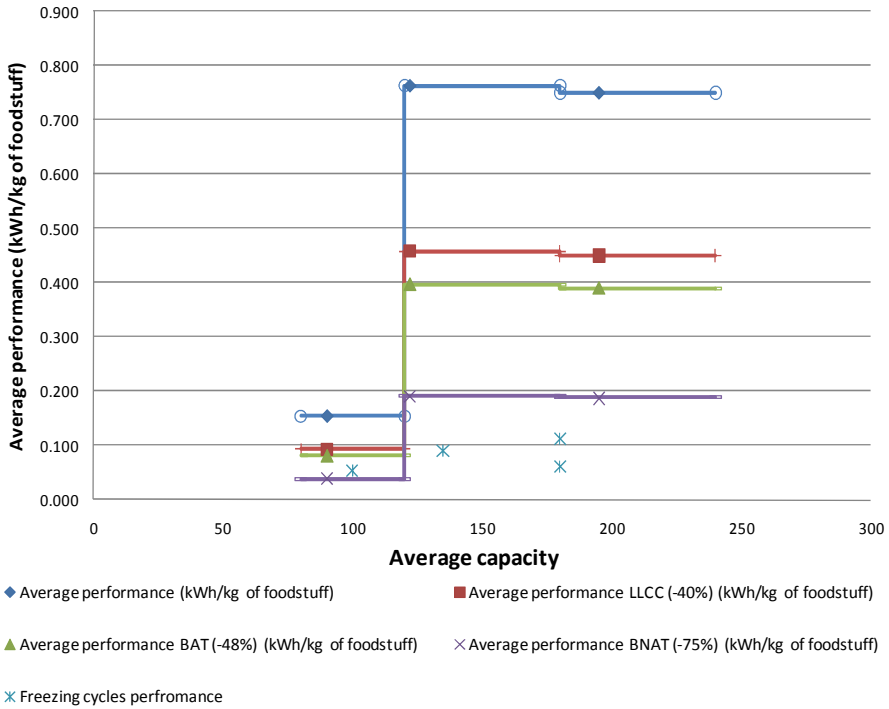
MEPS (3/3)

Small to large trolley equipment

Chilling cycle



Freezing cycle



	Chilling		Freezing	
Capacity (kg)	Short term MEPS (kWh/kg)	Long term MEPS (kWh/kg)	Short term MEPS (kWh/kg)	Long term MEPS (kWh/kg)
80 to 120	0.070	0.029	0.093	0.039
120 to 180	0.069	0.029	0.458	0.191
180 to 240	0.068	0.028	0.450	0.188

Alternative approaches

- **Energy labelling**
- Voluntary initiative (benchmarks)
- Information requirements
- Generic requirements
- Installation requirements/guidelines