

Service cabinets

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ENTR Lot 1 3rd Stakeholder Meeting
Brussels, Belgium, October 25th 2010

A study being conducted for DG ENTR by BIO Intelligence Service



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: Refrigeration systems and refrigerants
16:40 – 17:30	Conclusions, next actions to be taken and AOB

- Commercial refrigerated cabinets designed for storage, but not for display of chilled and frozen foodstuff
- Closed cabinets designed for the storage of foodstuff and have at least one door or lid.
- Largely used in food-service establishments, such as restaurants, hotels and cafeterias.
- Different configurations available on the market



Functional Unit

- One litre of net volume maintained at +5°C or -18°C

Exclusions

- Products with glass doors
- Open-top preparation counters (“saladettes”)

Main assumptions:

- UK MTP data extrapolated to EU
- Cross-checked against BSRIA data for France
- CAGR (2010-2014): 0.9%

Year	Estimated sales forecast *	Estimated stock forecast *
2006	390,578	3,196,511
2007	393,985	3,228,919
2008	397,444	3,260,163
2009	402,122	3,307,680
2012	412,096	3,380,904
2020	440,230	3,621,615
2025	461,396	3,824,409

*Extrapolation of figures provided by stakeholders

Technology	(%)
Refrigerators	69.3
Freezers	29.3
Refrigerators-freezers	1.4
Vertical	70
Under-counter	29
Chest	1
Plug-in	98
Remote	2
1-door	64
2(+) doors	36

Market data

Configuration	Operation temperature	Door numbers	Estimated average net volume (litres)
Vertical	Refrigerator	1	450
		2+	900
	Freezer	1	450
		2+	900
	Refrigerator/freezer	1	450
		2+	900
Under-counter	Refrigerator	1	150
		2+	200
	Freezer	1	100
		2+	200
Chest	Freezer	1+	400

- **EN ISO 23953:2005** (or **EN 441:1995**) commonly used to test performance
- CECED Italia proposed amendments to EN ISO 23953:2005 to adapt for use with service cabinets
- 3rd country: **ARI 1200:2008** (US), **ASHRAE 72:2005** (US) and **CSA C827-98** (CAN)

- **EU 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

- **UK Enhanced Capital Allowance and Danish Electricity Saving Trust schemes** (plug-in service cabinets)
- USA – voluntary programs: **Energy Star** and **ARI certification program**
- Canada – mandatory measures: **CAN/CSA-C827-98**: “energy performance standard for food service refrigerators and freezers”

- These do not deal with energy performance, but with the function within kitchens for food safety reasons:
 - French commercial food preparation hygiene requirements law of 29/09/1997
 - UK Department of Health Guidelines
 - Austrian Hygiene Certificate Guideline

Product type used for weighting:

Vertical, single-door, plug-in

Configuration	Operation temperature	Model type: door numbers	Estimated average net internal volume (litres)	Market share	Assumptions
Vertical	Refrigerator	1	450	34.30%	1400 kWh/year AEC
		2+	900	14.70%	0.8x 1-door vertical refrigerator per litre
	Freezer	1	450	14.70%	2.5x 1-door vertical refrigerator per litre
		2+	900	6.30%	0.95x 1-door vertical freezer per litre
Under-counter	Refrigerator	1	150	10.15%	1.35x 1-door vertical refrigerator per litre
		2+	200	10.15%	0.8x 1-door under-counter refrigerator per litre
	Freezer	1	100	4.35%	1.05x 1-door vertical freezer per litre
		2+	200	4.35%	0.95x 1-door under-counter freezer per litre
Chest	Freezer	1+	400	1.00%	0.8x 1-door vertical freezer per litre

3 BOM received from industry

Sub-Base Cases and Weighted Base Cases

Product characteristics	HT weighted Base Case (abstract model) based on Sub-Base Case (real product)	LT weighted Base Case (abstract model) based on Sub-Base Case (real product)
Design:	Vertical, single-door, plug-in	-
Functional unit:	Litre of net volume at +5°C	Litre of net volume at -18°C
Net internal volume [litres]:	450	450
AEC [kWh/year]:	1,400	3,500
EEI [TEC/m3]:	17.05	42.62
Use pattern:	8760 hours per year	8760 hours per year
Price (ex VAT) [€]:	2,000	2,000
Lifetime [years]:	8.5	8.5
Shipping volume [m3] :	1.5	1.5
Weight of product [kg]:	141	155
Refrigerant:	R134a	R404a
Refrigerant charge [g]:	300	300
Refrigerant leakage [% per annum]:	5	5
Refrigerant dumped at EoL [%]:	5	5



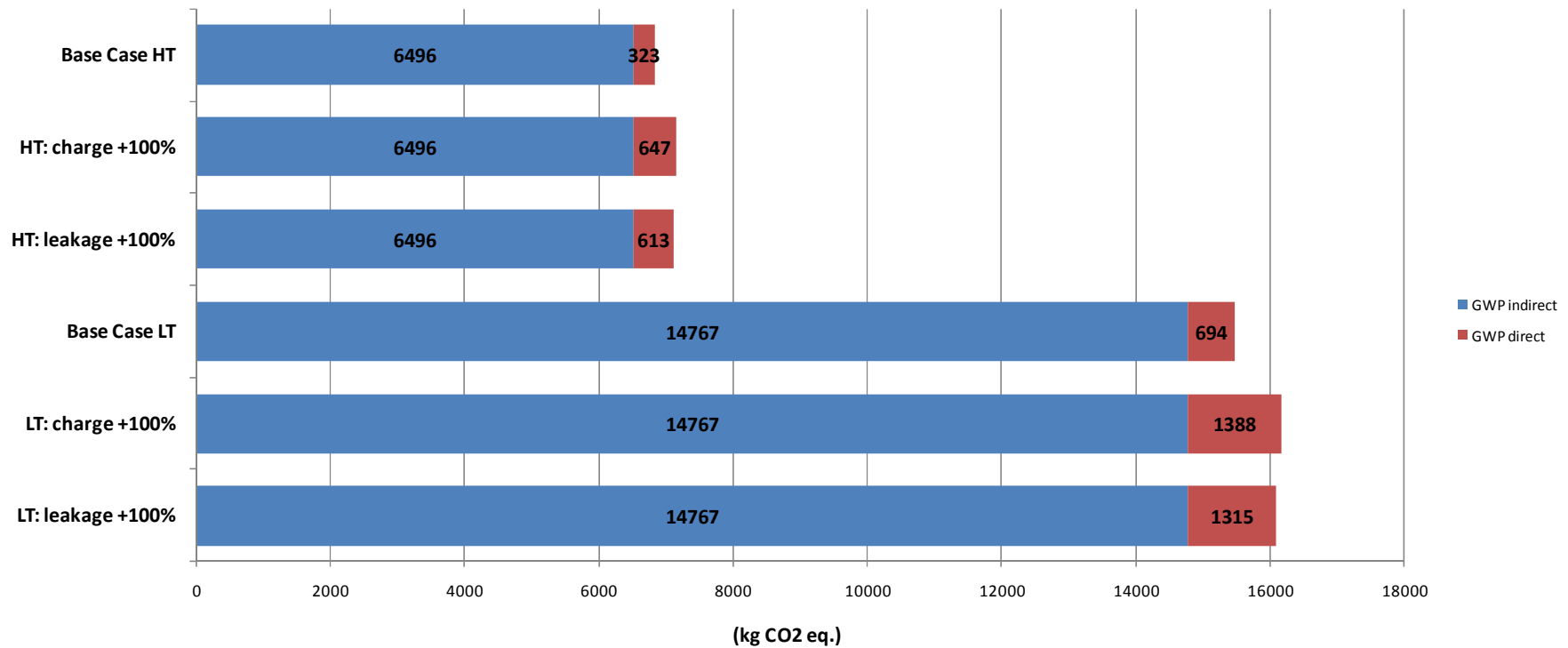
Environmental impacts

Total Energy (GER):

36.97 MJ / litre at +5°C / year, of which the use phase represents 91%

86.35 MJ / litre at -18°C / year, of which the use phase represents 96%

Direct GWP for HT and LT represents about **5%** of the TEWI



Saving potential of **64% AEC for HT** vertical single-door models, and **53% for LT** (sub-Base Case vs. real BAT)

Product characteristics	BAT HT	BAT LT
Design	Vertical/Plug-in	Vertical/Plug-in
Functional unit:	Litre of net volume at +5°C	Litre of net volume at -18°C
Net internal volume [litres]:	450	450
AEC [kWh/year]:	504	1,645
Use pattern:	8760 hours per year	8760 hours per year
Price (ex VAT) [€]:	2,250	2,250
Lifetime [year]:	10	10
Weight of product [kg]:	<i>TO BE COMPLETED</i>	<i>TO BE COMPLETED</i>
Refrigerant:	R290	R290
Refrigerant charge [g]:	45	45
Refrigerant leakage [% per annum]:	5	5
Refrigerant dumped at EoL [%]:	5	5

Product	AEC HT (kWh/year)	AEC LT (kWh/year)
Weighted Base Case	1,400	3,500
Weighted BAT	504	1,645

	Applicability (years)	Market penetration (%)	Savings for HT (% TEC)	Savings for LT (% TEC)	Increase in price of HT product (€)	Increase in price of product LT (€)	Priority
High efficiency compressor*	Now	40	7	10	10	10	1
ECM evaporator fan	Now	20	10	7	18	18	2
ECM condenser fan	Now	20	5	3	25	25	3
High efficiency fan blades	Now	20	3	3	5	5	4
Sealing door face frame	Now	N.A.	19	26	0	0	5
Insulation thickness	Now	35	4	8	100	110	6
R290	Now	20	13**	13**	0	0	7
Zeolite Filter Cassettes	Now	N.A.	0.5	2	175	175	8
Bubble expansion valve	Now	NA	10 to 20	10 to 20	N.A.	N.A.	9
Defrost control	Now	30	-	3	-	50	10
Anti-condensation control	Now	N.A.	2 to 20	-	N.A.	-	11
Insulation material	Now	N.A.	2	2	330	1115	12
BNAT							
VSD compressor	2 to 3	N.A.	10	10	40	40	1
Hot gas anti-condensation	2 to 3	N.A.	18	9	94	94	2
ECM compressor	2 to 3	N.A.	5	5	73	73	3
Hot gas defrost	2 to 3	N.A.	N.A.	8	N.A.	129	4

*Selected from technologies related to the component

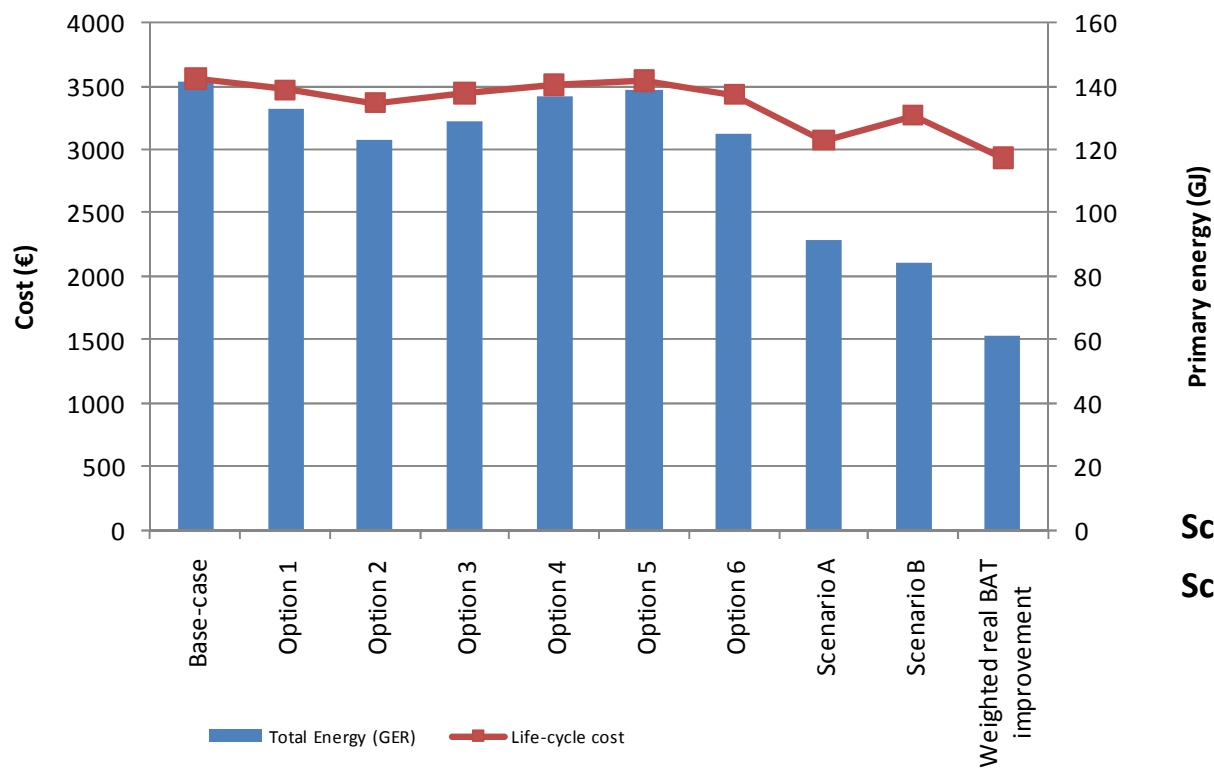
**The benefit of this improvement is also the lower GWP of the refrigerant and reduced refrigerant charge – although it could provide high energy savings at no extra cost, it has not been selected as top priority due to its flammability.

N.A.: Data not available

Note: Savings are not additive.

Priority based on cost increase, energy saving potential and applicability

Primary Energy Consumption and LCC



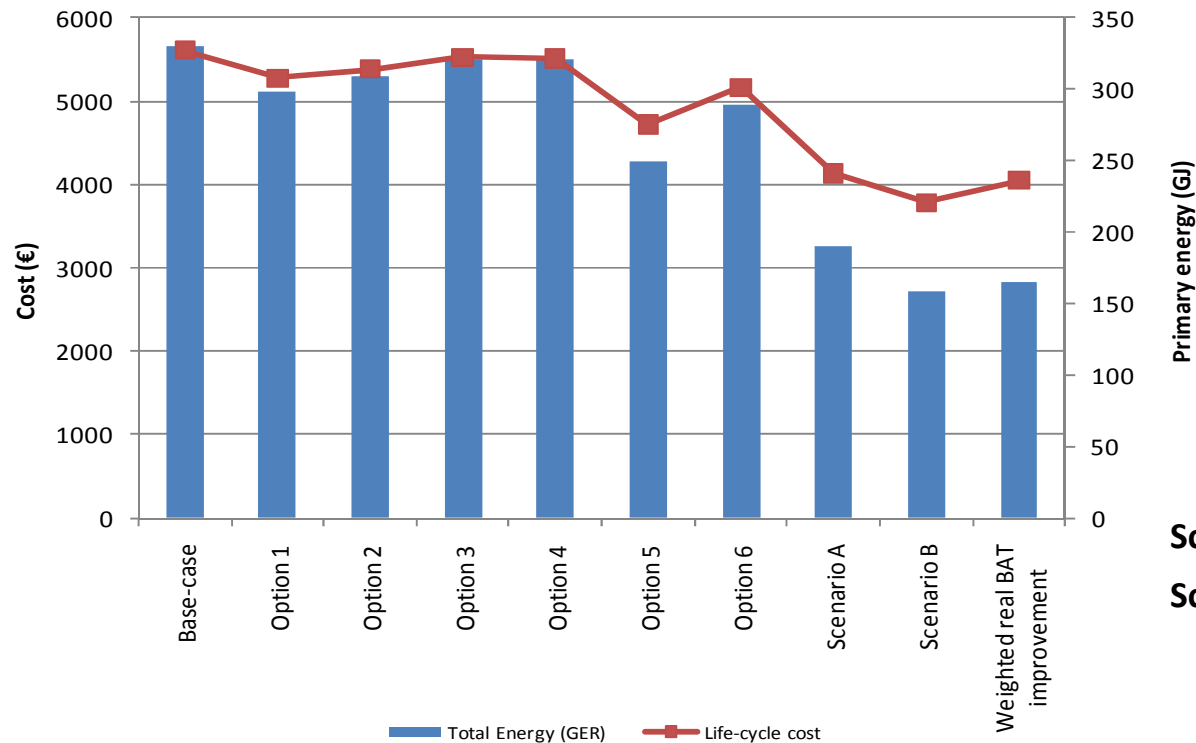
Options	
1	High efficiency compressor
2	ECM evaporator fan motor
3	ECM condensor fan motor
4	High efficiency fan blades
5	Sealing door frame
6	R290

Scenario A: includes options 1 to 5

Scenario B: includes options 1 to 6

	Energy consumption HT (kWh)	Savings HT	Product price HT (€)
Weighted Base Case	1,400	-	2,000
LLCC = BAT = Real weighted BAT	504	-64%	2,250

Primary Energy Consumption and LCC



Options	
1	High efficiency compressor
2	ECM evaporator fan motor
3	ECM condenser fan motor
4	High efficiency fan blades
5	Sealing door frame
6	R290

Scenario A: includes options 1 to 5

Scenario B: includes options 1 to 6

	Energy consumption LT (kWh)	Savings LT	Product price LT (€)
Weighted Base Case	3,500	-	2,000
LLCC = BAT = Scenario B	1,575	-55%	2,058
Real weighted BAT	1,645	-53%	2,250

The “best” service cabinets within next 5 years could achieve energy savings of up to approximately 70% using the following:

Refrigerant:	R290 or R600a
Compressor:	VSD ECM
Expansion device:	Bubble expansion valve
Evaporator:	ECM with efficient fan blades and improved heat exchanger
Condenser:	ECM with efficient fan blades and improved heat exchanger
Defrost :	Hot gas, controlled
Anti-condensation heaters :	Hot gas, controlled
Lighting:	LED
Insulation:	80mm PUR
Other:	Liquid suction heat exchanger

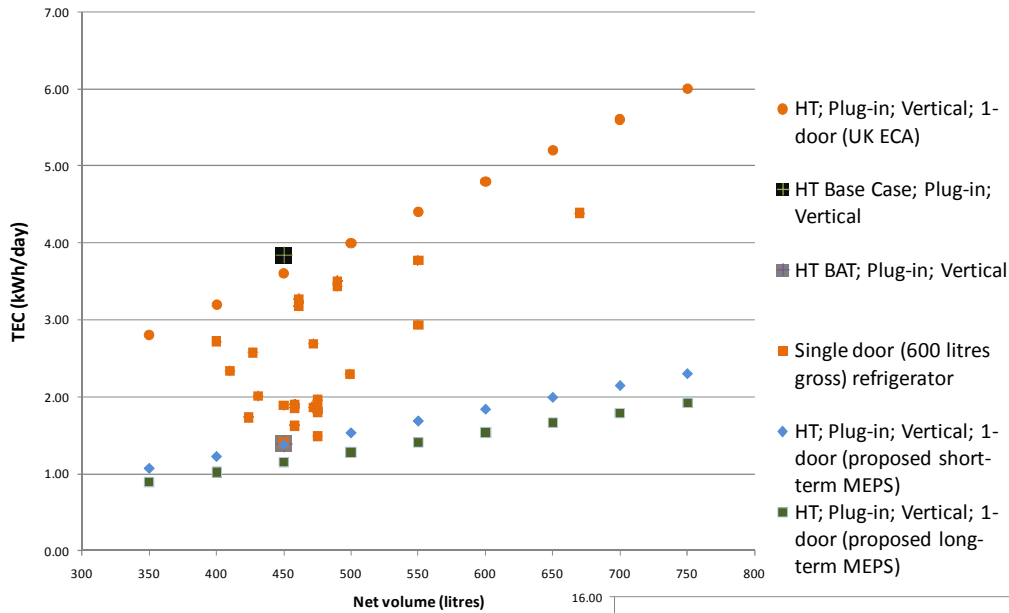
	Estimated average AEC HT (kWh)	Estimated average AEC LT (kWh)
Weighted Base Case	1,400	3,500
Weighted BAT	504	1,645
Weighted BNAT	420	1,050

Config.	Operation temperature	Door numbers	Average net internal volume (litres)	Average Base Case AEC (kWh /year)	Average BAT AEC (kWh /year)	Average BNAT AEC (kWh /year)	Base Case EEI	LLCC EEI (MEPS short-term)	BNAT EEI (MEPS long-term)
Vertical	Refrigerator	1	450	1400	504	420	17.05	6.14	5.11
		2+	900	2240	806	672	13.64	4.91	4.09
	Freezer	1	450	3500	1575	1050	42.62	19.18	12.79
		2+	900	6650	2993	1995	40.49	18.22	12.15
Under-counter	Refrigerator	1	150	630	227	189	23.01	8.28	6.90
	Freezer	1	100	817	368	245	44.75	20.14	13.42
Chest	Freezer	1	400	2489	1120	747	34.09	15.34	10.23

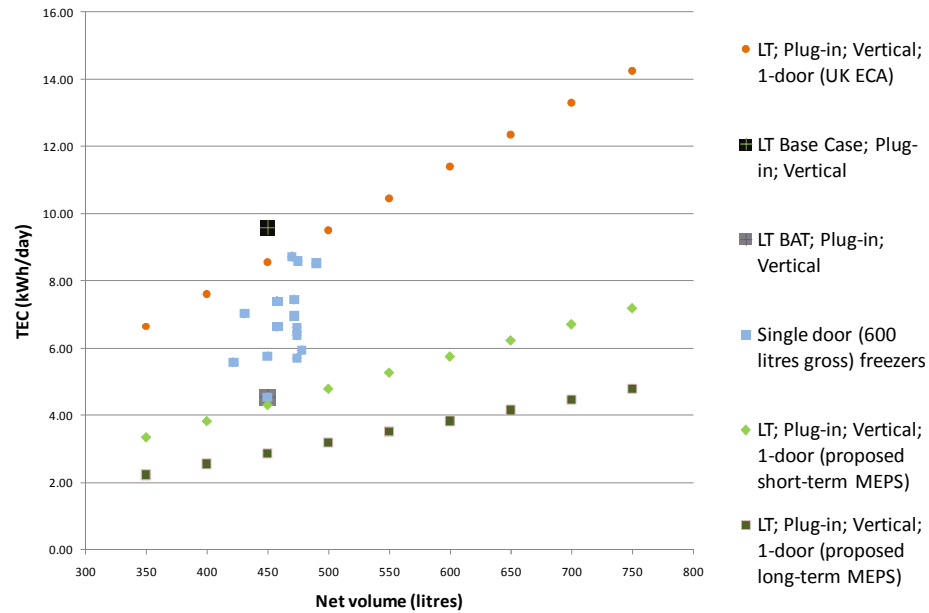
Assumptions:

- Short-term MEPS: LLCC
- Long-term MEPS: BNAT
- Improvement potentials applied to all categories in the same proportion

Configuration	Operation temperature	Net internal volume, V (litres)	Short-term MEPS based on LLCC (max. EEI)	Long-term MEPS based on BNAT (max. EEI)
Vertical	Refrigerator	0 < V < 600	6.14	5.11
		> 600	4.91	4.09
	Freezer	0 < V < 600	19.18	12.79
		> 600	18.22	12.15
Under-counter	Refrigerator	<i>Any size</i>	8.28	6.90
	Freezer	<i>Any size</i>	20.14	13.42
Chest	Freezer	<i>Any size</i>	15.34	10.23



1-door vertical plug-in – HT and LT



- The MEPS would be measured under the following:
 - Total Electrical Energy Consumption as defined in BS EN 441-9:1995 (until revision of EN ISO 23953:2005 is completed);
 - Net Volume equals shelf (or drawer base) area x loading height;
 - Adjustment factor for refrigerator-freezers:
 - $AV = \text{volume of refrigeration compartment in litres} + (1.63 \times \text{volume of freezing compartment in litres})$.
 - If it is assumed that the energy consumption of freezing per unit volume is 2.5 times that of refrigeration, this adjustment allows for just over 65% of the product's internal volume to be freezing storage.



Alternative approaches

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