Minutes of the third Stakeholder Meeting for EuP Preparatory Study Lot 1: Refrigerating and Freezing equipment

Place: European Commission, Conference Centre Albert Borschette, rue Froissart, 36, B-1040 Brussels

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Consortium:

Name:	Organisation:
European Commission	
Laure Baillargeon (LB)	European Commission – DG ENTR
Project Team	
Shailendra Mudgal (SM)	BIO Intelligence Service
Benoît Tinetti	BIO Intelligence Service (not present)
Jonathan Bain (JB)	BIO Intelligence Service
Alvaro de Prado (AP)	BIO Intelligence Service
Raul Cervantes (RC)	BIO Intelligence Service
Per Henrik Pedersen (PP)	Danish Technological Institute
Philippe Riviere (PR)	Armines

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1.1 AGENDA

09:30 – 10:00	Arrival and registration	
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10:20 – 10:30	Short introduction to the Ecodesign Directive	BIO
10:30 – 10:40	Horizontal session: Progress update	BIO
10:40 – 11:30	Product focus: Walk-in cold rooms	All participants
11:30 – 11:50	COFFEE BREAK	
11:50 – 12:40	Product focus: Service cabinets	All participants
12:40 – 13:30	Product focus: Blast cabinets	All participants
13:30 – 14:20	LUNCH BREAK	
14:20 – 15:10	Product focus: Remote condensing units	All participants
15:10 – 15:40	Product focus: Chillers	All participants
15:40 – 16:00	COFFEE BREAK	
16:00 – 16:40	Horizontal session: Refrigeration systems and refrigerants	All participants
16:40 – 17:30	Conclusions, next actions to be taken and AOB	All participants

The presentations and discussions in this meeting will be based on the documents published on the project website:

www.ecofreezercom.org/documents_1.php

The timings expressed in the agenda are indicative and do not necessarily correspond to the actual session

1.2 INTRODUCTION, TOUR DE TABLE AND PROGRESS UPDATE

Shailendra Mudgal presented the agenda for the day and introduced the project consortium, presented background information on the Eco-Design directive and BIO Intelligence Service. A tour de table was made to introduce attendees. Jonathan Bain then presented a progress update, informing stakeholders that the deadline for stakeholder comments is **Friday November 5th.**

First Name	Last Name	Initials	organization
Alexandra	Maratou	AM	Shecco
Anders	Sjøgaard	AS	Gram Commercial A/S
Chris	Playford	CP*	Foster Refrigerator
Daniel	Colbourne	DC	ECOS
Darcy	Nicolle	DN	United Technologies Corporation
David	Gibson	DG	Defra MTP Programme
Edouard	Toulouse	ET*	ECOS
Erika	Menosso	EM	Electrolux Professional
Florian	Schubert	FS	EPEE
Grahame	Keeping	GK	GR Scott Ltd
Hans-jürgen	Withopf	HW*	ebm-papst Landshut GmbH
Harrison	David	HD	Bayer MaterialScience
Hermann	Renz	HR	BITZER GmbH
Johannes	Hoogkamer	JH	Eurovent
Karin	Jahn	KJ	VDMA
Kathrin	Völker	KV	HKI Industrieverband
Keith	Warren	KW*	EFCEM
Manfred	Schwarz	MS	HKI
Marco	Imparato	MI	Ceced Italia
Marie	Görkem	MG	Emerson Climate Technologies
Markus	Lenz	ML	Emerson Climate Technologies
Michael	Degel	MD	Viessmann Kältetechnik AG
Nacer	Achaichia	NA	Honeywell
Niko	Baekelandt	NB	DAIKIN EUROPE NV
Paul js	Siderius	PS*	NL Agency
Per henrik	Pedersen	PP	Danish Technological institute
Philippe	Riviere	PR	Armines
Pierluigi	Schiesaro	PSc	ARNEG SPA
Rafael	Venancio	RV*	SYNEG and Friginox Company
Salvini	Stefano	SS	Anima Federation
Stephane	Arditi	SA	EEB
Thomas	Hartmann	TH	Viessmann Kältetechnik AG
Veerle	de Smedt	VS	Daikin Europe N.V.
Volker	Siede	VSi	HKI Industrieverband

**Stakeholders unable to review their comments before publication*

1.3 PRESENTATION OF WALK-IN COLD ROOMS AND DISCUSSION OF RESULTS

Presentation by Jonathan Bain (JB)

Discussion starts – JB: Are there any comments on exclusions?

Daniel Colbourne (DC): Please explain why these product sub-sets have been excluded.

JB: Pharmaceutical and double refrigeration system products due to tighter temperature control requirements; different functionality. Large systems; smaller cold air spill from product when door opened so different functionality; in addition, there may be other heat loads such as vehicle loading bays; difficulty in including them with the testing standards of other products. Those incorporated into a building covered by existing regulations and not similar type of product. Stand-alone due to different heat loads, and different component requirements for weather-proofing.

DC: Did you estimate the market size and impacts (e.g. energy consumption) of the sum of the products within these sub-sets? Are they significant?

JB: Believe we made an estimate of the size of the market of larger product types. Decided to focus on product categories with larger volumes, and those for which there was a proposed framework to enable testing of energy consumption.

DC: Consider that the consumption of the larger stores could represent a significant proportion of energy consumption of installed base. I understand that might have difficulty in testing them, but could at least have proposals, for example, of minimum efficiency components.

JB: In the US, they are discussing test standard methodologies and MEPS[1] limited to the scope of walk-in cold rooms only. In order to make headway, might be best to focus on the proposed (smaller) product types.

DC: Don't you think that some of the alternative approaches – not testing – but strip door curtains, insulation thickness, minimum efficiency of components, etc, could be viable options?

JB: Yes, they might be viable options. However, the project works to a standard methodology – having done that, we are looking at a specific proportion of the market for which we have made an analysis. The options could be applied to larger products, but we would not know what impact that would have.

Any comments on the market splits or categorisation?

[1] Minimum energy performance standards

Grahame Keeping (GK): What is definition of refrigerator-freezer? Ours is "dual compartment box".

JB: Terminology can be updated to "dual compartment box".

GK: But there are two separate refrigeration plants. Suggest just calling it a dual compartment.

JB: Agree.

David Gibson (DG): Are the stock figures more than just direct extrapolation of MTP data? UK estimates were somewhat tenuous.

JB: The data was cross-checked with BSRIA data from French market[2], and this approximately matched. Figures appear to be reasonable.

Any comments on test standards approach proposed?

DG: After meeting in London[3], I discussed testing options with Judith Evans. Judith has done a lot of refrigeration product testing work. I explained the approach suggested for small WICR (testing under EN ISO 23953), and Judith considered it impractical, due to difficulties in getting proper air flow around the product, even for the smallest WICR sizes, at conventional test facilities. In Judith's opinion, it is not an option.

JB: Did Judith have proposals for an alternative approach?

DG: No – difficult product to test. The American proposal to split testing of refrigeration system from that of the envelope seems sensible. You could test the refrigeration system (sold either as a monobloc or a combination of evaporator and condensing unit sold as a set) separately. In the UK we have something a bit similar, a beer cellar (basically a cold room in a pub to cool beer). They are not insulated, but they do have custom-built cooling units, i.e. a condensing unit plus an evaporator. There is a test standard for these in the UK, Public Available Standard (PAS) 57, which simply tests evaporator and condensing unit as a system with each side located in a controlled environment. Seems that the idea of simplifying WICR testing by separating the box, for which there could be minimum component requirementssuch as efficient lighting, door closing mechanisms, minimum insulation, etc., plus a simple test of the refrigeration system in a similar way to PAS 57 – might be a way forward. Problem with the American approach is that they include evaporator fan power in the box energy consumption, which could tend to make people use lower power fans. This seems wrong – evaporator fan power should be considered with the system, as if there are lower fan powers and lower air flow rates over the evaporator, this will reduce the evaporator capacity, which will pull down the back pressure of the refrigeration system, and overall this will result in a less efficient system.

[2] Assumed UK is 13.5% and France 10.5% of EU market.

[3] EFCEM meeting on WICR, London, Tuesday 12th October 2010

GK: A door-close test is as good as anything for an enclosure [*insulated box*] – just pull down room temperature – we have minimum standards for holding blood, and one of the main test procedures is that, when room is at target temperature and everything is switched off, the enclosure must maintain temperature between pre-defined range for *X* hours. Quite simple test to test insulation.

JB: Is that measured under a standard test, or just done when installed?

GK: There is a British Standard for it[4].

JB: And is this test done every time a product is installed?

GK: For the ones we've done, it's installed and then tested by client representative.

Hans-Jürgen Withopf (HW): With regards to the comment to take out the fan power from the evaporator calculation, I don't think that it is related to the air performance of the fan, as it depends on the efficiency of the fan – if you have a high-efficiency fan, you have less heat dissipation to the system, you have to cool out, but the performance is the same. [*Asked to clarify*] I don't think it's sensible to exclude the power consumption from the calculation of energy consumption in this case. A highly efficient fan with the same air performance, of the same RPM, so you have the same duty point, has less heat dissipation, which means less heat has to be cooled out. Also an important point for the compressor and the energy efficiency overall.

JB: Don't think it was proposed to exclude the consumption of evaporator fan motor totally – was only that it should be incorporated into the calculation of the refrigeration system, rather than the insulated envelope.

One issue of testing the refrigeration system is the variability of the components that might be put together. Does the PAS take this into account, does it simplify?

DG: Yes. Simply says that under the specified conditions (the environment under which the evaporator section is controlled and environment under which the condensing unit section is controlled), the unit must achieve certain efficiency. Very straightforward.

JB: Measured by the COP?

[*DG confirms*]

DC: In terms of the test method described, presume it's similar to EN 1455, used for testing of, for example, split A/C unit calorimeter approach. On one side have testing system, on other testing the cold store as a whole – I expect that testing individual cold stores, once they've been installed, especially if one of the smaller products, may be cost-prohibitive.

[4] BS 4376

GK: Yes, what we were looking at for the small boxes, with monoblock – which more or less can be classed as an appliance – can be a factory test, and then box can be manufactured to that standard and, for example, batch tested. Gets a bit more difficult with the bigger or custom-built ones. What we find a lot more now, when working for the big supermarkets and others like them, there are consultants (or the main contractor) testing insulation with thermal imaging. Smaller ones are easier, as plug-and-play, but issue is bigger ones.

DC: On the other hand, if just test the system itself, the efficiency is very dependent on the matching of that system capacity to the cold store load itself. Might test it under a calorimeter test, and get a good COP, but if used with cold store that it is oversized for, all the testing and improvements will come to nothing.

GK: That's true, that's where the ownership comes in. Problem where we can sell a whole bunch of cold rooms to a customer, and then their contractor puts the refrigerator system in. Not so bad if manufacturer is selling the whole product, can police it, and have ownership – but what happens when one sells enclosure and another sells system? Was discussed in London.

KW: One of key issues for consideration in work going on is that, while test standard proposals are concentrating on factory-built units, what happens when components are bough separately and installed together into a WICR, and the issue that that creates in creating a gap between manufacturers complying with requirements that have been set (i.e. lifts bar), and installers who purchase eclectic mix of panels and refrigeration systems and install a product outside of the scope of the work being discussed here. One of major concerns.

JB: Might it be possible to set information requirements for the two separate elements, which would then more easily be matched or compared against each other to ensure that the differences in sizing is less likely to occur?

DC: That seems like an easy approach for large-type systems, if you take the situations where have a calorimeter-tested system, or choose efficient components, and you produce a site-installed system you would typically add around 20% to calculated heat load, then selected system components to match this but with an extra 20%, as were concerned about whether were going to meet temperature requirements. So, in the end, I think contractors are going to be hesitant about following instructions to get exact match of system load and system capacity. Will end up oversizing system, and therefore reducing efficiency – having straightforward instructions/guidelines may not be sufficient to get the installed to achieve the efficiency that's desired. If then you do have on-site testing, and the systems is not meeting efficiency, is that contractor then going to take the system apart and re-install different components? Seem to be a few challenges in that type of approach.

JB: Any more comments on options for testing standards?

Are there any comments on weighting factors or consumption figures used to calculate the Weighted Base Case?

We received some comments on leakage, both during life and when a system is refurbished/repaired, and at end-of-life (i.e. refrigerant dumped). Plug-in assumption if 5% per annum, 5% end-of-life, while market weighted figures to include remote products are 9% per annum and 5% at end-of-life. Suggestions of 50 to 100% at end-of-life were provided. Any comments?

GK: We see 5% per annum leakage as very high – would be in trouble if we had 5% leakage rate.

JB: But to differentiate that from actual leakage due to repair/refurbishment, or at end-of-life when taking system apart, how much would be managed/disposed and how much would leak?

GK: Think that with a monoblock – if you did any work on a monoblock, you'd have to virtually reclaim the whole unit. Tricky one. Monoblock seen in the UK, in the retail market, as a throw-away item. Problem with the supermarkets is, if it goes wrong, their frame of mind is "take it out and swap it". Would be virtually dumping all of the refrigerant any time looked at a monoblock. For actual leakage per annum, would be tiny, less than 1%.

DG: But under the F-gas regulations, can't dump it. Means that people are acting illegally. When recovering refrigerant from a system, you can recover 95% of it quite easily, and that should either be incinerated or reclaimed for future use.

GK: We use the term "dumped", when what we mean is "reclaimed". Issue of terminology – is it a case of refrigerant "lost" at maintenance?

JB: We have two specifications – "leakage" and "dumped". Would be useful to have a more accurate estimation of the figures for end-of-life dumping, which could include any release during regular maintenance which is not included in "natural" annual leakage that for example might occur due to small faults in joints, etc.

DC: In terms of leakage rates and end-of-life, think it's important to define it quite clearly what's included. Some systems will leak very small amounts during lifetime, some will leak whole charge quite quickly and then be repaired and re-filled. When repairs are being carried out to parts of the system, then refrigerants may be recovered and during that process a proportion may leak out, therefore need to be clear that we're not assuming that all systems are leaking 5% of charge per annum. Quite a few studies, and some currently being worked on, that look into lifetime leak rates, and considering the broadness of the quality of the workmanship throughout the entirety of EU, think that 5% for this type of application is quite conservative, but obviously depends on type of system. Also, in terms of end-of-life, 5% is quite an underestimate, when we look at various studies that are available, regardless of the idealistic target of the F-gas regulation. In reality the end-of-life emissions are larger than this, and there are several studies that demonstrate this and can refer to, to get more realistic figures.

JB: Thanks, there is one quoted in your comments, we will come back to you for other references. Please note that the weighted refrigerant leakage is currently 9%. Is that

more or less accurate? We can certainly revise the end-of-life dumped figures, and there seems to be agreement that the figure is significantly higher that 5%. This may also feed into proposed policy options for end-of-life guidance to include in the regulations.

Chris Playford (CP): Just an observation, I assume that this is based on one refrigeration system to one room? There is no requirement if you have one system serving two, three rooms, etc.? Is that correct?

JB: Weighted Base Case includes all products on the market, including those served by a central refrigeration system, which may itself supply several rooms.

CP: But that changes the way you approach the testing, as now you are effectively treating them as splits. You have condensing units on one hand, and unit coolers on the other. Don't know what effect that has for the cold room people here, but that seems to be a much more complicated testing system.

JB: Believe the US approach take this into account. When separate the envelope from the refrigeration system, with that can work with central type refrigeration systems.

Nacer Achaichia (NA): Just a comment about the leaks and the leak rate – I think that there is a danger here of analysing large charge systems, if we express them in terms of percentages. I think that in terms of absolute, because the leak flow is dependent on the pressure difference and also the number of leak parts, which may or may not be the same between small and large systems. So if we assume 5, 10, 15% and use same amount for larger systems, which have been analysed, due to the larger quantity of refrigerant that they have already.

JB: Are there any other comments on refrigerant leakage?

Any comments on estimated saving potential for BAT?

Stephane Arditi (SA): It looks like you considered a business-as-usual BAU scenario, without any improvement at all – then you tend to overestimate the potential gains through BAT, and then in LLCC.

JB: So that refers to Task 7 scenario analysis, where comparing against BAU? [*SA confirms*] Thank you – we will look at that and revised as necessary.

GK: Very expensive cold room.

JB: What would your estimate be?

GK: In Euros, would be down to something like 7,000.

JB: Base Case is 8,800 Euros for 25m^3. This is BAT, so we estimated a price increase. [*GK acknowledges*]

DG: How did you arrive at the 35% AEC improvement potential? You've got a list of impact of individual component improvement options, but by my calculations, doesn't come out to 35%.

JB: This BAT AEC saving potential is not based on the analysis in Tasks 5 and 6, but instead on MTP improvement assumptions. Was used as a means of looking at BAT earlier in the process, and now we have evaluated the individual improvement options, we have come up with a separate figure which is more ambitious. We have chosen the LLCC, Scenario B, which is also the BAT calculated through Task 6 analysis, for the short-term MEPS target.

Any comments on improvement options? Not much time remaining, so stakeholders are invited to send us comments on specific figures.

CP: One observation is that the BAT used to drive the market AEC savings potential, there seems to be an assumption that none of this is being used now. So this is all effectively available to be added on to create a 35% AEC saving. In fact some of this technology is already in the marketplace, so you're available future technology isn't going to drive 35%, but only a fraction of that. Won't get 35% - need to be mindful of claiming these big numbers, which look fantastic in the report, need to be realistic, achievable and affordable in the marketplace.

JB: In the analysis, we base the BAU on the Base Case, which does not incorporate these improvements, to see effect. Means that in the results there is some saving that will not be in reality made, but also include some cost that is not required. What we want to know is whether some of these should be within the Base Case model, as opposed to a BAT improvement.

CP: Take it on board and think it needs to be reviewed. The other thing I touched on was the affordable element. If you take Grahame's estimate of a 7,000 Euros cold room, going to 10,500 Euros cold room – large amount of money to lever against clients. If the scheme is not adequately policed, there is a large part of the marketplace that will stay at the 7,000 Euros level, while credible manufacturers will be stuck at 10,500 Euros and lose a big share of the bottom part of the market. That needs to be understood.

JB: That is understood. At the EFCEM meeting, there was some discussion as to how to avoid so-called "cowboys" [*unscrupulous installers*] from undercutting credible manufacturers by providing low-cost products. One of the options discussed was having an industry-regulated market, and prevent these potential unscrupulous providers from entering the market.

CP: I'm not convinced that a completely industry-policed scheme is the endgame. Especially since you are then placing the burden back on industry, whereas there are schemes such as the UK ECA that provide a level of funding that supports policing of products – and this is a really tough one to police, because once it's installed, it's very hard to do anything about it.

DC: How is the UK ECA scheme policed?

CP: For service cabinets, they take products and test them. You can speculate on the rigour of that, but there is a scheme in place. WICR are more difficult to police. In putting together MEPS, you cannot ignore the fact that policing the scheme is crucial. If you cannot enforce it, it effectively degenerates into something that good people do and everybody else gets away with.

KW: As an industry, we have serious questions over the market surveillance that goes on over the health and safety standards – to expect industry to police energy efficiency standards I think is unrealistic. I don't think it's workable in the environments in which we work, because of the fragmentation of the end-user base, the fragmentation of the supplier channel, and the fragmentation and number of companies that could provide WICR. I don't think that will work.

JB: In terms of policing, it might not just be looking at the energy consumption, it might be a certification scheme for installers, so that consumers are aware of the potential difference in the quality of their product once installed. And it could also perhaps be regulation on information provision, and could be another way of ensuring that consumers are at least informed about their product.

Are there any comments on the BNAT level?

CP: I think if we can reach 80% AEC saving, we're doing something very badly now. Can the manufacturers comment on whether they have 80% saving left on their products?

JB: We are not talking about now, but in 5 years' time.

CP: But realistically, you're talking about not opening the door. In very crude terms, you have to open the door and go into the cold room. 80% seems incredibly high.

JB: These figures are certainly revisable, so if you have suggestions of better figures, we'd welcome them.

The MEPS are based on the levels LLCC, and BNAT. We've talked about the standards that could be used, and there is still discussion to be had on those.

Are there any components not included in the minimum requirements list that should be included?

One of the important issues to bear in mind is that the requirements should not be technology-dependent. For example, for fan motors, although the US CEC requires use of only ECMs and three-phase motors, it would best useful if we could instead set the level of efficiency required. One issue with this for motors is that the current levels of efficiency are set on the IEC standard, whose scope is upward of 750W electric motors only. Is there are any comments on how best to specify requirements for motors beneath 750W, that would be appreciated.

Are there any comments on policy options that could be taken?

Paul JS Siderius (PS): regarding energy labelling, there is a general discussion over whether energy labelling, which used to be for household products but now with the re-cast of the directive is now available for all energy-related products, can be extended to commercial products. When you think of businesses that buy products, as wanting to show that they are doing something toward energy efficiency, and also want to have an easy way to communicate the type of product they've bought, in terms of energy efficiency, then energy labelling certainly could be a good instrument. It is an easy and understandable way of showing, and for consumer or NGO to ask for, to indicate what has been done in regards to commercial refrigeration.

JB: Thank you.

1.4 PRESENTATION OF SERVICE CABINETS AND DISCUSSION OF RESULTS

Presentation by Jonathan Bain (JB)

Discussion starts – JB: Are there any comments on exclusions?

Erika Menosso (EM): First, we have some problems relating to the definition – whether "commercial" or "professional". For us, "commercial" should only refer to supermarket (consumer-facing) products, and "professional" should only refer to those with solid doors that are used by employees/professionals. It's important to not only think of energy performance, but also from the safety point-of-view. Our standard is related to professional users, not consumers in the commercial context. We must use the same differentiation in the terminology.

JB: Would the saving potentials and AEC not be equivalent for the use in the two different contexts?

EM: What you use to differentiate the appliances is the declaration of the manufacturer of intended use, and the use of the two appliances, commercial and professional, could be different in terms of opening and closing doors, etc. – for this reason must differentiate, and must be coherent with the other things, for example the safety, and you must use the same definition for safety. Would like a common approach. If treat commercial appliances for safety, better to treat professional appliances in a different way.

Laure Baillargeon (LB): Thank you. "Commercial" means an appliance that is intended to be opened by a customer? [*EM acknowledges*] So something that is not in the back of the store of the supermarket, but something that is in customer areas?

EM: If you take the guideline of the machinery directive, and the LVD[5], you have the declaration of the intended use of appliances. What is the difference between the

[5] Low voltage directive

household and professional appliances? – only the end user. Our user is one that has training, so is a professional user. This is the difference, and is really important.

LB: My understanding is that the appliances in customer areas, for example in supermarkets, would usually have no door, or transparent doors, and that this type of equipment, with solid doors, would mainly be for professional use. So it could be used in supermarkets, but in the areas where only professionals are allowed access.

EM: Yes, I agree. As Electrolux Professional, I sell only professional appliances, and I would like – if my professional appliances go into another environment where they are potentially misused – to know whether potential misuse of my appliance

LB: It may just be a case of terminology used. I assume you are looking at B2B market, where the users are only professional.

JB: Yes, that is right. We have used the terminology from the UK ECA scheme, which states "commercial service cabinets". Could we assume that the EN ISO 23953 is related to testing of "professional" type appliances?

EM: No. EN ISO 23953 is specifically related to commercial products, commercial display cabinets used in supermarkets. Clearly stated in the standard. For this reason, we (the Italian group) have developed a revised version to optimise the test standard methodology.

JB: So the adaptations are to apply it to "professional" appliances? [*EM confirms*]

EM: Two fields are covering this. One is safety and one is performance. It is different, but it's important from a normative point of view to have a coherent definition of things, otherwise it will become a mess.

LB: The terminology used first when defining the Ecodesign Working Plan was apparently not in line with the usual terminology used for safety legislation. What we meant was that ENER Lot 12 would be on commercial refrigeration – i.e. display cabinets that have no door or transparent doors – and this study would deal with professional cabinets, only ones with solid doors. BIO, am I correct?

Shailendra Mudgal (SM): Yes, just a question of terminology.

JB: Just to check – when we have been gathering market data, we have been receiving information on products with solid doors, so the figures that we have are correct for the professional user? [*EM agrees – BIO to update terminology*]

Chris Playford (CP): To add to that, we tend to have very similar differentiation, where you have "household", then "food service" as the definition for the cabinets going into a professional user, where they are using the product to prepare food for someone else. The third category is "food retail", which is around the display of food for people to select from. This works fairly well.

LB: Are there any cabinets with solid doors under the definition "food retail"?

CP: No.

LB: I guess all of the products with service doors are under your "food service" definition? [*CP confirms*]

JB: Can you see that changing at all in the future?

CP: No – the customer needs to see the food to get idea of what they are buying. You can use glass doors in the kitchen – it's a very small proportion, and generally we exclude them anyway. So it's a fairly clean definition. In that way it also ties in well with the safety legislation, as the domestic household product is clearly a different product. The only caveat to that, from a safety perspective, is that commercial food service cabinets are now coming more and more under 60335, which is a combined commercial/domestic safety standard, which does confuse things a little.

EM: As Electrolux, we only use at this moment the machinery directive and LVD guidelines in order to identify the categories as intended use, declaring "household" or "professional".

Another issue related to terms – but it's related to under-counter – we have refrigerators with and without counters integrated. "Horizontal" is the best terminology to use, not under-counter. It's only a term, not more that this.

JB: So if we change the terminology to "horizontal", would other stakeholders agree with that? [*SH confirm*]

We would like to confirm that the MEPS that we have proposed are based on figures resulting from testing under EN 441, are now related to what would be described as "professional" service cabinets, and that this is an agreed point to work from.

EM: About the standard, about what I have already said before, is a separate issue. In the mapping of the market carried out, based it on the 23953 standard. Third party testing laboratory used to keep testing out of industry.

Per Henrik Pedersen (PP): We did a big field test of commercial service cabinets in Denmark some years ago, and we measured the energy consumption, and also the number of door openings, and so on. This has been reported at an IIR conference in Glasgow some years ago, and we would like to offer the results from our field test to the coming discussions about the test standard. In my opinion, the situation for refrigerators is quite similar as what is specified in EN 23953, but it's different for freezers – the number of door openings for freezers is much less than the 72 door openings that is specified by the standard.

Pierluigi Schiesaro (PSc): I want to confirm that the EN ISO 23953 standard is under amendment, which are available, and have done the technical enquiry – it is prepared, needing only the formal vote. Mainly the opening and closing door cycles were changed, especially for chilled cabinets. For the opening cycle, were more than double for refrigerators compared to freezers. The cycles referred to big supermarket multi-deck cabinets with doors, so opening cycle is very high frequency, and clearly this

standard cannot be applied to service cabinets. During the working group discussion, with Australians, they have problems with applying to this standard, because the Australian standard is the same as the EN ISO standard, but they have problems with the opening cycle. So the revised version of the standard will have a different door opening cycle than that which is set today. The real opening cycles for service cabinets is much lower. So need to develop new standard to take this into account.

EM: As Italian group, we have done this. We have taken this standard and optimised it for the number of cycles.

Daniel Colborne DC: What is the difference, in terms of the performance, if you test with the existing standard, and test with the modified method? Would it make a significant difference to the outcome and the conclusions?

PSc: The differences are between the energy consumption and the temperature performance.

DC: But by how much?

PSc: 5 to 10%. Applying the EN ISO 23953 as it is results in higher consumption than applying the revised version. Estimate the difference of 5 to 10%. But the main problem is the performance of temperature. One of the main issues to highlight is that the cabinet should be tested at least at +30°C / +35°C ambient conditions. Normally a display cabinet is tested at reference conditions of +25°C and 60% relative humidity, but for a service cabinet, the reference is a tropicalised ambient classification, should be +35°C / +40°C. In these conditions, doing the opening cycles, there is a big difference in product temperature and energy consumption.

LB: Thanks to the Italian group for updating the standard. The contractor now needs agreement of all stakeholders on the basic assumptions of the study, especially regarding the improvement potential and the suitable approach. The Commission would appreciate an agreement within industry on the testing and measurement standard to be used for the purpose of the future Regulation (presumption of conformity with relevant requirements). This could base on the update of the EN ISO 23953. The level of ambition of legal requirements should be set in consistency with the standard

Rafael Venancio RV: I would like to remind you that there is a protocol test specific for service cabinets in France, for many years, with a specific door opening, with a specific load, and the main difference between the display cabinet protocol test and that of the service cabinet, is door opening, food M-package test positioning and also duration of the door opening. Often the door openings of the display cabinets, if you apply the heat on the service cabinets, the result is that the evaporation system is blocked by ice, because display cabinets is something like 12 hours of door opening, so it's totally different from service cabinets. It's clear that French manufacturers think it is necessary to adapt to make a new standard for service cabinets. It's a work in progress.

PSc: It is necessary that some EU states take charge of opening a work item for a specific standard, I think.

EM: From a refrigeration point of view, TC 44, doesn't cover in its scope the service cabinets, and this is the original problem with standardisation. Now we are starting with EFCEM activity in order to have a complete overview of the proposals of the different associations, and then we will have a proposal for a standard in EFCEM. Now, as manufacturers, we can have a meeting to organise this issue, because in this moment all we have is UK ECA, CECED proposal, and France has SYNEG proposal. Now we are coming around the table, and we discuss about it.

RV: Yes, it's a work in progress with the EFCEM association, with all EU manufacturers of service cabinets.

PSc: No, but the problem could be that either goes with CENELEC under the same standard, or through another standard. Because, normally not the professional appliances are under CEN, and the household appliances are under CENELEC. The service cabinet is an appliance that is not commercial, and not household and – the problem is that there is no specific working group that will open a work item, neither under CEN nor under CENELEC to have a proposal for a standard. There are different national standards, but not a EU standard.

EM: From this point of view, this thing is not so clear – OK, so from professional appliances are the machinery directive, but from safety point of view, we are under TC 59/61/E-C, and from performance point-of-view we are under TC 59X – this is what we have at the moment. [*Some discussion between EM and Stephano Salvini*] No – C44 doesn't cover our standard. First step is the creation of a working group, in order to discuss technical issues

JB: Is the industry about to meet to talk about this?

EM: Now we are starting to discuss about it – we have EFCEM, we have all the associations, and we can discuss about this standard and this methodology. It is not clear what is the best way to measure the energy consumption of these appliances. What we have done is done, but we must have a common base in order to compare appliances.

RV: The main problem is that in a lot of countries in EU there is food safety regulation, and today these food safety regulations are higher targets than the energy consumption, so the energy consumption protocol test needs to be in accordance with the food safety requirements in each country.

JB: So they need to meet the temperature range requirements, and those are different per member state?

RV: Yes, correct.

JB: And has this not been an issue before with display cabinets? Given that there is already a standard for display cabinets, and that they store food, would it not be the case that they have similar issues as service cabinets?

RV: I can't answer for display cabinets, I can answer only for service cabinets.

EM: Maybe I can make clear the issue about display and service cabinets. I know this, as we make banqueting for saladettes and other things. We have HACCP regulation about the banqueting, so you must display the things, and you have some certain temperature ranges for these kinds of foods. For storage inside, we have the EN 23953 limits of M-packages – only this. This is the difference between the two things, but perhaps you can speak to our commercial display cabinet expert about it in order to view the difference[6].

CP: I thought that the M1/L1 classification was fairly widely accepted as being conformant to food safety. And if you test to M1/L1, that was reasonably uniform – I wasn't aware that there are any food legislation requirements that that doesn't really conform to. Whether it's in 441 or 23953, the M1/L1 I believe are the same. So we can use M1 and L1 for food safety, so we just have to talk about energy performance. To me that seems quite simple.

RV: Yes, it could be, but it is different in each country. Temperature references could be different for food safety regulation. Commercial and display cabinets is a different market, more international and have a clearer use pattern, a lot different from service cabinets. But maybe the temperatures will be the same, but need to check with each country.

JB: Does the climate class not take into account different operating regions within the standard already? If the issue is international markets, could you not use different climate classes?

RV: Climate class if a matter of protocol test. It is clear that service cabinet is unlike a display cabinet, which will be placed in a commercial environment which has air conditioning, and service cabinets are more in kitchens. Maybe it is +30°C, maybe it's below, but it could be different. This is why manufacturers should meet to discuss the temperatures and protocol tests.

CP: I agree. We can't start testing at different climate classes, or it gets out of control. We have to agree on one climate class for the protocol test.

RV: I agree. Be careful when we are talking about protocol test, as we are talking about average values, so it is not the best situation or worst. We are not talking about +32°C or +42°C, it's necessary to define the correct average temperature, and it's not always +32°C.

JB: Could you please explain what a protocol test is?

RV: You put the cabinet in a room at a certain temperature and humidity, you place M-package type blocks in certain positions inside, you leave time to stabilise temperatures, then you start the door opening/closing cycles. During this you test the food temperatures, which should be below one temperature, or between two

[6] ANIMA representatives

temperatures. It's possible to have a lot of variation around that, and variation in results from that.

JB: We understand that these are a fundamental part of testing standards – but we thought that this work was being carried out in Italy by CECED Italia – but perhaps this has not been confirmed as the approach across the EU. Who is leading the co-ordinated approach on this?

Keith Warren (KW): I would like to respond on behalf of the European Association of Catering Equipment Manufacturers. The work that has been undertaken by CECED Italia has been under the auspices of EFCEM, who is sharing that information with manufacturers across the EU – that is across the 8 member states whose national associations are members of EFCEM. The document has been put out for comment and consultation, and that process is feeding back into the EFCEM energy standards performance committee, which is chaired by the EFCEM technical board. That's where the work is at the moment, and the proposal is that once it has been agreed, it will be formally offered up as a test methodology for refrigerated service cabinets. That process is underway, as we speak.

JB: Do you know how long that process usually takes?

KW: We recognise the speed that you and the commission are looking to go with this project, and the timelines that are set – that is why this work was started just over a year ago. I believe we are coming towards a conclusion, and I would anticipate that it would be published in the earlier part of next year at the latest.

JB: Thank you.

In general, is the methodology that has been proposed in this study – would the industry agree that it is the correct? And all that remains is for values, calculated under the new test standard, to be plugged in to come up with the final MEPS levels?

CP: So what you're suggesting that we run with 441, until this standard is available, and then we can change to the new standard?

JB: Yes. What's important is that the factors we've used to calculate this, and the values that we have for the saving potential are correct.

CP: That's a separate discussion. The first one is to clarify what standard should be used – we will run with 441 until a new standard is implemented. Is that correct?

LB: Apparently, the industry still needs to agree on three basic assumptions which significantly influence the measured energy consumption, namely the ambient temperature, the M-package positioning, and the door openings. Details of the full methodology do not absolutely need to be agreed before starting the discussion on the future Regulation; however, it would be better if industry could rapidly agree on these three basic technical assumptions. Once these assumptions are agreed on, the results of the study can be updated as necessary, so that the regulation is in line with the final test standard for service cabinets. The test standard does not have to be published at

the time of adopting the Regulation but its content should be broadly agreed. There will be a delay of *at least* 18 months between the vote for the regulation in the Regulatory Committee (Member States representatives) and the date when the legal requirements will enter into application. Agreement on the three technical assumptions is fairly urgent, so that the industry can provide test data and results.

EM: Yes, in Italy the study is starting with the test methodology assessment, but this is only the first step. Then, secondly, we have a complete statistical analysis in order to have the complete map of the market. If we want to go to an energy labelling scheme, we must have this statistical analysis. This is, I think, the most important part. If the methodology is not agreed, the first step is not in place in order to have a statistical methodology. For this reason, the numbers after this slide are not close to the reality. They are completely out, as we haven't got a common comparison methodology.

LB: The Commission would certainly prefer not to have to specify the number of door openings, the M-package positioning and the ambient temperature directly within the legislation. It is preferable that industry agrees on such assumptions within a harmonised standard.

EM: Another thing is related to technical committees. I agree that the situation now is not clear. Maybe at this moment, the first step is an agreement between the manufacturers, under EFCEM roof, in order to have a technical agreement. Then with this working group, we can go to offer the proposal to a technical committee, TC44 or TC59/X – it doesn't matter, really – in order to get a standard. Or we can go first of all to DIN, I don't know – this is another way, in order to go to EU standardisation system. But working together under EFCEM is the best way for the moment.

JB: Are there any last comments on service cabinets that anyone would like to make?

CP: You referred to the Gastronorm standard – that isn't particularly relevant. Sizes do not necessarily conform to it.

JB: We are not proposing to use it to set limitations; it is referenced only for information.

Anders Sjøgaard (AS): We have well established energy saving listings in UK and Scandinavia. Since 2004 we have tested according to 441 and we have put a lot of effort into testing. We are reluctant to just throw it away and start from scratch determining new testing standards. We believe that this discussion has to have more time to find out exactly what is replicating the use of the product. So far it has been proposed to split up 12 hours of door openings into 3 times 4 hours, where the middle 4 hours have no door openings. In our opinion this is not the correct picture of the daily use, for example in hospitals, where the cabinets have door openings throughout 12 hours of the working day. As Per Henrik mentioned, we have studies from a field test for more than a half year use in various professional kitchens. Here we saw exactly how much they cabinet was stressed through door openings. This is very useful and even necessary information for establishing a new standard for service cabinets. Please let the EN 441 be valid until we have had time to discuss and determine a new standard properly.

JB: Thank you. Since we have little time left, perhaps that discussion will continue under the EFCEM initiative.

Are there any other comments on service cabinets?

DG: I've got one about the MEPS levels. Can I confirm that the first level MEPS, for example 6.14 for a 450 litre vertical single-door cabinet, tested under 441 (per 48 hrs)? [*JB confirms*] So, that is very, very ambitious. What's the rationale behind that? Just to put it into context – on our ECA list at the moment, the best one of those cabinets is 6.2, the very best. So this exceeds that, and that list – whose threshold for this category is just 16 – is supposed to represent the best 20% of units in the marketplace. Could you clarify that?

JB: As you can see on this chart here, the ambition levels are presented at the bottom, and they are pretty stringent, given that the product would need to be below those, and most of the products on the UK ECA scheme are above. But we have been following the methodology, working from the Base Case that we have been provided – so if the industry doesn't believe that the AEC we have used is representative, they need to give us something that is more representative of the market. And in addition, the saving potentials given for the improvement options – if those are not correct, or if the analysis in Task 6 is incorrect, and therefore the level is too high, then the levels can be adjusted slightly, and the MEPS figures will increase and perhaps become more appropriate. They are certainly open for revision, and we hope industry will feedback.

Edouard Toulouse (ET): Two quick comments on the MEPS. MEPS, when based on the LLCC, meet the requirements of the ecodesign directive, which clearly states that this should be the objective. Instead of setting the MEPS at the LLCC level for example in 5 years, there could be a first intermediate step, which could be an option to avoid suddenly setting too big an improvement target, and it would also avoid that in the intervening 5 years nothing happens. We think you could refine how the MEPS are set. Coming back to the debate on the measurement standard, we had a similar issue when discussing the ecodesign measure for domestic washing machines, where the testing methods were under revision, and the new version was going to be substantially different, so you might find inspiration in how this was dealt with.

JB: Thank you.

1.5 PRESENTATION OF BLAST CABINETS AND DISCUSSION RESULTS

Presentation by Raul Cervantes (RC)

Discussion starts – Daniel Colbourne (DC): in this study is it being assumed when talking about cabinets (service or blast) they are meant to be stand alone cabinets also?

RC: yes, this is the case, stand alone, and also remote.

DC: does it also include blast freezing cold stores?

RC: the maximum capacity that is being considered is 240kg.

DC: it is important to define if cold stores are being dealt with, otherwise the same discussion on measuring efficiency and handling components is going to happen –as per service and walk-ins-.

Jonathan Bain (JB): are there comments from stakeholders whether or not the capacities presented describe cold blast rooms?

Erika Menosso (EM): the market share of this kind of appliances is not so high. Thinking about a model with panels and fitted to the description of a room, the volume is really low. Therefore, a differentiation in this case might be not so good. From my point of view sales of cabinets are really high compared to rooms. What would be the situation of other manufacturers in Europe?

DC: if it is case of the majority of stakeholders want just cabinets, then it should be expressed in that way. If a particular test standard is applied to cabinets, how could it be applied to rooms? One will get the same issues as discussed previously. If it is decided to be included, it should be included as a sub-category and be separated.

JB: would these rooms be tested for the same health and safety requirements as cabinets? And, are there the same issues related to the individuality of each product as for walk-in cold rooms?

EM: for Electrolux products the minimum loading capacity is 28kg, and the biggest 180kg. They are completely different. However, only cabinets are considered as they are the products with the highest market share. From safety and performance NF mark[7] point of view the standard are the same. Regarding the performance, there is only one problem related to the appliances non-monoblock. Electrolux produces only one model, as walk-in cold room, installed at the customer premises. The one problem of applying the NF marker is the quantity of mashed potato to be used in a 180kg machine.

JB: during the last meeting this issue and the temperature of the foodstuff was mentioned.

EM: yes, that is a problem of using this material and possibly the repeatability of the test.

JB: are the remote products designed specifically for its location or are they standard products?

EM: no, normally they are standard products and the panels used for this are standard too. Maybe the procedure to charge the shelves might be different, but is not such a

[7] Reference to NF AC D40-003

problem as per cold rooms up to 180kg. Beyond this capacity, I do not know if there exist any problems.

Rafael Venancio RV: Friginox manufactures chillers up to 640kg per cycle, and the main difference from cold rooms is that the ambient temperature does not impact these rooms, but the food type and temperature.

JB: how do you get over the problem of testing such a large room?

RV: the problem is mainly related to organisation, and the quantity of foodstuff.

Chris Playford (CP): for such big chillers the problem is not necessarily how they are tested, but the user behaviour. Having one entrance and one exit, the user pushes foodstuff from one side and take it out from the other end. In most of the location, it is more like a rapid cooling process, and not batch chillers. You cannot load 640kg of food consistently at the same temperature on one go. Users do not use the machine in that way either.

RV: the equipment is on the market, and Friginox produces a very small quantity, but there is a market.

CP: I agree there is a market, but the use is not in the conventional manner, perhaps used as part of a process. Unless one works in food processing, there is no need of that big amount of food on one go.

JB: would it be suitable a change of terminology to batch?

CP: having a standard of batch blast chilling, in reality the customers will not use them in that way. According to a recent market research conducted by us, we did not find a single customer of blast chillers using the equipment near to the legislation. There is more like a mix, without control on how the machines are being operated, but like a very cool rapid cooling space, with no real using pattern –Gram supported-. Regarding suggestion for standards, the "Lurcap"[7] is probably as good as it gets. Trolley equipments are probably different, but the reach-in cabinets are by far the highest volume, and maybe it is more beneficial to focus on those products as achievable.

JB: what would be your recommendation in terms of terminology for setting the MEPS and specifying the scope?

CP: for cabinets blast chillers or trolley blast chillers?

JB: taking into account products that could be tested under the NF AC D40-0037 or other standards.

CP: the first thing is to get the energy consumption of blast chillers, since up to now it has not even suggested as an important issue, but the performance related to the food safety. For setting the MEPS, it is important to get statistical energy data of blast performance of blast machines. This information will have to be get for the pull-down phase and the hold-in phase, because most chillers are used in both ways.

RV: I agree, but the testing of equipment should be done for its main feature, and blast chillers in all regulations that have set requirements are used for the chilling cycles. Therefore, cooling down rapidly and then switching the foodstuff to be held in other equipment, in order to avoid running a very powerful equipment only to hold the temperature. Even if the real used can vary from this, the test protocol is designed for food safety because food safety requirements are very well know in each country.

CP: it is clear that the protocol as it is today is good, but the discussion is extending the protocol to including energy. The proposal is as "LURCAP"[7] has a very well defined protocol for performance. It was sensible to extend it for energy measuring rather than start a whole new standard.

RV: yes, there is in Europe a very strong protocol for testing that would be possible to include the energy consumption measurement.

JB: is it going to be suitable for energy consumption measurement for standardised larger products as well? not only cabinets, but batch rooms as well.

RV: having a remote condensing unit is more difficult, but it is possible. Having an integrated condensing unit is possible for roll-in models, because the market for roll-in is approximately 1 or 2 trolleys 1x1, 80kg to 160kg. It is common to have the condensing unit on the top of the chiller. The case of freezer is different as the unit must be more powerful. Having remote condensing units represents different problems to make the test. It is more difficult.

CP: if it is possible to decide on a standard for measuring remote condensing units for cold rooms, it could be applied for blast chillers as well, one depends on the other.

JB: what would be the proposal for the envelope of the room itself? If measuring the envelope and the condensing unit by separate, what would be the proposal for the room?

CP: considering the ambient conditions of around the blast chiller?

JB: the performance of envelope as in walk-in cold rooms, of the remote condensing unit and the envelope is taken into account by separate.

CP: for the room itself the "Lurcap"[7] test and, for the condensing units it would be the same as the walk-in cold room.

JB: to use a proxy refrigeration system for the envelope to actual test, and the condensing unit would be tested with a separate process.

CP: what I think you are saying is taking a reference condensing unit for the testing, and that is not sure how it would work. I suggest using the same protocol for testing the remote condensing unit for walk-in cold rooms, for testing the blast room chiller. This will depend on having a protocol for the walk-in cold room. You can consider the blast chiller effectively as a high power cold room that, in its performance requirements, is different from other cold rooms.

RV: in blast chillers, the envelope has not impact on the performance or the energy consumption. That is the main difference with cold rooms. Cycles are so short and refrigeration equipment is so powerful. However, the ambient temperature and the location of the condensing unit will have an impact. If the condensing unit is cooled by water, the ambient temperature will not have impacts at all on the consumption or the performance. Not exactly like a cold room, but something in the middle. Retaking the description, the relevance of the temperatures of the functional unit is not really clear.

RC: these are figures commonly found in brochures.

CP: these figures correspond to the UK scheme. "LURCAP"[7] figures were discussed as more suitable during the last meeting.

VR: the "NF standard" [7] figures are from +63 in two hours. But the importance remains on the link to the standard. Talking of temperatures like that, it is related to performance, and it is not so clear.

CP: the plan was to adopt "LURCAP"[7] standard adding the measuring levels, with the conditions there expressed.

RC: yes, that is the main proposal, the NF standard and the "LURCAP"[7] are the same, therefore the functional unit should represent those levels.

JB: the functional unit is only for comparison of equipment provided in catalogues, and limiting the figures provided on those. It does not mean that the temperature ranges in the standards will follow these values.

CP: if the average capacity is 20kg, did you find that this capacity vary in different countries?

RC: yes, it has been mentioned that in Northern Europe the capacity is bigger, and this is an average.

RV: one remark regarding the figures, the ratio between blast and service cabinets are not correct. Friginox manufactures both and the ratio is more than 2 or 3. However, I cannot tell you whether blast or service cabinet figures are the correct. There is more than 2 or 3 times more service than blast, maybe a ratio of 10.

CP: as discussed last time, it could be 10% of blast cabinets to service cabinets.

JB: we have compared these figures with a BSRIA analysis for France. Perhaps France figures in particular are higher than the ratio 1:10.

CP: France is a bad example of this, since it is the only country with an actual law mandating the use of blast chillers[8].

[8] French law does not mandate the use of blast chillers or freezers, but set requirements that encourage them.

RV: I agree, but even in France Friginox' sales are a lot more for service cabinets than blast chillers.

RC: retaking the previous discussion, if the condensing unit is remote, what would be the procedure to measure the fans?

CP: you would evaluate it as part of the product. As previously said by the representant of EBM, if the fan has a lower consumption, the product will have lower energy consumption. And a "cheaper" fan with more energy consumption will lead to more consuming products.

Hans-Jurgen Withopf (HW): one of the main parts of the consumption is probably the evaporator side, there you have to cool down very rapidly, and there the energy efficiency aspect is probably much higher. But on the other hand, also in condensing side an energy efficient fan would save energy, but maybe it could be separated by comparing two units included or excluded.

JB: given that the energy consumption of evaporator fans is important, would not be an issue the envelope incorporating the evaporator fans not considered in the evaluation of the condensing unit as not part of the system.

RV: there is a possible way in the NF standard to separate built-in condensing unit and remote condensing unit, because it is two different applications. The problem is not if they are reach-in models or trolley models, but if the condensing unit is included in the equipment then it is in the scope, otherwise it is out of the scope. There is a way to test the equipment in the field with remote condensing units, but it is very complicated and never used in the field because its complications. It requires making tests in the field which nobody wants to do.

RC: do you have an estimate of the market share for remote condensing unit equipment?

RV: I don't have figures, but it is few quantity compared to plug-in equipment. The volume of blast chillers and freezers is up to 50kg where the condensing unit is included and remote condensing units are for trolley equipment, whose quantity is a lot less, more powerful but less.

JB: we have an estimate of the market of 16% for remote machines, do you agree with this?

RV: yes, it is about that, and no more than 20%.

LB: when you sale a large blast cabinet with remote condensing unit, probably trolleys, is there a need for safety testing under the French standard?

RV: we test it, but the test is not mandatory. The performance in the field is mandatory, but not for the constructors. The food safety performance required in the law can be checked and it is checked in the field by government agencies directly in the field, not in factories.

LB: is it checked only by government agencies once it has been installed or the installer/user has to test it?

RV: -it is tested- after installation. Remote condensing unit versions are for trolleys, and trolleys are more for collective restaurants. This type of kitchen is regularly checked for safety since they are used to prepare food for a big population, "danger is more present in these applications" than for smaller units, e.g. 20kg used in restaurants applications. In collective restaurants there are more safety checks and requirements and more frequent controls, it is not a standard used for these units. Bigger equipment is more under control by end-users and government agencies. This also depends on the country.

RC: any comments on the user behaviour?

CP: the use presented seems to be very high. Blast chillers are used for the preservation of food at the end of the day. It is not very uncommon to have one or two cycles per day. Five cycles seem a lot. That would suggest that in one shift the machine is constantly used, as soon one cycle finishes, the machine is unloaded and reloaded and the cycle starts again. In Foster's experience, blast chillers do not operate this way.

JB: in the NF standard evaluation there is only one cycle to test for, which in any case would be the testing of the product. The idea of having a user behaviour is to create an annual consumption figure, so it is an approximation rather than fixing a level of the target.

CP: understandable, but having a figure could lead to have a blast chiller with a higher impact than a service cabinet. Not sure if it is correct, but one cycle per day probably is relevant.

JB: would it be better to set the cycle level?

CP: the figure should be as correct as possible, and the analysis of the data is important.

JB: one issue is that these have been provided by different stakeholders, and used sort of an average to come up with a final figure. If you have a proposition to include in the report would be helpful.

EM: the same consideration has been made from the side of Electrolux. During internal evaluation it is considered two cycles per day and divided by the capacity of the appliance between this.

RC: are those two cycles per day chilling or freezing type?

EM: generally in order to go down with the temperature in the time required and then we make a maintenance temperature in order to maintain the temperature inside, but no more than this because the equipment is provided with the double functionality inside the appliance. So, this is the normal way that we consider for this kind of appliances.

RV: I agree that 5 cycles per day is a maximum, even in France where a lot of blast chillers are used not at the end of the day, but during the day, and by batch. The average value should be 2 or 3 cycles per day. These figures presented are averages. In the case of freezing, 2 freezing cycles seem correct. People do a lot less freezing than chilling.

JB: would you agree with an average of 2 cycles for chilling, 2 for freezing and one of each for combined?

RV: chilling between 2 and 3.

JB: we shall take that as an agreement. We will move on now to the next presentation. Thank you.

1.6 REMOTE CONDENSING UNITS DISCUSSION

Presentation by Alvaro de Prado Trigo (AP)

Discussion starts – PP: I have one problem with the set of data shown in slide 16. Some of the scroll compressors shown there should be removed in the next version of the paper work because these are unrealistic , go against the second law of thermodynamics. Taking units working at those conditions we would only receive a COP of 6

AP: we did not use these values for BAT, even though these values were in the ECA scheme database.

PR: probably in the database they mixed the columns with cooling capacity (or another propriety) and the COP

AP: in the brochures of the manufacturer we found the same values.

DG: if you take the second level MEPS and you add 5° to the air on temperature you will have +37° condensing temperature, that is the cycle -10°/+37°. You are proposing 4.86 for the second level MEPS. The Carnot efficiency for that cycle is 5.6 which gives you a Carnot efficiency about 87%, I am not an expert but that seems too high to me as an aspiration.

HR: I made some rough calculations on these numbers. Fortunately I have some simulation programs with me, and at -10° conditions using for example R410A a compressor could achieve in theory a COP level (based on 40° condensing temperature) of 3.99. You are expecting 3.89. The 3.99 COP is only considering the compressor, with no losses, no fan power etc. How the BAT and BNAT have been defined? It would be of interest to know what is the basis behind. Is it possible a theoretical number? What are the estimation for operating conditions to do some recalculations and see if this is realistic or not.

Reliability of performance data: Coming back to the ECA scheme, I was involved in that and we received data where the condensing temperature was defined with 4 K condenser approach with an even larger subcooling of 5°C. These are implausible numbers which cannot be reached in reality..

JB: we know the MEPS levels are quite ambitious and the figures used to calculate them are provided in the documents. Some of the feedback we need is perhaps suggestions on the Base Case that we selected, or the improvement options that we used are unlikely to be applied or cannot reach the same savings potentials that we estimated.

EM: in all the products not always the 80% energy saving is possible. It can be easy to reach the 50% energy savings, but not the 30% left. The first level is the AEC of the base case and the second step is the BAT, which usually is not that far from the Base Case.

ET: it is not clear what the timing of the proposed MEPS is, although it is stated in the comparison of scenarios that these are 2015 and 2020. That means that the second step would not take place until after the revision of the measure, and thus is not a fixed level, and will have to be reviewed. But it is important to include it as kind of indicative future target.

DN: The MEPS levels are ambitious, and it would require a high increase of the efficiency of all the products in the market in the next five years. It is important to see what is the impact on the market.

JB: the MEPS levels are probably too ambitious, but now it is time for the stakeholders to comment on the figures used to get these.

DC: from a general stakeholder perspective it would be good to have for all the products a number of data from products in the market like the one we have in this presentation, to get an idea of what is the maximum performance and what is the minimum performance, to see the suitability of the MEPS proposed.

JB: I agree, but for RCU there are many standardised test results, but not for the other products, and that is the main issue in some of the products, as we discussed before. The important thing now would be to comment on the improvement levels that we have presented

AP: We presented the COP values for real products in the real BAT products and sub Base Case products, and if you have better estimates of these it would be much appreciated to know them, and the same for the improvement options in task 5. The AEC was calculated following energy savings found in literature review and manufacturer's claims and then the COP was calculated using the same savings to the power input. Any information correcting these figures will be welcome.

HR: these numbers seem to me very plausible so far. You mentioned a 2.3 for the Best available product here, I would assume this compressor may reach an isentropic efficiency of 0.7 or slightly more. Then, if we consider the power consumption of the

fan, which is in relation to the compressor power, between 6 and 10%, and using all the potentials we may have an increase in compressor efficiency of 1-2-3% which is already very difficult. The improvements in fans are higher but as the ratio to compressor power is of 6-10%, even with the best fan you would save 5% in total. I am still asking how you can achieve the 3.89 when the best product is at a COP of 2.3. You would need an isentropic efficiency in the compressor of 120% or more, so I would like to know what is the basis for these numbers.

PR: in task 5 and 6, you are mixing full load and part load improvement option, but in Task 7 the COP is only full load and you are applying savings of part load too, you should be careful with that

DC: how the MEPS for RCUs apply to the other products that use remote condensing units? Is there a mechanism to link it?

JB: for the products with a significant amount of remote units we discussed of having different testing methods for the RCU and the envelope itself. In this section, as a product itself, we are looking at the remote condensing unit performance only.

DC: if you have a system using a condensing unit and it has a MEPs level and the application has another level, this could lead to inconsistencies and confusion, so what happens in the case of the guidelines for one part tell me to do one thing and the guidelines for the other part tell me to do another thing, or there are other options that also applies to the other part of the installation. For example, if there are installation guidelines, how do you check that there are no inconsistencies or double counting on these categories?

JB: as long as the method for testing the condensing units itself is harmonised, and then – in respect to each product type testing method, for the envelope – these methods can be matched for the product that you have.

DC: if there is a test method for a cold store (that has not been agreed), this method is not being used for the condensing unit. That means that the test method for the system is not the same than for the condensing unit and can be inconsistencies between the test method and the test standard for the whole system and the test method and the test standard for part of the system. It is strange to have condensing units in this lot, because I think this lot is handling self contained refrigeration systems while condensing units are components of the system, but I wanted to know if there is a possibility of harmonisation.

SM: this reminds me of standby issue, which affects to a number of products with their own regulation. The products affected by other regulation will have to comply with the requirements of their specific regulation and also with the requirements on standby, and in this case it can be the same, if tomorrow there is a product that uses one of those condensing units it has to see what is decided in lot 1 and then if there is another regulation after that has to follow what has been done before.

VS: We agree with HR, we also did the simulation and came to the same conclusion: the values would only be nearly achievable if we do not consider any other losses or

components. But there is another question, how the levels are established. In other lots (lot 10 for example) there were two tiers, the first one is below the LLCC and the second tier is right above. Here the second tier is actually the BNAT and I was wondering if this does not surpass the goal of Eco-design. Ecolabel is not applicable to this current lot, but the proposed MEPs are more in line of an Ecolabel approach, than of an Ecodesign approach. Where came the idea from of establishing the second tier at the BNAT level, which is more than ecodesing?

DG: could the last speaker explain what the "ecolabel" is?

VS: Currently Ecolabel for commercial refrigeration is no existing or relevant, but to explain: in the market distribution there is a pyramid: a lot of low-efficiency products (base of the pyramid) and a few best-in-class products (top of the pyramid),, which are highly efficient. The goal of ecodesign is to cut the base and the goal of ecolabel to promote the top products. We should not mix the goals of both.

CP: is this not the topic about the ECA Scheme and other programs, like in Denmark, where people are encouraged by taxes or funding to buy energy efficient products? So that already exists, is it not?

VS: I cannot speak for Denmark but in Belgium if you buy eco-labelled products you have taxes incentives. . In any case, Ecodesing should only get rid of the worse products in the market, not the current BATs e.g..

JB: in terms of the first level, LLCC is what after the analysis, seems to have the lowest costs of the improvement options. If you think the figures are wrong, of you have any data of feedback to give us, then we would appreciate that. And the level can change. Since the methodology is correct, the data and the levels can be revised. In terms of the BNAT the level is indicative and to be reviewed, is flexible and could be discussed. It is not a fixed point, is a proposal. The important thing is if you can have a look at the specific figures you can send us any comment.

HR: you may have considered the annual temperature distribution as a calculation basis. In reality, to optimise a condensing unit nowadays for only high ambient temperatures is not the right approach. We have to focus more and more on the annual temperature distributions including the part load conditions. Under these considerations and by floating the head pressure, to the best extend, in colder periods, it might be possible to reach this kind of values, but not at the basis of +32° ambient

DC: this is another issue, because a lot of equipments are tested at +32°C, but in most of Europe ambient temperature does not reach this temperature. The average would be 11-12°. The previous version of this RCU standard did not consider variable ambient conditions, I do not know if this one does, but these MEPS should account for more realistic ambient temperatures, because everybody can optimise the system to reach the top level at 32° ambient, but depending on the design of the system this poor performance is at more realistic ambient? And this issue should be taken into account within the MEPS.

GK: we discussed this last time, and we talked about dividing Europe between two different ambient temperatures

LB: The comparability of data is a very important issue; this includes agreeing on an ambient temperature, and preferably a representative temperature of real life conditions. The problem is that the BIO team has already encountered problems to find data with the EN 13215 at +32°C ambient temperature. Would the industry be able to provide with data for other ambient temperatures soon? The Commission may not be able to wait for an agreement on an updated standard before drafting a Regulation.

ML: lot of manufacturers (Emerson, Bitzer and Danfoss does) provide with software where one can type the parameters and get the results, seasonal efficiency, COP, everything you need for that. It is available on the internet, there is no secret behind.

LB: The consultancy was looking for what was technically feasible and what is the average performance on the market. Is the software helpful for the latter element?

ML: yes it is, in the software you can select the product you want, characteristics, conditions –ambient temperature, evaporating temperature, and it will give you the COP at every point, so if you want to get ideas of what is available on the market this could be useful tool.

RV: just one comment about condensing units, I do not manufacture but I use them. The standard EN 13215 gives conditions of 20°C aspiration of gas. For declaration of capacity is useful, but really I do not know if there are circuits that uses that, it is impossible. Is useful to select products, but in the real use is never like that. Also software can be adjusted, sometimes is easy and other is not, but they are useful. Sometimes what people do when use this standard is to put a very high refrigeration capacity that you will never find in the field. For low temp cabinet at -35°C you have superheat of 50°C in the evaporator, and nobody does that.

ML: in the software you can adjust the suction temperature and the superheat.

HR: These conditions were not really invented here in Europe. In regard of the international possibility of comparing performance data higher return gas temperatures had ambition, but there are several reasons behind that. First, the condition of higher return gas temperature is giving you the most accurate test results, because the enthalpy difference is higher than in normal circumstances and the uncertainty of measurement, is much smaller. But as Mr. Lenz has mentioned, with our software packages you can correct it, and a reliable manufacturer not only correct by thermodynamic data because return gas temperature is also influencing the isentropic and volumetric efficiencies. In so far a pure conversion by thermodynamics is not realistic but if you go to R407C or to R22 there are only minor differences. R404A is gaining a lot of this useful superheat which is only found in the data. In theory one could achieve it with an infinitely large internal heat exchanger, but in principle R404A is for example (R507 is the same) you have to have an internal heat exchanger, otherwise you'd never reach the best possible efficiencies. On the other side you must avoid that the heat exchanger on the suction side has a high pressure loss, otherwise

you get killed by the game. It is a little bit of a number gambling but nowadays due to software packages it is not a problem to calculate accurately.

Another comment that I have seen here regarding standards, this ISO 917 is from 1989., At that time, even the new HFCs were not really invented or introduced. There is a European standard, EN 13771-2, this deals with testing of condensing units.

GK: looking at the improvement options, a lot of products already have these, but when we look at this kind of improvements like magnetic bearings and even VSD, this is for bigger condensing units and chillers, the biggest share is probably below 7kW, and these technologies are not available for that size of unit. They are applicable to chillers or screw packs but not what we are looking at here.

AP: they are not available technically or because of the price, they will be available in the future?

GK: is better that the compressor manufacturers reply to that, but in the UK we are very limited, I can use scrolls when I am above 20kW, in smaller units we are more limited, even VSD is an exception

DN: the HFO blends are said to be available within the next 1 or 2 years? This is quite surprising, I do not know what the plans are, but they just started testing in research centres, so to be available in the market in this time is very ambitious.

HR: magnetic bearings are within the improvement options but is a bit misplaced, because are tools for turbo-compressors –potential tools, but not for positive displacement compressors.

1.7 PRESENTATION OF CHILLERS AND DISCUSSION RESULTS

Presentation by Raul Cervantes (RC)

Discussion starts – Daniel Colbourne (DC): absorption chillers would not reach the COP ranges that have been proposed in the MEPS.

RC: this type of equipment is not included in the study for limitations on the temperature ranges achievable through this technology.

RC: comments on the standards presented in the presentation?

Herman Renz (HR): talking about process chillers, the prEN 14825 cannot be applied because this standard is for comfort air-conditioning and shows the relationship between the load conditions and the ambient temperature, and on this basis have been the method calculation. So far in a process chiller we could assume that the load over the year is relatively constant. However, a major influence to the cooling capacity of the unit is the temperature profile of the heat sink on the discharge side. So, this

standard in my opinion cannot be applied to this kind of chillers. Also, the AHRI standard (ARI550/590) is related to for comfort air-conditioning.

RC: comments regarding the relative energy factors?

David Gibson (DG): can you tell us how you got them?

RC: these have been based on observation of the market and comments from experts regarding the typical COPs.

DC: concerning the relationship between water-cooled versus air-cooled, water-cooled ultimately have to be cooled by air, is this additional energy consumption taken into account? This condition is relevant unless there is a continuous supply of cooled water. This is an issue of the boundary of the system.

RC: if this is taken into account, do you have a more accurate figure to be provided?

DC: there is no other figure to be provided. The energy spent by the fans and pumps in the cooling tower is included in this factor?

RC: I think so, but this assumption should be reviewed.

HR: in the standards the water-cooled unit auxiliary power is not considered, while in air-cooled, the fan power is taken under consideration. If you are not comparing at constant ambient temperature you might end-up with some smaller ratio I would doubt that 1.4 is the right, under consideration of what we just discussed. But in a process chiller that is in operation over the year especially in medium or even low temperature, the condensing temperature can be floated down easily to 20°C or lower with an air-cooled system. So in the overall I would see a much smaller difference if we look to all these aspects.

RC: any comments regarding the BAT?

Grahame Keeping (GK): I think those can be ammonia charge, the refrigerant leakage can be considerably less than 1% on a packaged ammonia chiller.

RV: the charge should be in kilogram?

RC: yes

RV: what is the use of a chiller producing liquid at -25°C. Is it a current use? low temperature chiller? Maybe it is because I do not know this equipment, but I understand that to cool down at -25°C it is not water, but a very specific piece of equipment to do that because a liquid.

PSc: for supermarket refrigeration secondary fluid system for frozen display cabinets, you have a liquid at this low temperature – they are not glycol, but special fluids for

low temperature. It is not much supplied – but for secondary system for frozen food applications they also work at this level.

DG: Are there any chillers manufacturers present who could comment on whether R134a would be the refrigerant most likely to use in those medium and low temperature?

DC: not being a chiller manufacturer, but involve working with this, in general, low temperature is not likely to use R134a. Most companies tend to use R404A or R410A for these medium and low temperature applications. Also the leakage is probably less than 5%, using ammonia it would be probably lower than this because they tend to be constructed with stainless steel piping so the construction is more robust, so people can notice leakage and do something about it, but it is obviously using ammonia therefore not having impacts on the end emissions anyways in terms of CO2.

Darcy Nicolle (DN): we can confirm that we do not generally use R134a for low temperature. Our chillers manufactured in our factories, it's around 0%[9] - it is a point of insulation and use, not the chillers themselves. If you are using a refrigerants like CO2, that also is going to change your TEWI analysis. But I can provide further details after this meeting on the specific types of refrigerants that we use.

RC: any comments regarding the improvement options?

DC: by pool boiling are you referring to flooded evaporator? My feeling is that people tend to move away this type of evaporator. Because by using this type of evaporator, the refrigerant charge would increase by a factor of 5 or 10. Some companies, at least for lower capacities than 500 or 600kW, seem to be using plate heat exchangers to reduce the charge size. I am not sure whether pool boiling suits as a likely a future option. Also, vacuum process technology, referring to water-water chillers, in this case there is centrifugal technology, and it is not clear if it is an option that can be integrated into a certain standard chiller, the majority of the chillers that are listed (small, medium and large categories) tend to be displacement chillers, so you would not be necessarily looking at "water"-water chillers. There are some companies developing this type of chillers at the moment, but I think they are for the larger capacities. There is also an issue with the negative operation temperature for water-water chillers.

RC: this issue has been already raised, and it is under consideration.

DN: it's a question of boundary conditions, with advanced systems you should be looking at the potential of more intelligent control technologies, which are available now. Also, in some conditions, we are using thermal heat pumps in relation to our chiller operations which increase the efficiency. Also, using heat recovery, especially in Northern Europe, in heating stores. I do not know if this is part of your analysis or not, but I am not quite sure sometimes what you are showing today is how much is this Lot and how much should be or could be considered under Lot 12 by DG TREN on

[9] Leakage rate of chillers as assembled and tested in factories

commercial refrigeration, where you also have chillers being operated. Also, sometimes we actually use sources of renewable energy, like bore-hole water which also increases the efficiency of the chillers. These are al system type questions, so I do not know how you meant to be taking this into account or how you take these into account in refrigeration in supermarkets. I would like an explanation with that, as I am getting confused which lot is doing with what.

LB: ENER Lot 12 (DG ENERGY) was focusing to display cabinets, and cold vending machines. The system dimension has not been addressed in LOT 12. In ENTR LOT 1, there will be a separate chapter on the system dimension, but it is not intended to regulate at the system level.

HR: the MEPS are very ambitious, is -8°C and -25°C the evaporating temperature. Then for ammonia, you can reach in theory without considering additional drives, a COP 5.15, at -8°C evaporating and 35°C condensing temperature. This is already at a small TD (delta T) of 5K and two degrees of sub-cooling which is very practical under these conditions. The temperature profile over the year is somewhere behind it, but this would need careful consideration and recalculation whether this can be reached at least in short term. The best performing compressor for ammonia for example in this range, may reach – based on shaft power, and not on motor intake – an isentropic efficiency of 85%. But these are already the champions in the league. And then considering a motor efficiency of at least 94% or 95% you can deduct another 5%. So, I would propose that you recalculate these figures, and the right approach would be to take the temperature profile across the year. However it is different whether we are in Helsinki, Strasbourg or Athens. Looking for middle European climate based on Strasbourg, this could be the right approach and a trial could be carried out whether it is really achievable.

JB: given that our analysis is based on the improvement options figures, are there any comments on these?

DC: by ambient sub-cooling is meant ambient cooling? Using the cold air to help cool the water or do you mean having extra sub-cooling.

RC: it is sub-cooling in the traditional way.

HR: [*missing section of recording*] .. improvement figures end up with isentropic efficiency requirements of more than 100%,. In nowadays chillers, to a larger scale screw compressors with isentropic efficiencies in the range up to 75%, including motor losses, are applied. Even we may use in future permanent magnet motors they are mainly of advantage in part load conditions, not necessarily in full load. So, I cannot see any chance of getting in the direction of 35% improvement at rated full load conditions.

DN: I would like to support the comments from Bitzer, when you are looking at calculating this COP values they are practical ... but also the ambient conditions, if we are talking about the CO2 system for a supermarket it is important knowing where the supermarket is, whether you have an ambient temperature of +15°C or so you are going to see energy efficiency probably in the order of 10%, while operated in Scotland

you will get gains of over 20%. Also have the fact that if you put it in Switzerland, there is a legal requirement that you use all the wasted heat to heating the store, you are also looking at a more efficient store and that comes down to the amount of insulation used in the supermarket. I do not see in your list, these important issues on the operation of the supermarkets and how to make it a lot more energy efficient. Some of the options are not taken into account, for specific types of refrigeration, as the insulation of the building itself. To be realistic, I think this should be taken into account.

JB: to certain extend, some of these issues are discussed in the report, and we will be discussing systems in the following presentation.

DN: I still would like to have an answer for setting MEPS for the whole Europe or by climatic zones. What you see is interaction between MEPS for individual components of the supermarket system, and for the whole supermarket, I am not getting much an answer here. What we are aiming at to comply, a very ambitious or impractical COP value for individual components or are you looking to see taking important factors like climatic zones which have a very big impact in the efficiency of your systems.

JB: the climatic variation is something that we are considering as presented in the slides. As regards to the supermarket, they are not products in themselves that we are assessing. We are assessing chillers, but we have to look at systems as a separate study, and it is going to be discussed shortly.

DG: when we met last, high temperature chillers were included, and we were discussing what to do with them. Then you decided to hive off chillers producing fluid above +3°C to air-conditioning which makes perfect sense. But, by having done that, by how much has the population of chillers that we are dealing been reduced? These medium and low temperature chillers are quite rare beasts. It is not my area, but just I feel that the high temperature chillers used for example in food factories, plastic moulding applications, and chocolate factories are much more common. If we take these out, how many are leftand what is their environmental impact? It might be that they no longer merit legislation under the EuP.

RC: Based on the comment from the last meeting, these are the market figures that we considering, in this case low temperature and medium temperature chillers are quite important within the scope.

DG: any comments from chillers manufacturers? The number of chillers that they sell for process is not something that is easy to know, but they would have a better idea.

HR: we are not chillers manufacturers, but from the sales of compressors we can reflect the applications. That is completely right, this is best majority for high temperature, for process in plastic industry and chocolate, they are by far more, than for medium and low. But I cannot say how much.

DG: I guess then it should be good to revisit this and determine what the true population of chillers in Lot 1, and assess if is it worth continuing with them, or if they fall outside of the threshold of the directive.

JB: in any case, they would not fall outside, because they are being covered in Lot 6, covering the high temperature ranges. Perhaps, there has been a little confusion on the terminology, if we were to talk about the temperature ranges, and ignore the fact whether or not they are used in processes, does that change the picture at all, and how does that affect the market shares or the quantities in the different ranges? For the representative from Bitzer, you mentioned that process compressors are very small, is that specifically for process, or is that for temperature range in itself?

HR: there might be a misunderstanding. Applications above 0°C, these are to our experience the large majority of chillers. A big proportion of these units is applied to process, cooling for all kind of production machines as well as for the plastic industry. In all these cases with water supply above 0°C.

JB: so in the temperature ranges that are proposed here, from +3°C to -12°C and -8°C to -25°C, as a ratio to those working at high temperatures whether or not they are used for comfort cooling or process. Are there a significant number of products for these temperature ranges?

HR: the +3°C is more or less a chosen figure for whatever reason, so looking for production process of all cooling, they are all higher than +3°C.

JB: are there many products that are sold that work whatever the application of temperature ranges below +3°C?

GK: we used them now and again ... to do secondary refrigeration on cold stores, to be honest the market is actually growing with the low viscosity fluids, and using the natural refrigerants, but that in the cold storage is less than 1%. We do use it, but we tend to have our chillers manufactured by specialist low temperature chiller people: Sabroe, Grasso, etc. It is a special type of equipment because it is linking to a very low viscosity secondary fluid. It is a bit more high tech, but the market is growing. It is a lot more to say, distribution is a different thing because you are at distribution whether you are using lower or medium temperature secondaries. There is a market for them. But like I said in our market if 1% or less, in the bigger capacity chillers.

JB: would the chillers industry be able to suggest whether or not the market estimates that we have, that we are assuming, are linked to products sold that are functioning at medium and low temperatures ranges. Are those completely out and by what kind of proportion?

DC: approaching from a different direction. You say that the data came from BSRIA and the MTP reports. Within the BSRIA report, does it specifically characterise or identify proportion of chillers that are falling in this category? Or does it break it down further in terms of temperature ranges? How these numbers arrived to that?

DG: BSRIA in the last report they increase that from 20% to 50%. We asked them what was the reason, and the reply was that they had got it completely wrong the first time. You can see how difficult it is to come up with any estimate. What they are doing was trying to separately estimate high temperature chillers used in air-conditioning and process and which are are identical pieces of equipment. So the manufacturers could

not say who they sold them to, just the temperature range. So their current estimate is that roughly 50% are used for air conditioning and 50% for process cooling. I still feel that if you take high temperature chillers out, there will be very few left, but I do not know.

PP: at the second stakeholder meeting, Andy Pearson from Star Refrigeration referred to 90% of the chillers sold for air-conditioning purposes and 10% for process.

JB: we also agreed in the meeting not dividing the products by the process, but by temperature ranges.

JB: Thank you. We will move on to refrigeration systems.

1.8 REFRIGERANTS AND SYSTEMS DISCUSSION

Presentation by Alvaro de Prado Trigo (AP)

Discussion starts – DG: in the slide with efficiency of systems, the 40% seems to be calculated by adding them up. You cannot add up the impact on efficiency of different you have to find a different way of combining them otherwise you can easily get impossibly high efficiencies.

EM: in the presentation I don't find something that I found in the documents: the cost of the technology of new refrigerants. Sometimes appears zero. Is it really zero? I agree to the energy efficiency, but I don't know if the cost is really zero. From my point of view there has to be an investment. It would be better if you evaluated this issue with the manufacturers association, because when you evaluate the base case and the LCC this is very important. On the other hand, these technologies are already present on the market.

AP: this value was provided by the manufacturers, but we received some recent comments regarding the price of the refrigerant liquid. If you have comments, would be helpful

EM: if the technology is already in the market, you should take into account the costs of the implementation of the technology, because the LCC is totally different.

JB: the figures are open for comments, if appears to be zero but you think it is more, would be that you tell us how much more, because we already found products using propane at the same as products using R134a.

DC: in terms of ammonia, CO2 or others there must be a cost increase, because somebody has to do something in addition to the business as usual and new equipment has to be purchased. But what we found is that this depends on several parameters, such as the size of the enterprise and the output numbers. In the case of a large enterprise they tend to spend a little bit more and they have better efficiency, so the additional cost per unit can small. With the larger enterprises, if they are producing

a large number of units using alternatives, then the additional cost per unit sold can actually be quite low and the increase can be negligible. But if a small company uses a production line and has high investment for producing systems using alternatives and if the number of units produced is low the additional cost can be high. If an enterprise does not have a "production line" in the conventional sense and can adapt their manual activities, the additional investment can be lower and the additional cost per unit also small. But also if you don't consider the costs associated to the cost of the systems, for example for certain alternatives you can use smaller pipes and less material, so even though you have a cost implication for the changes to the production line, the cost of the system itself may be less because of less expenditure on materials so in some cases you can actually get a negative additional cost. In other cases the cost of material is going to be greater, and in some situations where you need additional safety requirements and the costs can be notably greater. It is difficult to have a general number but I can certainly provide some individual values for some technologies.

JB: that would be very useful thank you

RV: on the slide with applicability of refrigerants, I am not sure if you can use propane on blast chillers because of the quantity of the refrigerant needed. The problem with the inflammable refrigerants, is that in some countries, i.e. in France, it is not allowed to put this type of refrigerants in some buildings, where public is coming on. It is a technical solution available today but I am not sure if it will be the solution in the future. For blast chillers I am not sure at all if propane is the solution, even today

CP: just to clarify: technically there are little stops where you can put propane anyway, there is a safety regulation influence. The fluid is applicable, but whether it is safe to use it, depends on the guarding control.

RV: in France there is specific regulation that doesn't allow these refrigerants in buildings with public. It is a security aspect.

CP: that is correct, but my point is the safety regulation, is not about technology, you can design it to work but cannot design it to make the safety criteria.

RV: yes it is correct, but the safety does not allow the inflammable component.

CP: about the CO2 in the chart: I am not a great CO2 expert but I am not convinced to see the CO2 in blast chilling going together, even as second refrigerant, because CO2 reacts very quickly to heating in blast chillers, and I am not sure if it is possible to solve the safety issues with the CO2.

RC: there is evidence of remote blast chilling on CO2.

CP: that is my point, with CO2 you will have a primary plant somewhere cooling the CO2. And the CO2 has to react to the primary plant very quickly because the pressure of CO2 raises very quickly. And there is a lot of incoming food at the start of the process.

DC: regarding the applicability of the refrigerants to the applications, it is possible to apply any of these alternatives in any of these systems; you only need the enough amount of money. You could meet the desired levels of efficiency (and safety) but the question is how much does it cost.

ET: could you clarify why in the last chapter of the study you have not proposed any policy options to promote alternative refrigerants?

AP: the issue here is that the proposed policy options are not intended to promote one or other technology not refrigerant, compressors, etc. We based the policy options in energy performance, because the energy consumption is proved to be the highest environmental impact. There can be other recommendations apart from the main policy options, which are energy performance.

ET: we consider that direct emissions are significant, so this would not be promoting a specific refrigerant but only those with low GWP. And in other ecodesign measures there are policy options with specific requirements addressing other environmental impacts. We consider there are some inconsistencies between the first chapters, where refrigerants are addressed and there were some graphs showing that in some cases there was a significant impact, whereas in the last chapter it is not addressed.

DC: you said that energy is the main environmental impact but that is fundamentally not correct. Energy itself does not create environmental impact, . For example in Norway the situation is completely different as, energy has a minimum environmental impact. The main point in the first tasks of the report is that the greenhouse gas emissions are the greatest environmental impacts in your study, and then in the graphs (base case environmental impact assessment) you evaluate greenhouse gas emissions, not energy consumption.

SM: I think you misunderstood what Alvaro was trying to say, that is that the ecodesign directive itself focuses on the whole life cycle and it can give the target that the environmental impact should be reduced but how to reduce these targets is left to the manufacturers, you cannot impose that you should use ammonia or CO2, you can give them a GWP target or whatever target but ultimate technical choice has to be left to manufacturers. But Edouard is right that generic ecodesign requirements need to take into account these aspects while Task 7 is more specific ecodesign requirements where the use phase was the highest, the main step with environmental impacts, and to reduce the impacts in the use phase is to reduce the energy consumption, so it is a derivative rather than a conclusion that energy is the main impact.

DN: the f-gas regulation was mentioned: you showed how leakage rates vary across Europe. You should need to add that F-gas regulation applies to stationary refrigeration and is all about reducing or containing emission amounts and you can say that the Netherlands has lower rates than in other countries; that should be taken into account. You also might want to consider taxation and its costs on the cost of the refrigerants themselves: there are lower leakage rates because people do not want to waste money. But leakage rates are something dynamic, depends on the system, refrigerant, etc. and you are looking at figures from 2005, the F-gas regulation was coming in and the figures might have changed.

SA: I'd like to know how we can promote low GWP refrigerants, it probably is not the most significant impact, but it is not negligible. My question is, what could you suggest to help the industry use more of these low GWP refrigerants? I'd be please if you could investigate that.

LB: In a future working document, refrigerants will be carefully considered. It will have to be assessed whether refrigerants are significant environmental parameters. Then, a regulatory approach will have to be chosen (e.g. rewarding the use natural refrigerants by a "bonus" on energy consumption). The study report has to contain the correct technical data regarding the GWP associated with refrigerants, including end of life practices, maintenance practices, and leakage rates.

ET: our point was not at the political level, but only to make sure that the study does not close the issue, because then it would be difficult for the Commission to consider it. If it is not in the last chapter, you could mention that there are possibilities and it will provide technical data to promote this potential policy option.

NA: I agree with the idea of low GWP refrigerants to reduce the direct impact, but it is important not to forget the overall picture, to reduce the life cycle global warming performance. Other industries, as cars, realised that low GWP refrigerants are not the best solution for the environment, is important to look at the life cycle climate performance, the overall impact, and there are solutions that can be implemented at a cost/effective solution as well. Today we have solutions for R404a, especially in the retail sector, we have supermarkets in the UK removing R404a and substituting it by other R407F performax, only two months in the market but we have seen 15-20% lower energy consumption. So there are solutions to reduce considerably the energy impact.

In the presentation, the safety classification for HFO1234yf is A2L, that is an official classification. In chillers, R134A many manufacturers are experimenting today with HFO1234ze as a potential alternative to R134A, this is going to be implemented very soon, and this is a fluid with very low GWP

RV: with money, equipment can be manufactured to use all the refrigerants, but there is a problem with the training of technicians, sometimes is not enough to handle with this kind of refrigerants, and the manufacturer cannot make the maintenance service.

HR: the GWP seem to be a bit mixed up, I propose to use the values used for the F-gas regulation and for the EN 378.

Refrigerant designations are not correct, all the mixtures are with capital letter and the pure compound with a particular structure are with small "a", "b" and so on.

In Task 5 report there is a misleading "Although they are a good initial alternative for CFC and other substances, R134a and R404A present some problems regarding their high GWP. For this reason, alternatives for them are being analyzed. Alternative refrigerants can be other HFC with lower GWP (e.g. R410A, R407A)," In fact, R134a has lower GWP than the other alternatives.

I can also put the things together in writing with further remarks: in the slides there is a refrigerant 211 been mentioned, probably it should read R11.

JB: Thank you to all.

1.9 CONCLUDING REMARKS

JB repeated that the deadline for stakeholder comments is **Friday November 5th.**