

Stakeholder comments on Ecodesign Study: Air-conditioning and ventilation systems (ENTR Lot 6)

Introduction

This feedback log refers to comments received on the following documents:

- May 2010 - Information request
- June 2010 - Draft reports task 1, 2 and 3 (which covered both air conditioning and ventilation)

Comments received on May 2011 Ventilation tasks 1-5 draft reports will be addressed after the second stakeholder meeting.

Comments received – Task 1

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Answer	Action date	AC Or V
2010/07/01	Scope	Duct systems should definitely be a part of LOT 6 Duct systems are a very important Energy Related Products and have a great impact on the energy consumption if performed correctly. The most important feature is the design of the system but also the air tightness and in some respect the carbon footprint of the production, material and transport.	Svensk Ventilation AB Eurovent	Discussed at the first SH meeting. No new input from manufacturers following the meeting (but Minutes not published). Ducts presently included in the report regarding their impact on fan energy consumption not as a product candidate for IMs. Could lead to proposals in Task 7 of the ventilation study.	July 2010	V
2010/07/02	Scope	Accordingly wording should be changed from ventilation and air conditioning systems to ventilation and air conditioning products	Eurovent	Some products are integrated systems. What matters is the product definition in the report at the end.		AC & V

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2010/07/02	Scope	Air filtration products contribute a lot to energy consumption when wrong designed, wrong selected, polluted or clogged. It is therefore that Eurovent recommends to consider air filtration products as an Energy related Product and bring them under a relevant Lot.	Eurovent	Discussed at the first SH meeting. New input from manufacturers available following the meeting. Filters presently included in the report regarding their impact on fan energy consumption not as a product candidate for IMs. Could lead to proposals in Task 7 of the ventilation study and AC studies.	July 2010	V
2010/07/02	Scope	Eurovent recommends strongly not splitting the cooling and heating function as the product is the same and the two functions are linked together.	Eurovent	ENTR lot 6 will study the cooling and secondary heating function of air-conditioners > 12 kW, air-conditioning chillers, terminal units and heat rejection units. NB: A separate ENTR lot 6 briefing on AHU suggests addressing AHU only as ventilation product.		AC
2010/07/02	Scope	The Eurovent classification scheme for Chillers existed already since 2004. There are currently discussions regarding the introduction of A+ and A++ labelling classes in this scheme. Existing Eurovent energy classification scheme's (programmes) are for: Heat Exchangers Rooftops	Eurovent	Further details supplied by Eurovent have been integrated in the reports of Task 1 on air conditioning and ventilation in the part on voluntary agreements.	Oct 2010	AC & V

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		<p>Air Handling Units (AHU)</p> <p>and in preparation for:</p> <p>fan coil units (end this year)</p> <p>filters (end this year)</p>				
2010/07/03	Scope	<p>EPEE therefore regrets the decision made by the Commission to undertake two separate studies on heating and cooling functions; and would have preferred a combined approach as in ENER Lot 10. We clearly request ensuring a good balance of several functions when it comes to defining implementing measures for these products.</p>	EPEE	<p>ENTR lot 6 will study the cooling and secondary heating function of air-conditioners > 12 kW, air-conditioning chillers, terminal units and heat rejection units. NB: A separate ENTR lot 6 briefing on AHU suggests addressing AHU only as ventilation product.</p>		AC
2010/07/03	Definitions	<p>The wording "package air conditioning units" and "package air conditioners" are used in page 24 and page 30. Is the meaning the same for the two wordings? If it is the same meaning, we ask that you please unify the wording. If it is not, we ask that you please clarify the difference.</p>	EPEE	<p>This has been modified in AC Task 1 report Sept 2011, Page 14:</p> <p>"The standard EN15243:2007 uses the wording "Package" air conditioning units for this last category ; nevertheless, package is normally used to distinguish split units from package units (all components on a single mounting) and is thus replaced here by autonomous. Autonomous means which does not require</p>	Oct 2010	AC

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				other components to perform its duty (as terminal units, fans, pumps for all air or water systems)."		
2010/07/03	Definitions	The definition of VRF should also be clearer. It allows individual temperature control of each indoor unit. An outdoor unit has only common connection trunk pipes and not one-to-one connecting pipes.	EPEE	Corrected.	Oct 2010	AC
2010/07/03	Definitions	The performances of the split units depend on the combination of indoor and outdoor units. These are clearly defined in ARI210/240-2008 and JRA4048. These should be indicated in the Task 1 report page 141 and page 147.	EPEE	Corrected.	Oct 2010	AC
2010/07/03	Evaluation of impacts	On page 245, the report says " <i>There are currently installations on the market with a SEER higher than 6.</i> " This value seems to be based on small products like 2.5kW mini-split heat pump. However, beyond 12kW such high efficiency products are not in the market. It is not clear whether such high efficiency value is achievable or not in this size due to restriction of size and noise. Current calculated potential of energy reduction may be overestimating the potential.	EPEE	This is a very first estimate to be refined afterwards in the study.		AC
2010/07/03	Evaluation of impacts	In addition, the estimation is based on average and warmer climate conditions for heating and very rough estimation of units installed in markets are used. It should base average climate for cooling not heating. The current assumption that 65% in warmer climate and 35% in average climate indicated on page 245 may be correct, but more reliable values from the market should be used.	EPEE	This is a very first estimate to be refined afterwards in the study.		AC
2010/07/26	T1.3 national	Regarding the Spanish legislation I have the following comments, all my comments will be referred to Task 1 pages 183 to 186	CARRIER	Corrections integrated in Task 1 report on Spanish legislation.	Oct 2010	AC &

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	legislation Spain	<p>1.- Indoor temperature and humidity:</p> <p>According R.D. 1826/2009, 27th November 2009</p> <p>Winter maximum temperature 21°C when use conventional energy source</p> <p>Summer minimum indoor temperature 26°C</p> <p>Humidity between 30-70 %</p> <p>Attached pdf</p> <p><<BOE-A-2009-19915.pdf>></p> <p>2.- Table 1-100 RITE aeraulic system individual</p> <p>Line 4</p> <p>"Recuperadores de calor" 80 a 190 Pa The correct value is 100 a 260 Pa</p> <p>Enclosed pdf.</p> <p><<A12002-12004.pdf>></p> <p>3.- Page 186 Free Cooling.</p> <p>Due the characterization of this regulation, DX free cooling will be accepted, RITE accept to use new or innovative technologies if the final result is similar.</p>				V
	Task 1, 1 Subtask 1.1	Chillers are included for air-conditioning only. We understand that it was agreed at the ENTR Lot 1 (refrigeration) that Lot 6	MTP	All chillers, except the ones dedicated to refrigeration only	Oct 2010	AC

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	Page 34	<p>would cover ALL water chillers, on the basis that:</p> <ul style="list-style-type: none"> • They are identical units in design and construction and it makes no sense to treat them with two different regulations • They can be used interchangeably <p>The manufacturers often do not know whether a chiller is being sold for air conditioning or other use (e.g. process cooling), rendering the product split between the two EuP Lots artificial with a key risk that the same product group will be treated differently by separate legislation</p>		<p>are included in ENTR LOT 6 study.</p> <p>The following paragraph can be found in the AC Task 1 report of Sept 2011,</p> <p>Page 14:"chillers for air conditioning can be used also for refrigeration. There are four reference temperature levels defined by the industry (Eurovent) for chilled cooling media distribution:</p> <ul style="list-style-type: none"> - air conditioning for cooling floor and other radiant cooling surfaces with leaving chilled water temperature above 20 °C, - air conditioning, with leaving chilled water temperature between + 2°C and + 15°C - medium brine, with leaving brine temperature between + 3°C and - 12°C - low brine, with leaving brine temperature between - 8°C and - 25°C <p>ENTR Lot 6 only considers chillers serving air conditioning temperature levels. Medium and low brine chillers are presently considered in ENTR Lot 1 on refrigeration equipment."</p>		

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				<p>Appropriate recommendations for chillers serving either air conditioning or refrigeration medium temperature should come in Task 7 of this study (as this can be the case for medium brine conditions).</p> <p>The wording has been made clearer in the AC Task 1 report.</p>		
	Task 1, 1 Subtask 1.1 Pages 23 to 24	<p>Cooling is comprehensively dealt with but only occasionally addresses the important function of heating. We note that heating is considered to be covered by other lots (see Comment 17 below) but would welcome a thorough review to confirm that all aspects of heating covered by the equipment in this Lot is indeed covered by the other Lots.</p> <p>In addition, humidification and dehumidification are not well addressed.</p>	MTP Comment 11	<p>ENTR lot 6 will study the cooling and secondary heating function of air-conditioners > 12 kW, air-conditioning chillers, terminal units and heat rejection units.</p> <p>NB: A separate ENTR lot 6 briefing on AHU suggests addressing AHU only as ventilation product.</p>		AC & V
	Task 1, 1 Subtask 1.1 Page 31	Chilled and heated ceilings and floors are omitted from the description of terminal units as encompassing fan coils, cooling beams, and VAV terminals.	MTP Comment 14	ADDED	Oct 2010	AC
	Task 1, 1 Subtask 1.1 Pages 32-33	The discussion of heat rejection omits evaporative coolers. These are often similar to dry air coolers but with additional wetted pads to reduce the temperature of air entering the cooler.	MTP Comment 15	ADDED	Oct 2010	AC
	Task 1, 1 Subtask 1.1 Pages 34-35	The interaction with other ecodesign studies and regulation in cooling generation seems to be comprehensive, but ENER Lots 20 and 21 have not been studied by MTP, and we cannot be certain that all aspects of the heating as regards the general scope of the present ENTR Lot 6 are covered in this review. The Commission's current review of the scope of	MTP Comment 17	See MTP Comment 11.		AC

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		Lots 20 and 21 might also affect this preparatory study.				
	Task 1, 1 Subtask 1.1 Page 35	<p><u>Interaction with other lots – fans, motors, pumps and circulators:</u></p> <p>Regulation 640/2009 covers only AC induction motors. The scope of this Lot 6 may well cover fans and pumps with other types of motor.</p> <p>Regulation 641/2009 only covers glandless circulators with motors of 1 W to 2.5 kW. The equipment covered by this Lot 6 will incorporate many pumps and circulators that are larger than this range and also many that are not glandless. The impending regulation for water pumps might cover some of the glanded circulators. This implies is a much wider scope for this lot 6 than indicated in this section.</p>	MTP Comment 18	<p>Motors and circulators are subject of ENER lot 11 and the mentioned Regulations 640/2009 and 641/2009, not ENTR lot 6.</p> <p>However, ENTR lot 6 will make recommendation in Task 7 for the revision of relevant regulations to study the potential inclusion of these motors and circulators, if appropriate.</p>		AC & V
	Task 1, 1 Subtask 1.1 Pages 36-41	The section dealing with absorption and adsorption chillers (p.41) recognises only gas-fired units. Most units in the UK are supplied by hot water. Steam-heated units also exist. Clarification would be welcome on the proposed treatment of those units, which should not be omitted.	MTP Comment 19	Included	Oct 2010	AC
	Task 1, 2 Subtask 1.2 Pages 69-72	<p>In the description of EN 15242:2007 and EN13465:2004, notes are included within blue boxes in the text of this section indicating that the Study team intend to use this method for some purpose during the study. This gives rise to a concern, that an EuP Lot intended to improve the efficiency of products may move towards requiring calculations of the performance of entire buildings. While this is the current approach favoured in ENER Lot 1 for water-based heating systems, that was dealing with rather simple, domestic buildings rather than the much more complex and varied non-domestic estate.</p> <p>Clarification should be sought on the purpose of the</p>	MTP Comment 21	The system modeling is required to compute the energy consumption of the energy related products. However, the task 7 recommendations will be on (extended) products, following the revised ENER lot 1 approach.		AC

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		modelling proposed and confirmation as to whether any regulation proposed by the study would require whole-building energy calculations.				
	Task 1, 4, Page 198	<p>Significant difference in estimates of UK air conditioning energy consumption compared with those values established in Government Standards.</p> <p>Central air conditioning: 7,313 GWh (Task Report – data unreferenced) and 12,837 GWh (Government Standards, GS)</p> <p>Packaged air conditioning: 9,325 GWh (Task Report – data unreferenced) and 5,474 GWh (GS)</p> <p>However the total GWh value combined are not as dissimilar, which would indicate that a different split between the two categories is being used. Also MTP only addresses the cooling element of Packaged AC, which might explain our lower estimated figure.</p>	MTP Comment 37	The corresponding paragraph has been removed from Task 1 AC.	Oct 2010	AC
	Task 1, 1 Subtask 1.1 Page 34	<p>Products included:</p> <ol style="list-style-type: none"> 1. Air conditioning systems: <ul style="list-style-type: none"> • Cooling Generators <ul style="list-style-type: none"> • Package split and multi-split air conditioner (air to air >12kW, water to air, evaporatively cooled) • Rooftops (air to air) • Variable refrigerant flow (VRF) Systems (Air to air, and water to air) • Chillers for air conditioning application (air to water, water to water, evaporatively cooled) • Renewable cooling (evaporative and desiccant cooling, solar cooling (applicability to be specified), (earth pipes & seawater cooling not included) • Air circulation and air treatment 	MTP	<p>ENTR Lot 6 should issue recommendations in the Task 7 of the study regarding the potential measures to be applied to chillers used for refrigeration.</p> <p>See also MTP comment on Task 1, 1 Subtask 1.1 Page 34 above.</p>		AC

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		<ul style="list-style-type: none"> • AHUs including energy consuming subsystems as air to air heat recovery subsystems as air to air heat recovery air conditioning units • Water circulation – circulators • Terminal units to extract heat from space to be conditioned <ul style="list-style-type: none"> • fan coils, • active ceiling beams, • water to water air to air conditioners • Heat extraction from the cooling system <ul style="list-style-type: none"> • Cooling towers • Dry coolers • Controls to minimise energy consumption of air conditioning systems including Building Energy Management Systems (BEMS) <p>MTP response: Chillers are included for air-conditioning only. We understand that it was agreed at the ENER Lot 1 (refrigeration) that Lot 6 would cover ALL water chillers, on the basis that:</p> <ul style="list-style-type: none"> • They are identical units in design and construction and it makes no sense to treat them with two different regulations • They can be used interchangeably • The manufacturers often do not know whether a chiller is being sold for air conditioning or other use (e.g. process cooling). 				
	Task 1, 1 Subtask 1.1 Page 5	<p>Rooftop/boxed ventilation units rare in most parts of the EU (except UK). Power range 50W to 3kW</p> <ul style="list-style-type: none"> • Below 125W fall into scope of ENER Lot 10 on Domestic ventilation • Fan units >125W inside units are within the scope of ENER Lot 11 (Industrial fans) ventilation 	MTP	The fan regulation may not be sufficient and rooftop/box fans are thus covered by ENTR lot 6. See Ventilation report Task 1 May 2010 on page 6:	May 2010	V

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				“The assessment of the electricity consumption of a fan integrated in a ventilation unit adds several important dimensions, relating to e.g. internal pressure drop of the components, effectiveness in responding to ventilation demand and optimisation of controls in general.”		
	Task 1, 1 Subtask 1.1, Page 5	<p>The motors >750W could at some stage of unit production have been in the scope of Regulation on motors, but – as opposed to the planned fan measures – for integrated direct-drive fan motors there is no obligation for rooftop/boxed fan manufacturers to prove compliance</p> <p>MTP response: Suggested rewording to <i>“the motors >750W could at some stage of unit production be in the scope of Regulation on motors. With regard to the fan measures the fan components (motor plus fan) >125W within rooftop/boxed fans are likely to be required to demonstrate compliance”</i></p>	MTP	The statement will be deleted from the preparatory study (ventilation report task 1), as only the Commission/Market Surveillance Authorities clarify if a product is covered by a product regulation.	Next Task 1 ventilation report edition	V
	Task 1, 1 Subtask 1.1 Page 7 - 8	<p>AHU: No comment in text on cross-over with other EuP lots and regulations. Distinguished from CHR V units because they can be, ‘and in 95% of cases’ are combined with a heating and cooling function.</p> <p>MTP response: This distinction is still vague. What about the other 5%? How are they distinguished from the other categories?</p>	MTP	<p>Cross-over with other legislation has been added since then (marked as “to do” in the first draft). The separate AHU briefing will discuss how to address AHU combined with a heating and cooling function.</p> <p>The “other 5%” are ‘ventilation only’ AHUs that could be equipped with heating or cooling coils in the existing casing/configuration but for some reason are not. See also</p>		V

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				BSRIA definition in the May 2010 ventilation Task 2 report page 18.		
	Task 1, 1 Subtask 1.1 Pages 23 to 24	<p>A review of air conditioning types</p> <ul style="list-style-type: none"> • All-air, based around a central AHU <ul style="list-style-type: none"> • Single duct, single zone • Single duct multi-zone • Variable volume (VAV) • Dual duct (thought to be uncommon in Europe) • Multi-zone (thought to be uncommon in Europe) • Water based systems (in which chilled water is prepared centrally and distributed to terminal units) <ul style="list-style-type: none"> • Includes and AHU and terminal units where air is heated or cooled • Package air conditioners. These provide local cooling of air with ventilation provided centrally. Included package, split and multi-split systems. VRF is a specific type of multi-split unit <ul style="list-style-type: none"> • A rooftop unit is a related product that combines the functions of ventilation and cooling. <p>MTP response: This and the subsequent sections deal well with cooling but only occasionally address the important function of heating. However, see Comment 17 below.</p> <p>Humidification and dehumidification are not well addressed.</p>	MTP	T1 AC report completed with humidification and dehumidification. For heating, see MTP comment 11.	Oct 2010	AC
	Task 1, 1 Subtask 1.1	"AHU"	MTP	The part on AHU was improved in the Sept 2011 Task 1 AC	Oct 2010	AC

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	Page 31	<p>MTP response: This brief description of the cooling functions of an AHU is inadequate. Heating and humidification/dehumidification is not mentioned.</p> <p>An AHU with a DX coil is only occasionally called a rooftop.</p> <p>AHUs sized for cooling only have a higher air flow than would be required for hygienic purposes if they are VAV or dual duct systems. When associated with fan coils and some other terminal units the air flow is only that required for ventilation.</p> <p>No mention here of heat recovery or recirculation.</p>		<p>report, on p 23-26.</p> <p>It is also explained that a rooftop is a type of AHU with an integrated DX cooling system.</p> <p>NB: AHU will be further discussed with stakeholders in a separate briefing on AHU.</p>		
	Task 1, 1 Subtask 1.1 Page 31	<p>'Terminal Units': description of fan coils, cooling beams, VAV terminals.</p> <p>MTP response: Chilled and heated ceilings and floors are omitted.</p>	MTP	Chilled and heated ceilings and floors have been added in the AC Task 1 report of Sept 2011, page 28.	Oct 2010	AC
	Task 1, 1 Subtask 1.1 Pages 32-33	<p>'Heat rejection': review of systems to reject (dispose of) heat from building cooling: dry coolers, wet-dry cooling towers, wet cooling tower.</p> <p>A review of air conditioning types</p> <ul style="list-style-type: none"> • All-air, based around a central AHU <ul style="list-style-type: none"> • Single duct, single zone • Single duct multi-zone • Variable volume (VAV) • Dual duct (thought to be uncommon in Europe) • Multi-zone (thought to be uncommon in Europe) • Water based systems (in which chilled water is prepared centrally and distributed to terminal units) 	MTP	The heat rejection review has been improved in the AC Task 1 report of Sept 2011, page 28 and 29.	Oct 2010	AC

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		<ul style="list-style-type: none"> • Includes and AHU and terminal units where air is heated or cooled • Package air conditioners. These provide local cooling of air with ventilation provided centrally. Included package, split and multi-split systems. VRF is a specific type of multi-split unit • A rooftop unit is a related product that combines the functions of ventilation and cooling. <p>MTP response: Omits discussion of evaporative coolers. These are often similar to dry air coolers but with additional wetted pads to reduce the temperature of air entering the cooler.</p>				
	Task 1, 1 Subtask 1.1 Pages 34-35	<p>Interaction with other Ecodesign studies and regulation: Cooling Generation.</p> <ul style="list-style-type: none"> • Air to air conditioners below 12 kW cooling capacity are covered by ENER Lot 10. This Lot focuses on those above 12kW • Chillers are not included in Lot 10 so there is no lower capacity limit for Lot 6. • Lot 6 considers chillers for air conditioning temperature levels, medium and low brine chillers are considered in ENTR Lot 1. • Most cooling generators are reversible. Heating functions are addressed in: <ul style="list-style-type: none"> • ENER Lot 1 water based heating systems • ENER Lot 20 room air heating products • ENER Lot 21 central heating products using air to distribute heat (other than CHP) • ENER Lot 10 reversible air conditioners with cooling capacity <12kW 	MTP	See MTP comment 11		AC

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		<p>For this reason this study will address these products only in cooling mode.</p> <p>MTP response: This seems to be comprehensive, but ENER Lots 20 and 21 have not been studied by MTP, and we cannot be certain that all aspects of the heating as regards the general scope of the present ENTR Lot 6 are covered in this review.</p>				
	Task 1, 1 Subtask 1.1 Page 35	<p>Interaction with other Ecodesign studies and regulation: Compressors fans and pumps (as quoted):</p> <ul style="list-style-type: none"> • Compressor motors and controls are not the subject of any Ecodesign regulation or study • Fans: <ul style="list-style-type: none"> • Over 125 W are included in ENER Lot 11 • With motors between 750W to 375kW, will have motor efficiency regulated by Commission Regulation 640/2009 • Gaps include motor transmission and control, motors not covered by regulation 640/2009 and fan motor efficiency of motors below 750W • Circulators and pumps: Generally covered by Commission Regulation 641/2009. Any not covered by the above regulation are covered by this ENTR Lot 6 <ul style="list-style-type: none"> • In particular, pumps on primary chiller circuits are excluded from the regulation and are explicitly included here <p>MTP response: Motors: Regulation 640/2009 covers only AC induction motors. The scope of this Lot 6 may well need to cover fans and pumps with other types or motor.</p>	MTP	See MTP comment 18.	Oct 2010	AC & V

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		<p>Fans: Suggested rewording to <i>“for fans with AC induction motors (2, 4 and 6 poles) between 750W and 375kW, motor efficiency is regulated by the Commission Regulation (EC) No 640/2009”</i></p> <p>Pumps and circulators: Regulation 641/2009 only covers glandless circulators with motors of 1 W to 2.5 kW. The equipment covered by this Lot 6 will incorporate many pumps and circulators that are larger than this range and also many that are not glandless. The impending regulation for water pumps might cover some of the glanded circulators. This is a much wider scope than indicated in this section.</p> <p>Suggested rewording to <i>“Glandless circulators are the subject of the Commission Regulation (EC) No 641/2009. Circulators that are not covered by the regulation (EC) no 641/2009 and used in air conditioning systems are in the scope of ENTR Lot 6”</i></p>				
	Task 1, 1 Subtask 1.1 Pages 36-41	<p>Definitions for air conditioning systems (based on EN15243:2007), Cooling generators (based on prEN14511:2009, EN15218:2007 and prEN14825:2009).</p> <p>Definitions for AHU, Circulators, Terminal Units, heat Rejection and Controls are incomplete.</p> <p>MTP response: The section dealing with absorption and adsorption chillers (p.41) recognises only gas-fired units. Most units in the UK are supplied by hot water. Steam-heated units also exist. Clarification would be welcome on the proposed treatment of those units, which should not be omitted.</p>	MTP	See MTP comment 19		
	Task 1, 2 Subtask 1.2 Pages 45-	<p>Measurement and other standards: a thorough review covering:</p> <ul style="list-style-type: none"> The Energy Performance of Buildings Directive 	MTP	The Third Country Standard	Oct 2010	AC &

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	147	<p>(current and the 'recast' Awaiting Council consideration) (p45-46)</p> <ul style="list-style-type: none"> • European Standards – some 29 listed (p47-48) • Many Standards reviewed in depth (p 48-138) • Member State Standards: No Member State standard has been indicated as useful for this study, except for standards relating to building codes. These are reviewed in varying levels of detail in Subtask 1.3 – see following points. 21 onwards (p139) • Third Country Standards (p140-147) <ul style="list-style-type: none"> • Largely incomplete except for a detailed (5 page) review of US ANSI/AHRI 210/240-2008 		description has been reviewed in the AC Task 1 report of Sept 2011.		V
	Task 1, 2 Subtask 1.2 Pages 69-72	<p>Description of EN 15242:2007 and EN13465:2004</p> <p>MTP response: Notes are included within blue boxes in the text of this section indicating that the Study team intend to use this method for some purpose during the study. This gives rise to a concern, that an EuP Lot intended to improve the efficiency of products may move towards requiring calculations of the performance of entire buildings. While this is the current approach favoured in ENTR Lot 1 for water-based heating systems, that was dealing with rather simple, domestic buildings rather than the much more complex and varied non-domestic estate.</p> <p>Clarification should be sought on the purpose of the modelling proposed and confirmation as to whether any regulation proposed by the study will require whole-building energy calculations.</p>	MTP	See MTP comment 21		AC
	Task 1, 3. Subtask 1.3, Page 149	<p>Liquid Chilling Packages (LCP) under Eurovent inclusions:</p> <ul style="list-style-type: none"> - electrically-driven only - those using only refrigerants authorised in the EU 	MTP	Similar values are provided at EU level in Task 2.		AC

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		<p>And participating companies must certify all production models within the scope of the program:</p> <ul style="list-style-type: none"> - Air-cooled chillers <600kW - Water-cooled chillers <1500kW <p>MTP response: Around 10% of air-cooled chillers sold in the UK are >600kW and therefore out of the Eurovent scope</p>				
	Task 1, 4, Page 198	<p>Current estimates for annual energy use by central air-conditioning systems in the UK is 7,313 GWh, which compares to 9,325 GWh for packaged air conditioning.</p> <p>MTP response: Key Outputs from Government Standards suggest corresponding values in 2010 for the UK are 12,837 GWh and 5,474 GWh respectively</p>	MTP	See MTP Comment 37	NEXT T1 and T4 AC EDIT	
	P25	<p>Chillers with natural refrigerants are not covered in this part of the study. In Denmark there is production of ammonia chillers (JCI) and hydrocarbon chillers (JCI and Bundgaard). Many big buildings in Denmark are cooled by ammonia chillers, and this includes the Danish National Hospital in Copenhagen and Copenhagen Airport. There is also production of chillers with natural refrigerants in other countries in the EU. This should be reflected in the report.</p>	DK	Natural refrigerants will appear in Tasks 5 to 7.		AC
	P125	<p>The Danish ban on HFC (for refrigerant charge > 10 kg HFC) should be mentioned. Only chillers with less than 10 kg HFC have been installed in Denmark since January 2007. The Danish tax (at present 100 DKK per tonnes CO₂-eq) should be mentioned.</p>	DK	This has been added in the report.	September 2011	AC
	P124	<p>Shecco assesses that overall the document underplays the role that natural and low Global Warming Potential (GWP) refrigerants such as ammonia and hydrocarbons can play in comfort cooling for buildings. For example, ammonia</p>	SHECCO	Natural refrigerant will appear in Tasks 5 to 7.		AC

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		refrigerant is not listed as an option in the document section regarding refrigerants (page 124). shecco suggests the addition of a reference to ammonia in this section.				
	Page 25	Explanation about semi hermetic compressor is not correct.	JRAIA	This has been corrected in the task report.	Oct 2010	AC
	page 28	Explanation of VRF is not correct.	JRAIA	This has been corrected using ANSI/ASHRAE 1230 2010 standard for VRF.	Oct 2010	AC
	page 28 Figure 1-9	Ceiling mount cassette is right most one. Ceiling hanging unit is named ceiling mounted cassette	JRAIA	This has been corrected.	Oct 2010	AC
	page 147 figure 1-29	Reference is not correct. Triangles are for offices. Circles are for tenant shops. Squares for standalone shops.	JRAIA	This figure has been removed.	Oct 2010	AC
	Clause 1.2.1	Dehumidification is more important than explained in this clause. It determines evaporating temperature that results in limiting EER of equipment. For comfort purpose, dehumidification is mandatory, but excessive dehumidification makes people uncomfortable..	JRAIA	This has been explained in more details in the report.	Oct 2010	AC
	page 22	Desiccant cooling is explained as an alternative to classical air conditioners. However, combination of desiccant cooling with conventional air conditioner can be quite efficient. Please	JRAIA	This has been explained in more details in the report.	Oct 2010	AC

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Answer	Action date	AC Or V
		see following. http://www.daikin.com/csr/environment/production/p24.pdf				

Comments received – Task 2

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
	Task 2, 2. Subtask 2.2, 2.4.2, Fig 2-20 Page 23	There is a difference in chiller capacity between EU member states with UK capacity at 46 W/m ² tertiary floor area, and 18 W/m ² in France. Further discussion on whether chillers are favoured less in some countries would be useful.	MTP	Additional commentary added	Nov 2010	AC
	Task 2, 2. Subtask 2.2, 2.4.3, Page 25	There is a discrepancy between the total cooling capacity sold in the UK according to the Task Report (63 MW) and that implied by work on the Government Standards based on BSRIA Report 50571/13C which gives a total cooling capacity of 26.4 MW from 1,578 rooftop units sold in the UK in 2009.	MTP	Figures corrected	Nov 2010	AC
	Task 2, 2. Subtask 2.2, 2.4.4, Page 26	Sales data for large split and multisplit (>12 kW) systems can be obtained from BSRIA 50571/13B which contains data up to 2008 and forecasts from that point (UK)/	MTP	Now included	Nov 2010	AC
	Task 2, 2. Subtask 2.2, 2.5.1, Page 28	There is a discrepancy between the AHU sales data contained within the Task Report (13,281 units at an average size of 14,169 m ³ /h) and that implied by the Government Standards (13,292 units at an average size of 21,985 m ³ /h) which could be understating the size of the units installed.	MTP	This reflected differences between data sources. The AHU market data was revised, see the ventilation report Task 2.	May 2011	AC
	Task 2, 2. Subtask 2.2, 2.5.1, Page 32	The average Specific Fan Power (SFP) for supply fans cited in the Task Report is 1,916 W/(m ³ /s) which compares with 1,800 W/(m ³ /s) for local supply and extract ventilation system and central mechanical ventilation plant under Building Regulations Approved Document Part L 2010.	MTP	This section has been revised. Default SFP values per AHU categories are dealt with in the ventilation report task 4.	May 2010	AC

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
	Task 2, 2. Subtask 2.2, Page 6	Most AHUs contain cooling or heating coils (or both) and provide more than simple ventilation	MTP	The separate AHU briefing will discuss how to address AHU combined with a heating and cooling function.	Sept 2010	
	Task 2, 2. Subtask 2.2, 2.2.3, Page 9	Forward estimates ignore the impact of the economic downturn as data from 2008 and 2009 have been treated as anomalous. MTP response: Way forward would be to incorporate 2008 and 2009 into a moving average and then forecast based on that.	MTP	It seems better to explicitly account for GDP changes. The growth scenario includes a bounce-back scenario, with 2008 and 2009 below the trend and 2010 back to normal, which is now looking a bit optimistic.		
	Task 2, 2. Subtask 2.2, 2.3.2, Page 13	In UK, sales of active chilled beams are comparable in number and value with fan coils. MTP response: A reference for this statement would be beneficial. This will need to be taken into consideration in terms of technological shift.	MTP	The reference has been expanded (market research reports) on page 16.	Nov 2010	AC
	Task 2, 2. Subtask 2.2, 2.4.2, Fig 2-20 Page 23	UK implied chiller capacity per m ² tertiary floor area is around 46 W/m ² MTP response: This compares with Italy, say, with nearly 80 W/m ² and France with around 18 W/m ² . Is this an anomaly or an indication that chillers are less favoured in some countries?	MTP	This figure has been removed.	Nov 2010	
	Task 2, 2. Subtask 2.2,	EU stock of installed chiller power will rise to 265 GW by 2025 and 291 GW by 2030 MTP response: This seems to be as current trends, ignoring ecodesign	MTP	This is indeed the BAU scenario. A comment has been added accordingly.	Nov 2010	AC

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
	2.4.2, Page 24	improvements				
	Task 2, 2. Subtask 2.2, 2.4.3, Page 25	Total cooling capacity of rooftops sold was 0.7 GW – with 9% in the UK. MTP response: This is equal to 63 MW sold in the UK but no year is given for which the data applies. By comparison, the total cooling capacity of 1,578 rooftop units sold in the UK in 2009 was 27.0 MW (calculation ¹ based on data in BSRIA Report 50571/13C)	MTP	Years have been sourced in the report to enable comparison.	Nov 2010	
	Task 2, 2. Subtask 2.2, 2.5.1, Page 32	Average SFP for supply fans was just under 1,916 W/(m ³ /s) MTP response: This data is valid for Germany only and does not account for penetration of VSDs which may be different in other countries and especially the UK. Average SFP of 1,916 W/(m ³ /s) compares with 1,800 W/(m ³ /s) for local supply and extract ventilation system and central mechanical ventilation plant under Building Regulations Approved Document Part L 2010	MTP	This was indeed a value for Germany. SFP values have been refined by product type in the Task 4 ventilation report on page 11.	Nov 2010	
	Task 2, 2. Subtask 2.2, 2.11.2, Page 45	No data for refurb/replace market for VRF or large (>12 kW) splits. MTP response: Qualitative data exists only from BSRIA Report 50571/13B (page 16) which suggests that “ <i>the [VRF] trend will be away from new build and towards refurbishment projects</i> ” but also caveats this with “ <i>However even the refurbishment sector is struggling as end users are facing more difficulties in obtaining funds for the financing of projects</i> ”	MTP	Now included	Nov 2010	
	Task 2, 2. Subtask 2.2, 2.12.4, Page 47	EU27 AHUs: - 17% cooling only - 13% heating only - 5% ventilation only - 65% combination MTP response: The rest of this section discusses the German AHU market by breakdown in some detail but may not be directly relevant for an understanding of the UK market	MTP	This information is discussed now in annexes of the Task 2 ventilation report.	Nov 2010	

¹ 1,578 rooftop units sold in 7%:93% (<12kW; >12kW, respectively – estimated from data in Table 3.8 BSRIA 50571/13C) ratio with average rated cooling capacity of 5.5kW and 18kW respectively (WSP expert judgment). (1,578 units * 7% * 5.5kW) + (1,578 units * 93% * 18kW) = 27.02 MW.

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V																																																																																																														
	Task 2, 2. Subtask 2.4, 4.3.2, Fig 2-47 Page 54	<p>Average price of chillers in the UK: - <100 kW = ~€180/kW - 100-350 kW = ~€125/kW - >350 kW = ~€75/kW</p> <p>MTP response: The price of water cooled chillers (as a unit) is lower than for air cooled units. Which type are listed here? The report notes that air-cooled chillers are typically 30-40% more expensive than water-cooled chillers (from German data although this is in the right order for the UK).</p>	MTP	More detail now provided in the report	Nov 2010																																																																																																															
	Task 2, 2. Subtask 2.4, 4.3.2, Fig 2-48 Page 55	<p>AHU prices in the UK: - €810/m³/s</p> <p>MTP response: Other countries look cheaper (e.g. Germany at €400/m³/s). Although Task Report acknowledges that a greater proportion of UK-sold units incorporate heat recovery</p>	MTP	More detail now provided in the report	Nov 2010																																																																																																															
	Task 2, 2. Subtask 2.4, 4.3.2, Fig 2-48 Page 55	<p>Assumptions/data used in the construction of the base case for fan types as cited in Task Report 2:</p> <p>Definition of Base cases (source: preparatory study Lot 11)</p> <table border="1"> <thead> <tr> <th>Type of fan</th> <th>Base case size</th> <th>operating hours</th> <th>electricity consumption</th> <th>average efficiency driven fan (static pr.)</th> <th>average purchase price</th> <th>electricity consumption if efficiency =100%</th> <th>installation costs</th> <th>lifetime maintenance costs</th> <th>annual maintenance costs</th> </tr> <tr> <th></th> <th>[kW]</th> <th>[hr/a]</th> <th>[kWh/a]</th> <th>[%]</th> <th>[EUR]</th> <th>[EUR]</th> <th>[EUR]</th> <th>[EUR]</th> <th>[EUR/a]</th> </tr> </thead> <tbody> <tr> <td>Axial<300Pa</td> <td>0,8</td> <td>2.000</td> <td>1.600</td> <td>30,9%</td> <td>450</td> <td>494</td> <td>50</td> <td>90</td> <td>6</td> </tr> <tr> <td>Axial>300Pa</td> <td>1,32</td> <td>2.000</td> <td>2.640</td> <td>37,1%</td> <td>600</td> <td>979</td> <td>50</td> <td>120</td> <td>8</td> </tr> <tr> <td>Centr.FC</td> <td>0,44</td> <td>3.000</td> <td>1.320</td> <td>32,1%</td> <td>750</td> <td>423</td> <td>50</td> <td>150</td> <td>10</td> </tr> <tr> <td>Centr. free/plug</td> <td>3,76</td> <td>3.000</td> <td>11.280</td> <td>56,4%</td> <td>1.400</td> <td>6.360</td> <td>140</td> <td>280</td> <td>19</td> </tr> <tr> <td>Centr.BC</td> <td>3,82</td> <td>3.000</td> <td>11.460</td> <td>53,7%</td> <td>3.000</td> <td>6.155</td> <td>300</td> <td>500</td> <td>33</td> </tr> <tr> <td>Cross-flow</td> <td>0,42</td> <td>1.865</td> <td>783</td> <td>7,3%</td> <td>600</td> <td>57</td> <td>50</td> <td>120</td> <td>8</td> </tr> <tr> <td>Box</td> <td>0,37</td> <td>1.715</td> <td>635</td> <td>23,1%</td> <td>800</td> <td>147</td> <td>80</td> <td>160</td> <td>11</td> </tr> <tr> <td>Roof axial</td> <td>0,9</td> <td>2.520</td> <td>2.268</td> <td>25%</td> <td>1050</td> <td>567</td> <td>140</td> <td>210</td> <td>14</td> </tr> <tr> <td>Roof centr.</td> <td>1,2</td> <td>2.520</td> <td>3.024</td> <td>43,6%</td> <td>1.400</td> <td>1.317</td> <td>140</td> <td>280</td> <td>19</td> </tr> </tbody> </table> <p>MTP response: Fan energy accounts for different proportions of an air conditioning units total energy requirement, depending on the technology. Applying the above data to corresponding PRODCOM product categories</p>	Type of fan	Base case size	operating hours	electricity consumption	average efficiency driven fan (static pr.)	average purchase price	electricity consumption if efficiency =100%	installation costs	lifetime maintenance costs	annual maintenance costs		[kW]	[hr/a]	[kWh/a]	[%]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR/a]	Axial<300Pa	0,8	2.000	1.600	30,9%	450	494	50	90	6	Axial>300Pa	1,32	2.000	2.640	37,1%	600	979	50	120	8	Centr.FC	0,44	3.000	1.320	32,1%	750	423	50	150	10	Centr. free/plug	3,76	3.000	11.280	56,4%	1.400	6.360	140	280	19	Centr.BC	3,82	3.000	11.460	53,7%	3.000	6.155	300	500	33	Cross-flow	0,42	1.865	783	7,3%	600	57	50	120	8	Box	0,37	1.715	635	23,1%	800	147	80	160	11	Roof axial	0,9	2.520	2.268	25%	1050	567	140	210	14	Roof centr.	1,2	2.520	3.024	43,6%	1.400	1.317	140	280	19	MTP	Not feasible with available data		
Type of fan	Base case size	operating hours	electricity consumption	average efficiency driven fan (static pr.)	average purchase price	electricity consumption if efficiency =100%	installation costs	lifetime maintenance costs	annual maintenance costs																																																																																																											
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		will account for a significant proportion of total energy demand. This data will need to be apportioned across the entire air conditioning sector by product type				
	P15	<p>It is mentioned, that the average capacity of sold chillers in Denmark is much smaller than for other countries. It should be mentioned that there is a tradition to use ammonia in bigger chillers, and a ban on HFC for chillers with a refrigerant charge > 10 kg has been in effect in Denmark since January 2007 (see the statutory order: http://www.hfc-fri.dk/_root/media/19348_HFC-bekendtg%F8relsen%20ENG.pdf). The chillers with ammonia and hydrocarbons are not included in the data from Eurovent Certification, and this means that only small chillers sold in Denmark are part of the statistics from Eurovent Certification.</p> <p>It is not totally clear for me, what the energy consumption of the chillers is estimated to be. The 156 GW installed cooling capacity for cooling large buildings inside the EU will probably use something in between 50 and 100 TWh/yr, which is a huge figure?</p>	DK	<p>A note has been added in the AC Task 1, on page 159, paragraph 3.2.</p> <p>Regarding the chiller consumption, this is discussed in the AC Task 4 report.</p>	September 2011	
	P20	<p>Chillers with natural refrigerants should be mentioned in the study. They are not part of the statistics from Eurovent Certification, but a significant number of ammonia chillers and hydrocarbon chillers are produced and installed in many countries.</p> <p>In the future we will probably also see chillers with water vapour compression and chillers with transcritical CO2 cycle. This will of course be discussed in later tasks in the study!</p> <p>The DTI would like to help you to find the relevant information about chillers with natural refrigerants. You are welcome to contact us and we will help you.</p>	DK	Ok, the study team will contact DTI, as appropriate.		

Comments received – Task 3

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
	Task 3, 2.2, Page 17	IAQ Category III (IDA3) is used to constructing ventilation-related legislation in Europe which is based on occupant density (of between 0.63 and 5 l/s/p for different types of building) and may be different in the UK for certain building typologies. In the UK this requirement varies from whole building ventilation rates for offices of 10 l/s/p to 3.5 l/s/p for dwellings as well as other types of rooms requiring ventilation and for other building typologies (Approved Document F (2006): Ventilation).	MTP	This comment can be included as a footnote, but in the preparatory study we are bound to preferably use EN standards like EN 13799 etc,	WHEN EDIT LOG	
	Task 3, 2.3.1, Page 18	Barriers to heat recovery ventilation does not acknowledge that in member states, incentives or other market mechanisms may exist to encourage uptake: for example the UK Enhanced Capital Allowance programme.	MTP	Comment included.	Dec 2010	V
	Task 2 and 3, general comments; Task 1, 3.2 Subtask 1.3.2; Task 2, 2. Subtask 2.2, Page 6; Task 2, 2. Subtask 2.2, Page 6; Task 2, 2. Subtask 2.2, Page 7	Data collected at EU25 or EU27 level with various degree of detail for different member states although it is noted that considerable data is referenced for Germany and Norway. Thus linking this to a UK-specific profile of air conditioning requirements and penetration may yield some errors.	MTP	Regarding air conditioning, best available data have been bought and used in the study. They cover in most cases EU27. Regarding ventilation, best available data was used ; it does not only base upon Germany and Norway.		

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
	Task 3, 2.1, Page 13	<p>Infiltration rates of 0.6 m³/h/m³ building volume identified as the normal standard</p> <p>MTP response: This may be significantly higher in the UK than in Europe. Part L requirement is 10 m³/m²h i.e. at 50 Pa (Approved Document Part L1 (2010), L2; section 5.20, 5.14 respectively)</p>	MTP	There may be some confusion there. First about the units: 0,6 m3/h/m3 at a floor height of e.g. 3-3,5 m comes down to ca. 2 m3/m2h. Second, to the best of our knowledge, the requirement of Part L is a MAXIMUM requirement, probably to be tested with a blower door test at 50 Pa. It is not a MINIMUM requirement or particularly close to a typical average value: it is the very worst case.	Dec 2010	V
	Task 3, 2.2, Page 17	<p>IAQ Category III (IDA3) is used to constructing ventilation-related legislation in Europe.</p> <p>MTP response: This is based on occupant density (of between 0.63 and 5 l/s/p for different types of building) which may be different in the UK for certain building typologies. In the UK this requirement varies from whole building ventilation rates for offices of 10 l/s/p to 3.5 l/s/p for dwellings as well as other types of rooms requiring ventilation and for other building typologies (Approved Document F (2006): Ventilation)</p>	MTP	The values are from EN standards (e.g. EN 13799). Also based on several UK case studies we don't think they are very different from what is common practice in the UK.	Dec 2010	V
	Task 3, 2.3.1, Page 18	Barriers to heat recovery ventilation does not acknowledge that in member states, incentives or other market mechanisms may exist to encourage uptake: for example the UK Enhanced Capital	MTP	OK, under the heading "Drivers" we can add voluntary government measures such as ECA.	Dec 2010	V

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
		<p>Allowance programme</p> <p>MTP response: This is therefore likely to understate the impact of HRV on the air conditioning market. However, in the UK it is noted that HRV penetration is greater as a proportion than in most other EU member states and the mechanisms that facilitate this (such as ECA, for example) should be acknowledged.</p>				
	Task 3, 3.4, Page 28	<p>Average European heating season stated as approx. 5000 hours. Average values have been used for insulation and ventilation rates to determine heat load/ventilation heat losses which may not be appropriate to the UK.</p> <p>MTP response: Suggest use of established UK standards (e.g. Building Regulations Parts F and L) for re-calculation specifically for the UK</p>	MTP	This is a first estimate to be refined in the following tasks.		V
	Task 3, 4, Page 35	<p>Estimation that penetration of central mechanical ventilation across Government buildings in the EU is 15%.</p> <p>MTP response: This figure may be higher for the UK which has a larger share of air conditioning equipment within the tertiary sector</p>	MTP	The estimate is 20% (15% related to other buildings except schools). Anyway it can be mentioned that in the EU15 and especially the UK it may be higher. Useful comment for task 2 and Task 3.	Dec 2010	V
	Task 3, 9.2, Page 63	Anecdotal data for exhaust ventilation is year-round operation at 60% of design capacity. For AHUs the most common control is probably operating at 12h per day at 100% design capacity and 12h per day at 50% design capacity	MTP	True, this is a high estimate (given by Kaup). In new Task 2 this is closer to exhaust ventilation estimates, but still: there are no data..	Dec 2010	V

Date received	Task No. and Page No.	Stakeholder Comment	Source	Study Team Action	Action date	AC Or V
		<p>MTP response: No other corroborating evidence is offered but seems high at 75% although the Task Report also states that building automation systems for gas/humidity/occupancy is relatively rare (<20% of cases)</p>				
	Task 3, Annex II, Page 87	<p>Special ventilation applications have been excluded from the scope and estimated that these account for 1.7% of total ventilation demand in EU</p> <p>MTP response: No examples of special ventilation are given</p>	MTP	Extra Annex (from scope document) has been included in the ventilation Task 3 report of May 2010	Dec 2010	V