Stakeholder consultation
on possible Ecodesign Requirements for DG ENTR Lot 1 Professional Refrigeration:
High temperature industrial process Chillers

Introduction to Questionnaire

This questionnaire on Ecodesign of Refrigeration Process Chillers enables stakeholders to comment on proposals and provide evidence that will assist the commission in preparing for an envisaged future regulation.

See also the following documents:

- Annex 1: Transitional Method For Determination Of The SEPR (Seasonal Energy Performance Ratio) For Chillers Used For Refrigeration And Industrial Applications, Draft of 20 December 2012 (PDF document)
- Annex 2: SEPR calculation spreadsheet tool for Process chillers (Excel spreadsheet, Version 1.5 dated 7 January 2013)
- Annex 3: Summary of supporting evidence (background on product data analysis and justification for thresholds, PDF document)

The latest versions of these documents and more information can be found at: http://www.taitconsulting.co.uk/Ecodesign_Consultation.html

Please submit responses electronically to ecodesign@taitconsulting.co.uk **by 18 March 2013**. Submissions are welcome written into the Word version of the document, or on separate papers.

What is this consultation about?

Possible mandatory requirements applicable to high temperature industrial process chillers (CE-marking). The objective is to collect additional evidence to assess the economic and environmental impacts of the envisaged requirements.

Background

The European commission carried out an impact assessment study during 2012 that looked at possible minimum performance requirements for low-temperature and medium temperature industrial process chillers (also reported at www.taitconsulting.co.uk/Ecodesign_Consultation.html). As part of that 2012 study, only mandatory information requirements were envisaged for high temperature chillers, although evidence was persuasive that minimum performance requirements should be feasible and justified. This possibility featured in consultation questions. The Commission is now able to re-examine the setting of minimum performance requirements for high-temperature chillers as a result of additional evidence being made available. That new evidence is summarised very

briefly in this document along with proposed minimum requirements arising from it. See Annex 3 for more details on the supporting evidence and rationale.

What is the definition of "high-temperature industrial process chiller" for the envisaged Regulation?

a) A 'process chiller' is a factory-built piece of refrigeration equipment which is primarily intended to cool down and maintain the temperature of a liquid (water or brine) using a vapour compression cycle within a refrigeration process, including at least a compressor and an evaporator within a "package".

This includes:

- Refrigeration process chillers sold with an integral condenser, and refrigeration process chillers intended for use with a remote condenser.
- Refrigeration process chillers intended for use with air-cooled or water-cooled condensing.
- Refrigeration process chillers sold with or without the coolant circuit hardware[1].
- Refrigeration process chillers intended for use at high, medium or low operating temperature.
- Refrigeration process chillers of all cooling capacities.

Notes:

i. 'Operating temperature' means the temperature of the **cooled liquid at the outlet of the evaporator** ("temperature of the water or brine leaving the evaporator")
ii. 'Low operating temperature' means that the chillers is intended to function at an operating temperature between -25°C and -8°C with the reference point at -25°C
iii. 'Medium operating temperature' means that the chillers is intended to function at an operating temperature between -12°C and +3°C with the reference point at -8°C
iv. 'High operating temperature' means that the chillers is intended to function at an operating temperature between +2°C and +15°C with the reference point at +7°C

THE FOLLOWING ARE EXCLUDED

- Refrigeration process chillers which are not factory-built units, i.e. are field erected (built in-situ from components purchased separately by the installer)
- Refrigeration process chillers exclusively intended for use with evaporative condensing
- Refrigeration process chillers using absorption technology

b) It is necessary for the purposes of eco-design regulation to distinguish between high-temperature chillers used for air conditioning applications, and high-temperature chillers used for industrial process applications (air conditioning chillers may be covered under planned eco-design regulation under DG ENER Lot 6 – see http://ecohvac.eu/index.html).

High-temperature industrial process chillers meet the above definition **and** are chillers designed to operate the whole year round, including in ambient temperatures below [10°C - exact temperature to be confirmed]. Note that having the functionality for free cooling operation does not on its own qualify a chiller as being "designed for year-round operation".

[1] The coolant circuit hardware is the ancillary equipment designed to drive the refrigerated liquid through the coolant circuit and usually includes a circulation pump and a liquid buffer tank. Refrigeration process chillers sold without the coolant circuit hardware are known as "split chillers" and included into the scope of the present Regulation.

Basic rationale behind the proposal (see Annex 3 for further details)

Available evidence suggests that there is a significant market failure in the EU to deploy efficient technologies that are demonstrably available on the market at investment levels that are easily justified economically. There is a marked contrast with air conditioning chillers in terms of economic viability since typical equivalent full load hours for industrial chillers are around 7500, compared to only 600 hours per year for typical air conditioning chillers. This is a factor of 12.5 higher usage - and 12.5 times annual running costs - for chillers often sold at similar initial investment costs. The market often does not differentiate between products sold for air conditioning and product sold for industrial process. Not only do these have very different annual total usage patterns but process chillers spend most of their time working at 80% or higher loading compared to air conditioning chillers often running at significantly lower loading. If the chiller design is carefully considered, different control and technology approaches would be appropriate for these two situations. Hence substantial carbon savings, cost savings to end-users and increased revenues to manufacturers could be ensured by allowing mandatory minimum requirements to remove poor efficiency products from the market.

The energy consumption of high temperature industrial process chillers justifies their separate consideration under eco-design regulations: The 2012 Impact Assessment estimated that EU high-temperature industrial process chillers account for 89 TWh energy consumption, compared with 39 TWh for combined low and medium temperature industrial process chillers. This compares with 97 TWh/year for air conditioning chillers[2]. Due to typically having 12,5 times the equivalent full load hours per year, the energy savings achievable by high-temperature industrial process chillers are proportionately more than ten times those from air conditioning chillers.

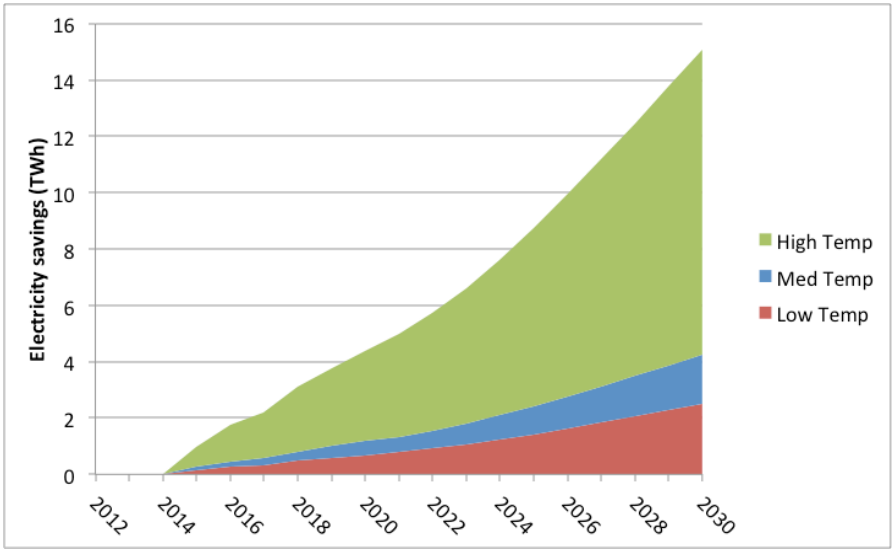

Figure 1. Annual energy savings projected for high, medium and low temperature industrial process chillers, according to data presented in the impact assessment study report.

In the case of high-temperature industrial process chillers, it is appropriate to set more stringent requirements than those envisaged for conventional air conditioning chillers due to their much higher annual usage hours and high loading. Since process chillers generally operate all year

[2] For 2010 the stock of products in scope of DG ENER Lot 6 is estimated to consume 97 TWh/y, including the heating function of reversible air conditioners. From: final report of Task 7, Lot 6: Air-conditioning and ventilation systems, Contract No. ENTR / 2009/ 035/ LOT6/ SI2.549494, ARMINES, version of July 2012, p11.

round (over 7,500 equivalent full load hours per year), a significantly higher investment in energy efficiency measures is cost-effective compared to with air conditioning chillers that operate an average of only 600 equivalent full load hours per year.

The EU market for this equipment has failed to establish a distinction between chillers designed to operate for only part of the year at partial and variable loading (mainly conventional air conditioning applications) and chillers designed to operate at high loading for the whole year (mainly industrial process chillers). This is despite the evident economic justification for such a distinction. The proposed ecodesign regulation aims to address this market failure and establish such a distinction in the market. This will benefit end-users through significant life-cycle cost savings and benefit manufacturers by clarifying the rationale for investment in better products.

ENVISAGED REGULATORY REQUIREMENTS

Once envisaged requirements enter into force, only products complying with the values in the tables below would be allowed to be placed on the EU market.

SEPR is the seasonal energy performance ratio (see explanations below)

Table 1 – Minimum requirements to be met by *air-cooled* process chillers. Medium and low temperature requirements included for reference only.

Operating temperature (°C)	Cooling capacity (kW) At +35°C ambient temperature	Minimum SEPR Tier 1	Minimum SEPR Tier 2
High	<400 kW	4,5	5,0
	>400 kW	5,0	5,5
Medium	*<300 kW*	*2,24*	*2,58*
	>300 kW	*2,80*	*3,22*
Low	*<200 kW*	*1,48*	*1,70*
	>200 kW	*1,60*	*1,84*

Table 2 – Minimum requirements to be met by *water-cooled* process chillers

Operating temperature (°C)	Cooling capacity (kW) At +30°C cooling liquid temperature	Minimum SEPR Tier 1	Minimum SEPR Tier 2
High	<400 kW	6,5	7,0
	>400 & <1000 kW	7,5	8,0
	>1000 kW	8,0	9,0
Medium	*<300 kW*	*2,86*	*3,29*
	>300 kW	*3,80*	*4,37*
Low	*<200 kW*	*1,82*	*2,09*
	>200 kW	*2,10*	*2,42*

For the purposes of discussion under this consultation: Tier 1 is proposed to be introduced 2 years after publication of the regulation; Tier 2 to be introduced 4 years after publication of the regulation.

Mandatory information requirements

One year after publication of the regulation [*assumed date for the purposes of this consultation - date to be confirmed*] the following parameters shall be reported in the product documentation for all refrigeration process chillers (whatever the operating temperature):

- Intended operating temperature(s), expressed in °C
- COP at full load and +35°C ambient temperature (air cooled) / +30°C cooling liquid temperature (water cooled), and corresponding cooling capacity and power input expressed in kW, with rating temperature of test liquid
- SEPR and corresponding cooling capacities and power inputs at all reference points A, B, C and D, expressed in kW, with rating temperature of test liquid
- Declaration of intended use and capability of the unit to operate all year round in the case of industrial process chillers (conversely, a declaration of intended use is proposed to be required for air conditioning chillers)

What is the test method?

- **EN 14511:2011** Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.
- **EN 14825:2012** Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance.

Please be aware that these standards will be updated to:

- allow calculation instead of testing under certain conditions
- include the method for measuring the **SEPR** (Seasonal Energy performance ratio). Please see the transitional SEPR calculation method in **Annex 1**. An SEPR calculation spreadsheet (**Annex 2**) will be available freely on-line for helping SME manufacturers to calculate their SEPR.

What is SEPR?

SEPR is the seasonal energy performance ratio of a chiller. It is calculated from the COP of the unit at four different ambient temperatures and cooling loads, called rating points. The required rating points are specified in Annex 1 (SEPR calculation method), showing for each rating point the necessary part load ratio and air dry bulb temperature for the outdoor heat exchanger. A calculation tool is also provided to help suppliers calculate the SEPR from the 4 rating point measurements. See Annex 2 (SEPR calculation spreadsheet). The spreadsheet then calculates the required SEPR automatically.
NB. The calculation tool is not yet finalised and is provided for guidance only

Useful links:

- ASERCOM http://www.asercom.org/
- EPEE http://www.epeeglobal.org/
- Eurovent CECOMAF http://www.eurovent-association.eu/
- Information on DG ENTR Lot 1 professional refrigeration proposal: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/product-groups/freezing/index_en.htm

High Temperature Industrial Process Chillers Questionnaire

What is your field of activity?

- ☐ Manufacturer of chillers
- ☐ Installer of chillers
- ☐ User of chillers
- ☐ Other industry

  Please indicate: _____
- ☐ NGO
- ☐ National authority

  Please indicate:
- ☐ Consultant or other independent technical expert

  Please indicate:
- ☐ Other

Please indicate: _____

1. In order to estimate the energy savings that could be achieved through regulation, it is necessary to estimate the efficiency of typical products on the market today. The table below shows current estimates. Efficiency is only widely known in terms of ESEER at this time, until SEPR is properly established. ESEER is defined as the European Seasonal Energy Efficiency Ratio, according to Eurovent definition.

AIR COOLED CHILLERS

Temperature range	Capacity range, kW	Assumed Market average capacity for that range, kW	Typical (market average) EER	I agree with typical EER (Y/N/DK)	Best available EER today on the market*	I agree with best available EER (Y/N/DK)	Typical (market average) ESEER	I agree with typical ESEER (Y/N/DK)
High	<100 kW	40	2,7		3,4		3,8	
	>100 & <400 kW	250	2,7		3,5		3.8	
	>400 kW	1000	2,9		3,4		3.9	

*With best available technology, irrespective of price.

Cooling capacities stated at 35°C ambient for air cooled and 30°C for water cooled

Y/N/DK = Yes / No / Don't Know

WATER COOLED CHILLERS

Temperature range	Capacity range, kW	Assumed Market average capacity for that range, kW	Typical (market average) EER	I agree with typical EER (Y/N/DK)	Best available EER today on the market*	I agree with best available EER (Y/N/DK)	Typical (market average) ESEER	I agree with typical ESEER (Y/N/DK)
High	<400 kW	250	4,4		5,6		5,4	
	>400 & <1000 kW	750	4,8		5,9		5,4	
	>1000 kW	1600	4,9		6.3		5,7	

Y/N/DK = Yes / No / Don't Know

2. Please have a look at **Annex 1** explaining the SEPR calculation method. The method is for use by manufacturers to provide comparable information on the energy performance of all chillers placed on the EU market. Therefore, it has to be based on "standardised" use pattern and load profile. Do you agree that the proposed SEPR calculation method is acceptable to assess the energy performance of high temperature chillers over the year?

   ☐Yes

   ☐ No (Please state why and what improvements you suggest):

   _____

   _____

3. The proposed requirements will result in products with lower SEPR being removed from the market. The available evidence suggests that Tier 1 would remove around one third of 2012 products from the market; Tier 2 is more stringent and evidence implies that it would remove around two thirds of 2012 products from the market (but less than that proportion of larger water cooled products).

   a) In your view, what share (in %) of all *process chillers* **CURRENTLY SOLD** on the EU market would ***fail*** to meet the **Tier 1** SEPR requirements?

   ☐ 0%-10% ☐11%-20% ☐21%-40% ☐41%-60% ☐61%-80% ☐Over 81%

   b) In your view, what share (in %) of all *process chillers* **CURRENTLY SOLD** on the EU market would ***fail*** to meet the **Tier 2** SEPR requirements?

   ☐ 0%-10% ☐11%-20% ☐21%-40% ☐41%-60% ☐61%-80% ☐Over 81%

4. In your view, will the requirements affect any sub-segments of the market, or any geographical region much harder than others? (For example any specific type of product, any specific cooling capacity range, disproportionately affect industry in any particular region of Europe). If so, please state which and why.

   _____

   ☐ No

5. Our preliminary assessment is for some positive and some negative impacts on competitiveness / profitability. Do you agree with each statement?

   i. Such a regulation will help ensure that poor performing chillers are less widely available for industrial applications and so place market focus on better performing products. If not, please indicate why
   ☐ Yes ☐ No

   _____

   _____

   ii. The regulation will encourage investment in product development and innovation
   ☐ Yes ☐ No

   iii. There will continue to be an adequate supply of products that meet the requirements, although not at current price levels. If not, please indicate why
   ☐ Yes ☐ No

   _____

   _____

6. Does this summary cover the main impacts of a possible regulation for high temperature industrial process chillers? If there are other important impacts to consider, please mention them here. Indicate which parts of the market are affected and how important the additional impacts are:

   _____

   _____

7. Product definitions: It is proposed that the manufacturers will have to declare, for each model of high temperature chiller which they sell in the EU, whether it is:
   a. Primarily intended for industrial process applications and so designed to operate all year round, or if it is
   b. Primarily intended for conventional cooling-season only air conditioning applications and so designed only to operate during ambient temperatures above [10°C - exact temperature to be confirmed].

   This will determine whether the chiller has to meet the legal requirements applicable to industrial process applications (under the Regulation which is discussed here under DG ENTR Lot 1) or air conditioning applications (under a future Regulation, DG ENER Lot 6), or both. Do you agree that this approach should be workable?
   ☐ Yes ☐ No

   Reasons, if no and any alternative suggestions:

   _____

8. Please indicate any issues that you believe need to be taken into account relating to how industrial process chillers and air-conditioning chillers should be grouped for regulation. Options for regulation include:

   a) grouping high-temperature industrial process chillers with air conditioning chillers and low/medium temperature chillers under a separate regulation (i.e. putting chillers with similar operating temperature ranges under the same regulation);
   b) grouping high-temperature industrial process chillers with low and medium temperature process chillers, and air conditioning chillers under a separate regulation;
   c) grouping all industrial process chillers with air conditioning chillers under the same regulation

   _____
   _____
   _____

9. Do you foresee any significant impact(s) on the profitability of this sector resulting from the proposed requirements?

   ☐ No

   ☐ Yes, and the main ones are: _____

   _____

   _____

Thank you for your valuable input!