CLEAN DEVELOPMENT MECHANISM

CDM-MP72-A02

Information note

Determination of standardized baselines for energy efficient appliances - refrigerators and air conditioners

Version 01.0

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The CDM Executive Board at its 85th meeting (EB 85) considered a concept note on the development of standards with a methodological framework for two specific project types to facilitate the development of standardized baselines and approved the identified sectors, i.e. energy-efficient appliances for residential/household application (e.g. air conditioners, refrigerators) and energy efficiency in buildings.

2. The methdology panel at its seventy-second meeting (MP72) and the small-scale working group at its fifity-third meeting(SSC WG 53) jointy recommended a Draft methodological tool “Tool to determine standardized baseline for energy efficient refrigerators and air conditioners”, as contined in Annex 1 of the MP72 meeting report. The draft tool takes public comments into account.

2. Purpose

3. This document proposes a draft tool (mentioned above) with a methodological framework for the development of standardized baselines (SBs) to cover energy-efficient appliances for residential/household application (i.e. air conditioners, refrigerators). The tool can be used to develop SBs. A SB, before its approval by the Board, needs endorsement from the designated national authority (DNA). Once approved, CDM project developers can apply the SB, provided eligibility criteria of the SB are met. This tool also addresses additionality.

4. Key issues and proposed solutions

3. The proposed draft tool provides framework with options to calculate efficiency metrics such as annual electricity consumption, as well as refrigerant emissions from refrigerators and air conditioners in identified regions, using various data sources, including energy efficiency labels. The variety of options provided aims to facilitate the development of standardized baselines in all eligible countries. The afore-mentioned necessitates considering up to three different sources of data to ensure that the data used is of an acceptable quality. In the event that reliable data is available, even a single source suffices.

4. This document provides an overview of the key elements and data requirements under the proposed draft tool.

5. Impacts

5. Simplified and standardized methods recommended under the draft tool are likely to result in positive impacts on CDM project and programme development, as well as reduce costs of the development of standardized baselines in the RAC sector.

6. The proposed work does not foresee any cost implications for third-parties/stakeholders with no potential for any negative impacts.

6. Recommendations to the Board

7. The Board may wish to consider this document in conjunction with “Draft methodological tool “Tool to determine standardized baseline for energy efficient refrigerators and air conditioners” and “Information note Road-testing of the draft standard: Tool to determine standardized baseline for energy efficient appliances - refrigerators and air-conditioners”, as contained in Annex 1 and 3 of the MP73 meeting report respectively.

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7. Introduction

1. The CDM Executive Board at its 85th meeting (EB 85) considered a concept note on the development of standards with a methodological framework for two specific project types to facilitate the development of standardized baselines and approved the identified sectors, i.e. energy-efficient appliances for residential/household application (e.g. air conditioners, refrigerators) and energy efficiency in buildings.

2. This draft tool was prepared in response to the Board's mandate. Initially, energy efficient appliances were ranked according to the potential for energy savings. Different patterns were observed among Least Developed Countries (LDCs), Small Island Developing States (SIDS), CDM under-represented countries, and the remaining countries:

   (a) In terms of the share of electricity saving potential through appliance efficiency regarding LDCs, SIDS, and under-represented countries, refrigeration (30-55%), lighting (30-40%) and air conditioners (10-20%) ranked high for projections to 2030.[1] Data for Brazil, China, India, Mexico and South Africa, however, showed heterogeneity for the ranking.

   (b) Nevertheless, lighting, air conditioners, refrigerators, fans, televisions, water heaters, and washing machines are considered to have the largest potential for energy efficiency and emission reduction in most countries.[2]

3. Among the above discussed appliances, refrigeration and air conditioning (RAC) equipment, besides energy savings, offer the possibility to reduce emissions due to a reduction in electricity consumption, and/or reduced leakage of refrigerants used in the cooling circuit of the equipment and/or new insulation foam blowing agents.

4. A few methodologies have been approved for RAC applications under the CDM. However, in spite of the huge potential, only a few projects and programmes have been developed using these methodologies. So far, very few manufacturers have used the benchmarks of methodology AM0070 to introduce high efficient refrigerators, and very few utilities applied AMS-II.C and AMS-III.X to expand their incentive programmes to replace old refrigerators. A primary reason appears to be that the respective market information required by these methodologies is too costly to obtain and/or readily available information is unreliable. In addition, many market transformation efforts such as "Top Runner", "Energy Star", and many large Demand-Side Management programmes have not accounted for the greenhouse gas (GHG) impacts. Simplified approaches, similar to the deemed savings approaches introduced for lightbulbs (e.g. as in AMS-II. J) with usage hour averages, are critically absent from the RAC sector.

5. The focus of this tool is, therefore, on RAC equipment with the greatest potential to achieve GHG emission reductions. A standardized baseline may potentially be applied by several players involved in the value chain of RAC manufacture, that is; retail, use, after-sales/service and scrapping/replacement. The draft tool therefore aims to be

[1] SE4All country assessments (<www.se4all.org>).

[2] For instance, potential in China by 2030 is 41% for air conditioners, 18% for refrigerators whereas for Mexico for the same period, potential is 41% for refrigerators, 22% for TVs and 21% for air conditioners. In South Africa the potential is 30% for refrigerators, 30% for water heaters and 20% air conditioners.

exhaustive so as to include all variables that may need to be considered in these different standardized baselines. However, for any given standardized baseline, only some variables may be relevant. The draft tool provides conversions and standardizations so that varied data sources that are available in host countries can be combined for as many stakeholders as possible. In particular, the practice of energy efficiency labelling and the associated data collected can be used to determine market averages of annual electricity consumption, or other efficiency parameters of the appliances.

6. As refrigerant emissions are also important components of this standard, recent developments under the Montreal Protocol (MP) are also reported here. Under the MP, control measures to phase out CFC refrigerants were implemented. Subsequently, the MP has been amended and adjusted to cover the phase-out of over 100 substances, including HCFCs.

7. Recently, the Kigali Amendment aims to address HFC emissions with an estimated potential of emission reduction of 100 billion tonnes CO_2eq[3]. The amendment envisages that by the late 2040's, all countries will consume no more than 15-20 per cent of their respective baseline consumption of HFCs and HCFCs[4]. The need to enhance energy efficiency of cooling equipment is explicitly recognised in the amendment and Technology and Economic Assessment Panel of the MP. They have been tasked to review energy efficiency opportunities in the refrigeration, air-conditioning and heat pump sectors. Incentivising energy efficiency improvements alongside refrigerant transition could significantly increase the climate benefit from the Kigali Amendment. An increase in energy efficiency will also reduce operating costs and stress on energy grids, which would grow significantly, as the world moves towards installing 1.6 billion air-conditioning units by 2050.[5]

8. This draft standard was launched for public input at the 71st meeting of the Methodology Panel, where two inputs were received. The revised draft takes these public comments into account and a detailed assessment of the comments can be found in Appendix #.

8. Purpose

9. This document proposes a draft tool with a methodological framework for the development of standardized baselines (SBs) to cover energy-efficient appliances for residential/household application (i.e. air conditioners, refrigerators). The tool can be used to develop SBs. A SB, before its approval by the Board, needs endorsement from

[3] As per a report by the Lawrence Berkeley National Laboratory (LBNL-1003671).

[4] The Kigali Amendment will enter into force on 1 January 2019, provided that it is ratified by at least 20 parties to the Montreal Protocol. Some A5 parties will freeze HFC growth in 2024 based on 2020-22 levels and achieve a 10 per cent reduction in 2029. A second group of A5 parties will freeze HFC growth in 2028, based on 2024-26 levels, and achieve the first reduction step in 2032. Article III of the Kigali Amendment clarifies that it will not have the effect of excepting HFCs from the scope of the commitments contained in Articles 4 and 12 of the UNFCCC or in Articles 2, 5, 7 and 10 of its Kyoto Protocol. The Kigali Amendment mandates all HCFC-22 producing facilities to collect and destroy HFC-23 by-product from 2020 to the extent practicable (using technology approved by the Parties).

[5] N. Shar, M. Wei, V. Letschert, A. Phadke (2015). Benefits of Leapfrogging to Super-efficiency and Low Global Energy Efficiency Benefits in Implementing Low Global Warming Potential Refrigerants in Room Air Conditioning. Ernest Orlando Lawrence Berkeley National Laboratory. Available at: <http://eetd.lbl.gov/sites/all/files/ lbnl-1003671_0.pdf>.

the designated national authority (DNA). Once approved, CDM project developers can apply the SB, provided eligibility criteria of the SB are met. This tool also addresses additionality.

9. Key issues and proposed solutions

10. This tool provides framework with options to calculate efficiency metrics such as annual electricity consumption, as well as refrigerant emissions from refrigerators and air conditioners in identified regions, using various data sources, including energy efficiency labels. The variety of options provided aims to facilitate the development of standardized baselines in all eligible countries. The afore-mentioned necessitates considering up to three different sources of data to ensure that the data used is of an acceptable quality. In the event that reliable data is available, even a single source suffices.

11. Most countries, including LDCs, have regulations for air conditioners and refrigerators (and many more appliances) that generate sufficient data to calculate the average values of parameters referred to in paragraph 10. Some countries have up-to-date efficiency data of all available air conditioner models which are publicly available online (e.g. China and India), while other countries only issue endorsement labels when manufacturers solicit them. Therefore, this framework includes a variety of calculation options so that the framework is broadly applicable and accommodates different data availability conditions.

12. The following three sources are discussed in this document:

    (a) National Standard & Labelling (S&L) information;

    (b) Commercially available marketing data;

    (c) Data from importers, distributors, and retailers (industry data).

13. All three sources include data for air conditioners and refrigerators based on global test standards, such as the ones from the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). To ensure data comparability, conversion factors for relevant differences between efficiency metrics are also provided in the framework. For example, an overseas manufacturer active in the market in country A, may be selling models identical to those tested in the manufacturer's home country B. Therefore, no new testing is necessary for monitoring and metering purposes when the relevant values from the home country's metric are converted to the country A metric.

14. Two types of SB for electricity consumption can be developed:

    (a) Replacement baseline: When applied on a stand-alone basis, corresponds to project activities removing functioning old refrigerators and replacing them with new high-efficiency refrigerators, thus crediting the avoided continued use of old, functional refrigerators;

    (b) New sales baseline: Set to be, at a minimum, the efficiency of the refrigerator or air-conditioner, which is among the top ten or twenty percent of models on offer in the market. It is calculated based on all models available, or when sales data is available, the sales-weighted model data is used for the calculation, and

credits electricity savings over and above the current efficiency level of sold models.

15. Additionally, a *refrigerant* SB may be developed as a third component. Introducing new efficient models can indicate models with *refrigerants* with a lower global warming potential (GWP) (typically by a factor of 100). A refrigerant baseline reflects the average refrigerant emissions from currently sold refrigerators and air conditioners, and allows emission reductions to be estimated from new models, based on the reduced/avoided release of refrigerants, eligible to be considered in the baseline under the CDM. The Methodology Panel and the Small-Scale Working Group agreed to recommend this component at a future meeting of the panel considering that related work is ongoing in this area in another stream.

16. As can be seen in Figure 1. the S&L database typically contains information for numerous refrigerator or air conditioner models sold in a country (example from Indian BEE[6] on refrigerator models):

Figure 1. Extract of Standard & Labelling database from Bureau of Energy Efficiency in India

S.No	Brand	Model No	Gross Volume (Litres)	Storage Volume (Litres)	Electricity consumption (unit per year)	Approval Date	Valid Till	Star Rating
1	LG	GN-M702HSHM	546	507	400	23-12-2015	31-12-2018	2
2	LG	GC-B519ESQZ	452	398	360	23-12-2015	31-12-2018	2
3	LG	GN-M602HLHM	511	477	404	23-12-2015	31-12-2018	2
4	GODREJ	RD EDGE ZX 195 PDS 5.2	195	188	210	26-02-2015	31-12-2016	5
5	GODREJ	RD EP210 PD 5.1	210	198	203	18-03-2016	31-12-2016	5

17. Usually, the brand, type, model number, Energy Efficiency Ratio (EER), capacity (power rating), annual electricity consumption, validity of test result and efficiency class (1-5 stars) are included. In a mandatory S&L database, all manufacturers and importers are required to report information for all models produced or sold. Typically, a national energy administration maintains the S&L database and verifies the data. Some countries have voluntary S&L databases, containing only information from companies willing to report. In some countries, manufacturers and importers are also required to provide annual sales data so that efficiency data of models can be sales-weighted.

18. The second data source is the commercial marketing data, which is available in most countries from commercial data companies. Marketing data companies use elaborate survey methods, screening all retailers, typically every week or month, collecting model sales numbers, efficiency data and pricing information. This marketing data is usually comprehensive in sales and price coverage, however, the cost of such marketing data

[6] Five randomly extracted brands out of thousands of models in the database for illustration, accessed in October 2016 <www.beestarlabel.com/Home/Searchcompare>.

can be very high. Figure 2. contains an example for three of 1,037 refrigerator models available in a country, sold in 2010:

Figure 2. Extract of a typical marketing data

Model	Brand	First Activity	Net. Liters Total	NoFrost Sy	En.I	Energy Cor	Sales Units	Sales Units
							January 2008 - December	ry 2009 - December
5231 NFY	ARCELIK	September 2009	>400<=450 ltr.	YES	B	657		5,042
BD 4306 ANFE	PROFILO	May 2009	>350<=400 ltr.	YES	A	453		9,133
BK 7121 T	BEKO	July 2008	>100<=150 ltr.	NO	A	235	5,787	15,294

19. The third data source represents industry data, where data from companies selling appliances is directly sourced, including from importers, wholesalers, distributors and retailers. A SB developer may approach all such companies and request data on their sales for previous year or months; In smaller countries with only a few appliance importers and sellers, this may be the pragmatic and feasible option. It requires assuring that commercially sensitive, proprietary information is not revealed. In larger countries, such data may be collected through sampling approaches, applying CDM sampling guidelines.

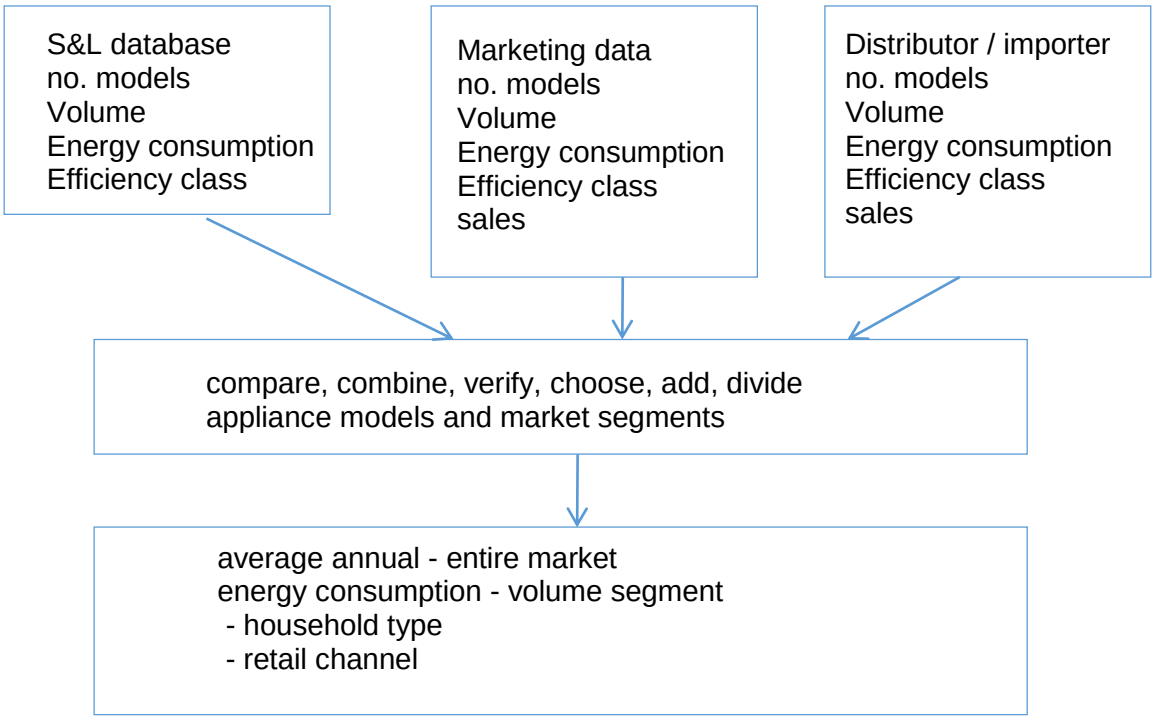
20. How these three data sources are utilised is case specific. When data is complete, that is, all models in a market covered and data is accurate and recent, only one source may suffice. In practice, a SB developer can opt to use the primary data and the data to perform a cross check.

21. Figure 3 below provides a general overview on the application of the data under the proposed tool.

22. The applicability of this tool in many countries is enhanced with conversion factors between test regulations, by conversion factors between efficiency metrics and by conversion factors for efficiency label classes. The tool contains examples of these. Other important information on making efficiency standards comparable can be found on-line. [7]

[7] <mappingandbenchmarking.iea-4e.org> and < superefficient.org>

Figure 3. General overview on the application of data



Appendix 1. Assessment of Public Input Name of submitters: Sandrine Marinhas and Francesco Scuderi

0	1	2	3	4	5	6
#	**Para No./ Annex / Figure / Table**	**Line Number**	**Type of comment** ge = general te = technical ed = editorial	**Comment (including justification for change)**	**Proposed change (including proposed text)**	**Assessment of comment (*to be completed by UNFCCC secretariat*)**
	Input from Eurovent Certita Certification					
1	NA	NA	te	It seems references to European regulations (EU) No 206/2012 and (EU) No 626/2011 regarding definitions and minimum requirements for room air conditioners. These should be added. See <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1471954866669&uri=CELEX:32012R0206> and <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1471954987904&uri=CELEX:32011R0626>	Standards associated with the corresponding EU regulations given above are EN 14511 regarding determination of performances (EER and COP) and EN 14825 for seasonal data (SEER and SCOP) See <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1397827730589&uri=CELEX:52014XC0411>(02)	The framework minimizes citing particular standards in order to be universally applicable. ISO5151 is included. Other than ISO5151 all other mentioning of standards is for illustration purpose only. SB developers are free to choose equivalent national or international standards including the EU standards.
2	NA	NA	te	Role and interest of certification is missing.	Add for example: In the EU air conditioners are certified since the 90's by the accredited body Eurovent Certita Certification, who annually organizes tests in independent laboratories of performance of numerous units per manufacturer. It allows verification of declared performance and rerating of catalogues when failures are detected.	The framework refers to voluntary and mandatory certification in general and introducing specific certification regulations would limit the applicability of the standard. There are differences in quality of certifications and it is the DNA's prerogative to account for these.

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3	16.	(d)	te	Certification of products is defined in ISO 17065. To be verified that assessment made by the laboratories is indeed certification.	…the laboratory ~~certifies~~ assesses the annual electricity consumption ant the Energy Efficiency Index.	Further clarity has been provided in the revised draft standard. .
4	16.	(h)	te	Definition of EER shall refer to ISO 5151 but also to EN 14511 (see comment 1)	~~All~~ EER information refers to a test standard (EN 14511 or ISO 5151)	Referring to ISO 14511 would reduce the applicability of the framework, notably because the calorimeter room method is mandatory. ISO5151 to the contrary is used in all test regulations in air conditioner producing countries. The framework allows to use all tests results from all versions of ISO5151. The latest version of ISO5151 is closer to EN14511 but remains broader.
5	16.	(l)	te	Definition of SEER shall refer EN 14825 (see comment 1)	Add at the end of the §: In the EU ESEER information refers to test standard EN 14825	The framework does not include any preference for a particular SEER definition and Tables 1 and 2 in Appendix 3 have been included to allow converting SEER data from all import sources. The framework follows the SEAD Initiative as the leading international platform for air conditioning standards and policy. The text in 16.l mentions why SEER standards are different and the user of the framework can decide which SEER standard to convert SEER data as in Appendix 3.

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6	16.	Between (j) and (k)	te	Definition of SCOP is missing. It shall refer EN 14825 (see comment 1)	Add before "For example…": Seasonal Coefficient of Performance (SCOP) for air conditioners is derived from the COP by weighing for different part load periods of the year. It is a legally required parameter in Europe, referring to EN 14825, reported in Watt/Watt.	SCOP reflects efficiency during the heating season and is included in S&L in Japan and the EU but not in most other countries. The framework concerns only the cooling season and most air conditioners are used only for cooling. SCOP does not affect the SBs created with this framework.
7	Table 1		ed	Subscript avr,y is not clearly defined		. Comment is taken care of
8	28.	β_L	te	Source of default values of βL is missing.		Comment is taken care of
9	28.	EF_{grid}	ed/te	Definition of EF_{grid} is missing for eq. (7)		Comment is taken care of
10	28.	$EER_{avr,y}$ or $SEER_{avr,y}$	te	It seems there is a misunderstanding of the meaning of SEER Note that hrsyxβL/EERavr,y is "equivalent" to 1/SEERavr,y	Divide in two equations, once with hrsyxβL/EERavr,y, second time with 1/SEERavr,y	Further clarity has been provided in the revised draft standard.

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11	29.		te	EU doesn't use ISO 5151. Accuracy of conversion factors are questionable. It could influence final results by several % if not realistic.	Add: .South Korea, ~~and~~ USA and the EU… Add if available conversion coefficients for the EU data.	The source of the conversion factors is cited in Footnote 12 and is the best available and most recent source from the SEAD initiative. It is correct that neither EU 626/2011, EN14511 nor EN14825 cite ISO 5151, however ISO5151 T1 condition is one of the four-part load conditions in EN14825. More importantly, ISO5151 conditions are in the Japanese, Chinese, Korean, Indian and US test standards. Waide, Rivère and Watson 2011 state that conversions for Chinese, Japanese and Korean indexes are straightforward (p.46) and therefore the conversions are correct for the largest part of the air conditioners in all markets. Further clarity has been provided in the revised draft standard.
12	29.		te	"Equation 7 applies to only EER or only SEER" to be modified according to modifications in eq. (7)		Equation (7) applies when for all air conditioners the EER and the SEER is known. Further clarity has been provided in the revised draft standard.
13	36.		te	EU doesn't use ISO 5151.		See response to comment 11. .

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14	36.		te	Refer to Appendix 3 for conversion between SEER of each country? Accuracy of tables given in Appendix 3 are questionable. It could influence final results by several % if not realistic.		Para 32 and Table 11 refer to Appendix 3. Choosing the accuracy of Tables 1 and 2, one needs to take into account that SEER is calculated from 8, 12, 15 or 24 temperature bins by extrapolating from 2 or 4 measured data points. Since the actual climate conditions in which the air conditioners operate vary, it is not possible to establish which SEER standard is best for a particular SB. The literature on the merits of different SEER standards is not conclusive (for instance that US SEER are not accurate for the Southeast of the US). Waide, Rivère and Watson also used defaults from the EuP Lot 10 study (p.43). Further clarity has been provided in the revised draft standard.

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15	Table 13		te	Modify line regarding “Measurement Procedures” according to modifications suggested above.		SEER is in Measurement Procedures in Table11. Not agreed. The essential aspects of the procedures are given and these can be followed in a particular manner in each case. For instance, SEAD produced a prototype International Database of Efficient Appliances (IDEA) with a toolkit to automatically cross-reference retailer data with government run certification databases (Gerke, McNeil, Tu and Xu at 2016 ACEEE Summer Study). Similar database tools will emerge to speed up the data gathering and information in “Measurement Procedures” encourages this by containing the essentials only.
16	Table 13		ed	I would expect to find in the line “Measurement Procedures” of the table information about the applicable standards.		Agreed. The Measurement Procedures only refer to ISO5151. The framework does not require any other standard.
17	App. 3		te	Accuracy of tables given in Appendix 3 are questionable. It could influence final results by several % if not realistic.		See response comment 11.

0	1	2	3	4	5	6
#	**Para No./ Annex / Figure / Table**	**Line Number**	**Type of comment** ge = general te = technical ed = editorial	**Comment (including justification for change)**	**Proposed change (including proposed text)**	**Assessment of comment (*to be completed by UNFCCC secretariat*)**
	Input from Eurovent Association					
1	NA	NA	te	There is not any reference to the European regulations regarding residential air conditioners: (EU) No 206/2012 and (EU) No 626/2011. It is suggested to add these references		. The Framework seeks to use the least number of standards in order to be realistic in as many countries as possible. In addition to ISO5151 all other standards are mentioned only for illustration, such as in Footnote 13, US, Japan, Korea, China and EU standards. Further clarity has been provided in the revised draft standard.
2	NA	NA	ge	It may be necessary to take into account the recent agreement of Kigali regarding the global phase down of HFCs		Agreed and brief description included in the information note
3	2.1	12	te	This standard covers energy-efficient appliances for residential/household application (i.e. air conditioners, refrigerators). The subject matter, as it is proposed in this draft standard, is too general and it is not clear which product falls and which does not fall within the definition of residential air conditioners. • Are air conditioners with a rated capacity >12 kW (for cooling and/or heating) covered by this standard? • Which is the upper capacity limit? • Are VRF units covered by this standard? It is suggested to better define the products in the scope of this standard.		Further clarity has been provided in the revised draft standard.
4	2.2	14	te	See the above comment 3		

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5	16	(e) (g) (h) (l) (j)	te	The majority of air conditioners are reversible, and used for both cooling and heating functions. Not only the cooling function, but also the heating one should be in the scope of this standard.		The framework can be expanded to cover also the heating period and then COP and SCOP are included in this table 1, but for the present framework heating is not addressed. Further clarity has been provided in the revised draft standard.
6	16	(h)	te	There is not any reference to the related European standards. The definition of EER shall refer also to the EN 14511.	~~All~~ EER information refers to a test standard (EN 14511 or ISO 5151)	ISO5151 is well contained in US test regulations, in Japanese, Chinese, Korean and Indian procedures. The global alignment of standards with ISO5151 is similarly to the alignment with IEC62552 for refrigerators. Because of the spreading of SEER standards with climate variations, the alignment for air conditioner standards is currently diminishing concluded CLASP in "Improving Global Comparability of Appliance Energy Efficiency Standards and Labels" in 2014. Further clarity has been provided in the revised draft standard.
7	16	(i)	te	There is not any reference to the related European standards. The definition of SEER shall refer also to the EN 14825.	The EU's SEER definition reflects average climate conditions in Europe and it refers to the test standard EN 14825, the Indian definition reflects…	Further clarity has been provided in the revised draft standard.
8	16	(i)	te	The SCOP is not defined (see the above comment 5); it shall refer to the EN 14825.	Add: Seasonal Coefficient of Performance (SCOP) for air conditioners is derived from the COP by weighing for different part load periods of the year. It is a legally required parameter in Europe, referring to EN 14825, reported in Watt/Watt.	Further clarity has been provided in the revised draft standard.

0	1	2	3	4	5	6
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9	16	(k)	te	The refrigerant charge should be expressed in kg and not in litre. We suggest to amend accordingly this draft standard		Section to estimate baseline associated with refrigerant emissions is now withdrawn and will be introduced at a future revision.
10	16	(k)	te	The values of GWP differ between different IPCC assessment reports. It should be mentioned which value is used. It should be the same GWP as used in the global phase down of HFCs under the Montreal Protocol		Section to estimate baseline associated with refrigerant emissions is now withdrawn and will be introduced at a future revision.
11	16	(k)	te	HFOs are not used for household /residential air conditioners (they are candidates for large chillers). As for GWP values of HFCs, R-32 represents 675 and R-410A 2088. 5% average leakage rate means 5 units out of 100 need full refilling because of accidents. So, 95% of units do not need refilling to run 10 to 15 years. The refrigerant charge should be expressed in kg and not in litre (see the above comment 9).	Refrigerant - chemicals circulating in a thermodynamic process in refrigeration or air conditioning equipment. GWP of refrigerants currently used vary between 10,000 for CFCs, ~~700-1,900~~ 675-2100 for HFCs and 1-10 of Hydrocarbons. An average household air conditioner contains about one ~~litre~~ kg of refrigerant and an average refrigerator 0.1 ~~litre~~ kg. ~~Refrigerants leak slowly out of the appliance so it needs to be refilled periodically.~~ Air conditioners ~~need this maintenance every one or two years, while~~ and refrigerators leak so little that they run for 10 or 15 years before the refrigerant needs to be refilled; “	Section to estimate baseline associated with refrigerant emissions is now withdrawn and will be introduced at future revision.
12	16	(l)	te	See the above comment 11	Delete “others need to be refilled with refrigerant periodically, some up to 30% refilling per year”	Section to estimate baseline associated with refrigerant emissions is now withdrawn and will be introduced at a future revision.
13	16	Table 1	te	Every reference to COP and SCOP is missing (see the above comment 5)	COP and SCOP to be added	See response to comment 5 above
14	28	Equation 7	ed/te	Definition of EF_{grid} is missing for eq. (7)		Further clarity has been provided in the revised draft standard.
15	28	Equation 7	te	Source of default values of βL is missing		Further clarity has been provided in the revised draft standard.

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#	Para No./ Annex / Figure / Table	Line Number	Type of comment ge = general te = technical ed = editorial	Comment (including justification for change)	Proposed change (including proposed text)	Assessment of comment (*to be completed by UNFCCC secretariat*)
16	28	Equation 7	te	It seems there is a misunderstanding of the meaning of SEER Note that hrs_y x βL/EERavr,y is "equivalent" to 1/SEERavr,y	Divide in (7) in two equations (7.1 and 7.2): $BE_y = \sum_i EF_{grid} \times n_{P,i,y} \times hrs_y \times \beta_L \times \frac{P_{BI,i}}{EER_{avr,y}}$ (7.1) $BE_y = \sum_i EF_{grid} \times n_{P,i,y} \times \frac{P_{BI,i}}{SEER_{avr,y}}$ (7.2)	EER and SEER are ratios in Watt/Watt and both need to be multiplied with annual usage hours and load factors to establish an electricity consumption baseline. Further clarity has been provided in the revised draft standard.
17	28	Equation 7	te	Every reference to COP and SCOP is missing (see the above comment 5)	Introduce two new equation taking into consideration both COP and SCOP	See response to comment 5 above
18	29		te	EU doesn't use ISO 5151. Refers also to EN 14511 Accuracy of conversion factors are questionable. It could influence final results by several % if not realistic.	All national testing standards use ISO 5151 as well as other testing standards (i.e. EN 14511), except the one from South Korea, the EU, and USA with a small variation of in a parameter related to ambient temperature. Add if available conversion coefficients for the EU data.	It is correct that neither EU 626/2011, EN14511 nor EN14825 cite ISO 5151, however ISO5151 T1 condition is one of the four-part load conditions in EN14825. More importantly, ISO5151 conditions are in the Japanese, Chinese, Korean, Indian and US test standards.
19	30		te	Every reference to COP and SCOP is missing (see the above comment 5)		See response to comment 5 above
20	30		te	To be modified accordingly to the above comment 16	(d) COP – Coefficient of performance (e) SCOP - Seasonal Coefficient of Performance (f) FS/V – fixed-speed, inverter (variable speed drive) …	The framework does not reflect the heating usage of air conditioners.
21	34	(d)	te	SCOP to be added (seethe above comment 5)		See response to comment 5 above
22	36		te	EU doesn't use ISO 5151. Refers also to EN 14511 (see the above comment 18)	Refers also to EN 14511	While not citing ISO5151, EN14511 contains elements of ISO5151.

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#	**Para No./ Annex / Figure / Table**	**Line Number**	**Type of comment** ge = general te = technical ed = editorial	**Comment (including justification for change)**	**Proposed change (including proposed text)**	**Assessment of comment (*to be completed by UNFCCC secretariat*)**
23	37		ge	Eurovent Market Intelligence (EMI) (http://www.euroventmarketintelligence.eu) is the European Statistics Office on the HVAC&R market, and provides key market data since 1994. The guiding principle of EMI is to establish a detailed map of the European, Middle-East and African market thanks to the manufacturers' participation in the data collections.	Include Eurovent Marketing Intelligence in the list of Marketing data providers	Further clarity has been provided in the revised draft standard.
24	47		te	Every reference to COP and SCOP is missing (see the above comment 5)	COP and SCOP to be added	As comment 5.
25	48		te	Every reference to COP and SCOP is missing (see the above comment 5)	COP and SCOP to be added	As comment 5.
26	49		te	Every reference to COP and SCOP is missing (see the above comment 5)	COP and SCOP to be added	As comment 5.
27	Parameter table 9		te	Every reference to COP and SCOP is missing (see the above comment 5)	The bL shall be defined also by considering COP and SCOP	As comment 5.
28	Parameter table 10		te	Every reference to COP and SCOP is missing (see the above comment 5)	Heating capacity to be added	As comment 5.
29	Parameter table 11		te	Every reference to COP and SCOP is missing (see the above comment 5)	COPavr,y to be added	As comment 5.
30	Parameter table 11		te	EU doesn't use ISO 5151. Refers also to EN 14511	Modify line regarding "Measurement Procedures" according to modifications suggested above.	While not citing ISO5151, EN14511 contains elements of ISO5151.
31	50	1	ge	Air conditioner replacement seems to be missing completely		To be considered at a future revision of the draft standard.
32	63	4	te	HFC-134a is not used for household/residential air conditioners.	Delete HFC-134a	Section to estimate baseline associated with refrigerant emissions is now withdrawn and will be introduced at a future revision.
33	70	Equation 11	te	Every reference to COP and SCOP is missing (see the above comment 5)	Average heating capacity of air conditioners sold in year y in KW shall be added	

0	1	2	3	4	5	6
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34	73	Equation 13	te	Every reference to COP and SCOP is missing (see the above comment 5)	Average heating capacity of the project air conditioners in KW shall be added	Further clarity has been provided in the revised draft standard.
35	Parameter table 19			Every reference to COP and SCOP is missing (see the above comment 5)	Average heating capacity of air conditioners sold in year y in KW shall be added	
36	Appendix 3		te	Every reference to COP and SCOP is missing (see the above comment 5)		
37	Appendix 3		te	Accuracy of tables given in Appendix 3 are questionable. It could influence final results by several % if not realistic.		Choosing the accuracy of Tables 1 and 2, one needs to take into account that SEER is calculated from 8, 12, 15 or 24 temperature bins by extrapolating from 2 or 4 measured data points. Since the actual climate conditions in which the air conditioners operate vary, it is not possible to establish which SEER standard is best for a particular SB. The literature on the merits of different SEER standards is not conclusive (for instance that US SEER are not accurate for the Southeast of the US). Further clarity has been provided in the revised draft standard.

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Document information

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