UNFCCC	**CDM: Recommendation Form for Small Scale Methodologies (version 01)** ***(To be used for presenting questions/proposals/amendments to the simplified methodologies for small-scale CDM project activity categories)***
Date of SSC WG meeting:	26–29 April 2010, SSC WG 25
Title/Subject (give a small title or specify the subject of your submission, maximum 200 characters):	Expanding the applicability of AMS-III.X
Indicative methodology to which your submission relates (refer the items of Appendix B of the Simplified Modalities and Procedures), if applicable.	AMS-III.X "Energy Efficiency and HFC-134a Recovery in Residential Refrigerators"
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Summary of the query:

Please use the space below to summarize the query related to SSC methodologies/categories SSC Modalities and Procedures provide recommendation/analysis of the SSC WG.

Original text from Stakeholder:

Globally, refrigerators are typically the largest or second largest source of electricity demand in households that have refrigerators, yet not a single refrigerator project has been approved under the CDM to date despite the fact that a number of potentially applicable CDM methodologies have already been approved (e.g., AMS III.X., AMS III.AE, AM0070, AM0071). Both the existing stock of refrigerators (more than 600 million old fridges older than 10 years are still in service) and the new refrigerator market (representing roughly 100 million fridges per year), which is rapidly growing in developing countries, represent a huge lock-in to high electricity consumption. The older fridges can easily consume over 800 kWh/year on average, whereas the most efficient fridges today consume only 20% as much (or even less, in some cases). Even replacing only 30% of the current stock of fridges older than 10 years would result in roughly 115,000 GWh in electricity savings or 70 Mt of carbon dioxide emissions reductions annually (not taking into account reduced technical grid losses, which can exceed 30% in developing countries), assuming a grid emission factor of 600 t CO2/GWh. Furthermore, refrigerators can contain very high-GWP (Global Warming Potential) refrigerants and foam blowing agents, which can be collected and/or avoided altogether. None of the high-GWP gases contained in the refrigerator stock are regulated under the Montreal Protocol; nor are they included in the UNFCCC basket of greenhouse gases (with the exception of the CFC substitute HFC-134a, which only represents a small share of the total). The CDM can fill this regulatory gap.

Whereas refrigerators are taken for granted in the industrialized world, the convenience and health benefits that they provide are not accessible to many poor households – and where they are able to afford a refrigerator, these are often outdated (second-hand), inefficient models in poor working condition, which waste electricity and thus represent a heavy economic burden on household budgets. For this reason, encouraging the development of high-efficiency, low-GWP and no-ODP (Ozone Depleting Potential) refrigerator models suitable for poor households and promoting their rapid dissemination could be a key focus of CDM activities to benefit countries and populations under-represented in the CDM, thereby supporting the CDM priorities set by Parties at COP15. In fact, the CDM Executive Board has already defined "energy for households" as a priority sector for its methodological work (http://cdm.unfccc.int/EB/051/eb51_repan11.pdf), and domestic refrigerators clearly fit under this

heading.

Unfortunately, the existing methodologies that are applicable to refrigerators have limitations that are preventing progress:

- The large-scale, upstream methodology AM0070 cannot be applied in practice, for a number of reasons: (i) the required data are not available in any host country; (ii) the benchmark-setting procedure is too stringent to generate sufficient CERs to cover the transaction costs, let alone to serve as an incentive to invest in even more efficient products; and (iii) assumptions regarding autonomous improvement rates and the related methodological provisions are not sound (details can be provided on request). Furthermore, the methodology cannot be applied to new entrants in host country markets, so it creates an investment and technology transfer barrier.
- The calculation method and monitoring provisions in AMS II.C. are inappropriate for refrigerators, because the algorithms require a "power" rating for refrigerators, which does not exist. A refrigerator is actually a system, including several energy-using devices (compressor, lights, fan, water pump…), so whereas a compressor or light would have a "power" value, the refrigerator itself does not (and whereas the refrigerator operates continuously, compressor or interior light run-times are complex functions). Instead, international testing standards deliver a value for the annual consumption of the fridge, assuming continuous operation of the fridge (but not of its component parts). This is reflected in AMS III.X. – and probably explains why the project developer that submitted SSC_362 indicated a desire to use this approach for a project activity involving refrigerator efficiency rather than AMS II.C. (which specifically mentions refrigeration, but would be very cumbersome, if not impossible, to apply). Similarly, for the new installation market, AMS II.C. requires weighted average market data on the "power" of the baseline refrigerators, and this parameter does not exist in any national or international standard.
- The new methodology AMS III.AE. could theoretically also be an option, but using a whole building simulation model to quantify greenhouse gas emissions reductions from refrigerator replacement programs is a much less exact approach than focusing on the refrigerators themselves, since the plug loads are usually modelled in the aggregate, based on a default value per unit of floor area. Similarly, it would be difficult to separate the signal (impact of refrigerator efficiency improvement on building electricity use) from the noise, when attempting to use the other option included in the methodology, namely constructing a regression line to establish the relationship between building energy use ex post with that of a comparison group of baseline buildings.
- AMS III.X., on the other hand, is specifically for refrigerators, but has narrow applicability conditions, which exclude many worthwhile types of downstream refrigerator project activities.

The proposed revisions seek to expand the applicability of the methodology to a broader range of downstream refrigerator programs. The proposed revision also integrates the specific guidance provided by the SSC WG under the Request for Clarification SSC_327. And it provides provisions on leakage to account for net leakage of non-Kyoto gases and energy embedded in recycled materials.

A succinct justification for each proposed substantive change is provided below. We are happy to elaborate, should the SSC WG need further information.

- Expansion of the scope of applicable technology/measure to make AMS III.X. a comprehensive downstream refrigerator methodology to accommodate:
    - Both refrigerator replacement and new installation activities. Specific provisions for determining the energy baseline in the case of new installation have been added. The basic approach is to select a benchmark efficiency level, based on 4 possible options for establishing the benchmark. Note that Option 4 is based on the approach taken by the ENERGY STAR program to determine the maximum energy usage in kWh/year required for refrigerators to qualify for the voluntary ENERGY STAR label, but includes an automatic efficiency increase in the baseline benchmark level of 1.5%, compounded annually, when applied in countries other than LDCs, so as to encourage rapid action (a detailed justification of this value can be provided). We believe the proposed formula is conservative in most host country settings, based on available data for

refrigerator efficiency in developing countries. In a study for Ghana, the average efficiency of the refrigerator stock in 100 households in the capital city, Accra, was found to be nearly 1140 kWh/y (Van Buskirk et al., 2007), and data for 100 Brazilian refrigerators collected in 2009 showed an average of 871 kWh/y, with over one-quarter of the refrigerators using more than 1000 kWh/y (Grammig et al., 2009). In both cases, "new" refrigerator demand is met to a significant degree by refurbished, rather than newly manufactured units – although data on the energy use of the "new" refrigerator market in developing countries is not readily available. Assuming a typical refrigerator/ freezer, with a fresh volume of 186 l and a freezer volume of 66 l, Option 4 would result in an energy baseline with a default value for SECBL of 742 kWh/y, if the project were launched prior to the end of 2014 (the same project launched in 2019 in a country other than an LDC would have to apply a more stringent value for SECBL of 716 kWh/y). For comparison, as recently as a decade ago, a new refrigerator in Japan used between 690 and 770 kWh/y, and the average consumption of refrigerators shipped in 2000 in the United States was in the same range. In the case of a country like China, which has already acted to promote high-efficiency refrigerators by enforcing a mandatory energy performance standard (MEPS), the proposed Paragraph 8 would ensure that the MEPS could not be circumvented, as this would be detrimental to market transformation. Furthermore, the project proponents would still need to demonstrate that the project activity would be additional.

  - Both replacement programs that seek to credit HFC-134a reductions (with the existing strict recycling requirements in AMS III.X.), as well as those that do not would be allowed. Less stringent recycling requirements have been added for the latter case, but these still go beyond AMS II.C., which does not require recycling at all. These projects will still result in significant reductions in greenhouse gas emissions from refrigerant, but any HFC-134a reductions could not be credited. The fact is that AMS III.X. as currently written cannot be applied in any host country, because it requires state-of-the-art recycling facilities that do not exist outside of Europe (one such facility is currently under construction in Brazil, supported by a grant from the German government). Adding the option of less stringent recycling requirements when HFC-134a is not credited (either because an advanced recycling facility is not available, which is the case in all host countries at this time, or because the old refrigerators taken back under the program do not contain HFC-134a at all, which is difficult to know in advance of program implementation) responds to the issue raised by the project developer in CLA_362. The main reason that energy efficiency and HFC emissions reductions were combined in a single methodology in the first place was because at the time, the modalities for PoA did not allow for application of more than one methodology in combination, hence the integrated methodology. In hindsight, it appears to make a lot of sense to have an integrated downstream refrigerator methodology. Classifying the methodology as Type III, because it contains the HFC option, while still allowing projects that do not exercise this option would seem allowable under CDM rules and procedures. Otherwise, we would need to have a nearly identical methodology (without the HFC option) approved as a Type II methodology, just to accommodate these projects. That cannot be in the interest of administrative economy.
  - The full range of program designs, from refrigerator give-aways under utility DSM programs to rebates for retail purchases. Even in the most advanced industrialized countries, there is a significant stock of inefficient old refrigerators and a large difference in the energy consumption of new models sold (despite mandatory minimum standards being in place) – yet AMS III.X. is currently limited to project activities under which the refrigerators are provided to households at "no or low cost", when programs should be free to tailor incentives to the socio-economic status of the target households (and other factors affecting refrigerator market dynamics). In this way, the most cost-effective programs can be designed. The ex ante survey requirement was therefore removed, because it was too prescriptive and only relevant in the context of one particular baseline situation (of course, nothing prevents PPs from undertaking a survey to obtain data useful for program design purposes or as a basis to demonstrate additionality).

- Removal of restrictive applicability conditions: The current version of AMS III.X. contains a number of applicability conditions that in our view unnecessarily restrict the types of programs that can be implemented, and we request to have these deleted:

- Restriction that any refrigerators replaced must be replaced by project refrigerators within the first year. Many refrigerator programs last more than one year, so this provision would require PPs to set up discrete project activities (or CPAs) for each year of their program, which would exacerbate DOE bottlenecks and increase transaction costs, without any added value in terms of environmental integrity. Such a provision is inconsistent with methodologies for other types of SSC projects – and we do not understand the rational for it.
- Restriction to direct installation. This requirement precludes many types of effective refrigerator schemes that use normal retail channels for selling high-efficiency fridges (e.g., instant rebates at the point of sale; bounty on surrender of old fridges, with proof-of-purchase of new high-efficiency fridge). Such a provision is overly restrictive and inconsistent with methodologies for other types of SSC projects.
- Ex ante specification of only one very specific baseline scenario (and related requirements), when many other scenarios are possible. Again, this is inconsistent with most other SSC methodologies, which allow any baseline scenario (or do not even mention the baseline scenario), as long as the project activity is consistent with the definition of the technology/measure and the proposed project complies with the general SSC additionality provisions included in Attachment A to Appendix B of 4/CMP.1 Annex II. We seek to expand the applicability of the methodology to a much wider range of baseline situations and project designs.
- Requirement that project refrigerators must be offered at no or low cost to the refrigerator's owner and/or end-user. At current prices, CER revenues do not come close to covering the full capital cost of the efficient refrigerators, in addition to transaction costs and operating expenses. The underlying project on which the methodology was based was a utility DSM program in Brazil that gave refrigerators away to low-income favela residents for free. This is a very specific case, which relied on the ability of the utilities to recapture the capital cost of the refrigerators via legal electricity connections and associated revenues. In many other refrigerator programs, the goal is to create a large enough financial incentive to get the buyer to select a typically more expensive high-efficiency refrigerator over a less efficient model (whether they are purchasing a new refrigerator or replacing their existing refrigerator at end-of-life or on a discretionary basis). This can be done without giving refrigerators away for free or nearly free, and in most cases, project developers don't have the luxury of doing so.

- Removing the limitation on CERs from avoided HFC-134a emissions, which are currently capped at 15% of the total emissions reductions in any given year of the crediting period. This provision was added by the CDM Executive Board during the meeting at which the methodology was approved, and there have been a series of queries and exchanges with the Board and SSC WG about this since (full documentation can be provided on request). Following subsequent discussions with the UNFCCC secretariat, we still maintain that there is no rational methodological basis for this provision, which results in an arbitrary situation where less HFC-134a can be credited in countries with low grid emission factors and more in countries with high grid emission factors, all other things held equal. There appears to have been a misunderstanding, reflected in written communications with the SSC WG and EB, that the methodology seeks to credit fugitive emissions during the operational phase of the refrigerator – but this is not the case. It merely conservatively credits the remaining single charge of HFC-134a, when this is actually collected from a baseline refrigerator (not all refrigerators contain HFC-134a, which is a CFC substitute), since the HFC-134a must be collected and handled according to the most stringent industry voluntary standard (the WEEE standard) – which even requires the construction of global state-of-the-art recycling facilities in order to be able to comply – and the project refrigerators are not allowed to contain this substance.
- As pointed out by the Montreal Protocol Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee in its latest assessment (ROTC, 2006), total emissions from refrigerators are dominated by end-of-life emissions – and there is little economic justification for recovering refrigerant, let alone foam blowing agent, at end-of-life: "The small amount of refrigerant charge present in domestic refrigerators – typically 50 to 250 grams with up to 500 grams present in some

older units – combined with geographically disperse service and disposal needs, constrains commercial incentives to promote recovery and recycling." Hence, AMS III.X. is one of the few means of providing a positive incentive to address greenhouse gas emissions from the domestic refrigeration refrigerant bank, which according to the ROTC "will be a topic of consideration for more than 20 years into the future." We understand that industrial gases are a sensitive topic for the CDM Executive Board, but HFC-134a is a household gas, which faces specific abatement costs that are a factor of 1000 higher than for HFC-23, so the support of the CDM is clearly needed. Otherwise project economics do not work out, and there is no incentive to construct advanced recycling facilities.

- Proper treatment of leakage emissions associated with high-GWP ozone-depleting substances (ODSs): The methodology currently does not account for leakage emissions, although refrigerants and foam blowing agent can be high-GWP gases. HFC-134a is included within the project boundary, since this substance is one of the GHGs regulated under the Kyoto Protocol, but non-Kyoto gases need to be treated as leakage. In the past, the SSC WG and CDM EB have ruled that non-Kyoto ODSs should be treated as leakage, and we propose to address leakage in AMS III.X. in a way that is consistent with the "Glossary of CDM terms" (Version 05), which defines leakage as "the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity". The stocks of these gases in refrigerators are not regulated directly by either the Montreal Protocol or the Kyoto Protocol, but clearly represent a significant source of net leakage – and the CDM is the only means to facilitate collection of these stocks of strong GHGs within an existing regulatory framework. In parallel, it should be noted that voluntary standards have developed guidance (Voluntary Carbon Standard, www.v-c-s.org) or offset protocols (Climate Action Reserve, www.climateactionreserve.org) to allow issuance of VERs for destruction of ODSs, which, in our opinion, are detrimental to recycling efforts in developing countries and less stringent than the requirements of AMS III.X., which allows for direct tracking of ODS sources from refrigerator exchange programs (refer to the related comments on the CAR protocols submitted during the public consultation process by GTZ-Proklima, the largest bilateral implementing agency under the Multilateral Fund for the Implementation of the Montreal Protocol). We hope the CDM will not miss the opportunity to (i) provide an incentive to address this otherwise unregulated emissions source and (ii) set a high standard for accounting of net leakage impacts of refrigerator ODS stocks to encourage best practices in the carbon market.

- Providing for leakage associated with recycled materials for projects that involve refrigerator replacement. Materials recovered from the refrigerator demanufacturing process can substitute for virgin materials with much higher embedded energy and greenhouse gas emissions (not to mention that recycling avoids metal accumulation in sediment or leaching into groundwater). Virtually all materials that make up a typical refrigerator can be recovered, with steel, non-ferrous metals (aluminum), foam and plastics being the largest fractions by weight. It should be noted that the life cycle inventory of materials in closed loop systems is not dependent upon the source of the material, but on the levels and yields of recycling and the relative impact of the recycling versus the primary route.
  Our proposed approach is to treat these material recycling effects as leakage, as they occur outside of the project boundary. In cases where the base case for end-of-life disposal of refrigerators is recycling, the leakage factor for recycled materials is zero. Otherwise, we propose the use of conservative default values, and limit the consideration to only steel and aluminum (although many other fractions can be reused/recycled – such as poly-urethane foam, glass and copper – which is a simplified, conservative approach). The justification for the default values we propose is as follows:

  - Steel: The default value is based on the extensive life-cycle inventory (LCI) database maintained by the World Steel Association (the IISI Worldwide LCI Database for Steel Industry Products). The methodology, results and interpretation of the LCI study for 2000 were subjected to a critical, third-party review, to ensure that the project was consistent with the ISO14040 standard (full documentation can be provided upon request). Seven of the 10 top steelmaking companies in the world have contributed, and the sites represented account for 16% of the total worldwide crude steel production. According to this database, the global default value for t CO_2 reduced per t steel recycled ("scrap LCI") is 1.51 kg CO_2 per kg of steel.

- Aluminum: Aluminum is also contained in refrigerators, and the energy required to produce aluminum from scrap metal is approximately 5% of that required for primary production. Similar to the approach for steel, the International Aluminum Institute has compiled an ISO-compatible life-cycle inventory for aluminum (IAI, 2007), based on a global survey from 2005. Given that there is a global market for aluminum and that energy sources and technologies do not differ much globally, the global data is a good basis to assess leakage associated with recycled aluminum. According to this database, the global default value for t CO2 reduced per t aluminum recycled is 9.171 t CO2e / t recycled ingot, derived from the difference between the carbon dioxide equivalent emissions associated with producing one ton of primary ingot (9.677 t CO2e, taken from IAI (2007)) and the corresponding emissions from producing one ton of recycled ingot from old scrap, such as refrigerators (0.506 t CO2e, taken from EAA (2008)). Given that metal is lost during the melting process to produce secondary aluminium from scrap, we have applied the high end of the loss range cited by the IAI for consumer durables of 7% (EAA, 2008), resulting in a scrap LCI of roughly 8.53 t CO2e / t scrap aluminum collected at the recycling plant.
  In cases where there is a mix of landfilling and recycling in the baseline, a weighted average default value can be applied, if data are available. Otherwise, we also offer the option of using a default landfilling rate of 50% for projects entering validation through 2015, decreasing by 1% per year from 2016 through 2040 (in other words, a project launched in 2015 would apply a landfilling rate of 50% and a project validated in 2020, a rate of 45%). The recycling rate for home appliances has been estimated at roughly 50% globally (World Steel Association, 2009), with much higher rates in some industrialized countries, such as the USA (67% for major appliances in 2008) or Japan (71% for refrigerators in 2006). A feasible target rate of about 75% is commonly cited – and the proposed default value would reach 75% by 2040.

Incorporation of the ruling of the SSC WG on CLA_327, by replacing the PoA-specific requirements related to monitoring scrapped refrigerators with general monitoring provisions as outlined by the SSC WG that would be applicable to all project activities that involve replacement of old refrigerators.

Recommendation by the SSC WG:
Please use the space below to provide amendments/change (in your expert view, if necessary).

Please refer to paragraph 16 of the meeting report of the SSC WG 25 (http://cdm.unfccc.int/Panels/ssc_wg).

Answer to authors of query by the SSC WG:
Please use the space below to provide answer to the authors of the above query.

The small-scale working group of the CDM Executive Board would like to thank the author for the submission and recognizes the large potential for emission reductions from efficient refrigerators and air conditioners within the "energy for households" sector. The SSC WG also recognizes there are limitations to the applicability of the different methodologies that are applicable to refrigerators as well as limitations imposed by the CDM requirement for reliably and conservatively determined CERs.

The SSC WG understands from the submission that the author would propose several changes to AMS-III.X related to broadening the applicability of the methodology and removal of applicability conditions that are considered to be restrictive, and the treatment of leakages. In order to possibly suggest changes to AMS-III.X in a future meeting, the SSC WG would like to see further substantiation for these changes based on proposed projects, preferably explained in a draft PDD. Actual projects provide a context under which the SSC WG can evaluate the tradeoffs between support for project development and a conservative determination of emission reductions. At the same time, the SSC WG would like to respond to some of the issues raised in the request.

- With regards to adding new installation refrigerators to AMS-III.X, the baseline would very much depend on the context of the program under which the efficient refrigerators are being offered. For example, can there be a situation of suppressed demand? Also, the current energy baseline scenario is based on testing the efficiency of the replaced refrigerators by sampling. The SSC WG believes this is an appropriate method for determining the baseline for replacing refrigerators. The query author

suggests expanding the methodology to 'greenfield refrigerators' and suggests several baselines. However, the SSC WG is unclear as to how a Greenfield refrigerator program would work and will not recommend amendments to AMS-III.X until a draft PDD is presented that explains how such a program that does not replace existing refrigerators would: (a) operate, (b) provide refrigerators that are demonstrably better than would be baseline refrigerators, (c) not simply address suppressed demand, and (d) how it would reduce emissions.

- Regarding energy efficiency projects that would not have an HFC reduction component, the SSC WG agreed to state that energy efficiency projects are Type II projects. If a SSC project is submitted under AMS-III.X, but without claiming emission reductions for the HFC component, it would be an energy efficiency project. The SSC WG would then consider recommending to the Executive Board to approve a separate methodology under Type II based on the existing structure of AMS-III.X.
- The SSC WG would favorably consider recommending relaxing the requirement of replacing with efficient refrigerators at no or low cost if other program requirements that meet the same objective can be identified, via a draft or actual PDD.
- Requirement to conclude installations of project refrigerators within the first year is consistent with the approaches of other methodologies requiring one to one replacement of equipment e.g., AMS-II.J for residential lighting retrofit projects. Project proponents may note that the modalities of Program of Activities (PoAs) allow addition of project households on a more continuous basis during the crediting period. In addition rules for bundling of project activities also provide some flexibility in this regard (see clarification SSC_390 recommended for EB approval).
- The SSC WG would also favorably consider recommending relaxing the requirement of direct installation if other program requirements such as a bounty/reward on surrender of old fridges are added, within the context of an actually proposed project activity.
- Pertinent issues related to fugitive emissions of refrigerants from sealed system refrigerators have been explained in response of the SSC WG to SSC_268; estimating the point in time at which these emissions would occur in the baseline situation taking into account for example IPCC default values to determine when these emissions become eligible for claim during the crediting period is an important issue. While a thorough treatment of these complex issue under the SSC methodology framework may not be desirable or feasible having a cap would nevertheless simplify the matter to account for uncertainties and to err on the conservative side.
- As the author points out, the SSC WG and the CDM EB have already ruled out any emission reductions related to non-Kyoto greenhouse gases. It is not within the mandate of the SSC WG to change this.
- Leakage steel (recycling in baseline): AMS-III.AJ defines the framework conditions under which recyclable materials in a landfill can be treated under a CDM project component, project proponents may consider proposing conditions of comparable rigor for AMS-III.X, although the applicability of such additional requirements for a small scale activity may not be appropriate.

Signed by the Chair, Mr. Peer Stiansen
Date: 29/04/2010

Signed by the Vice-Chair, Mr. Hugh Sealy
Date: 29/04/2010

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