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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
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REPORT ON THE MULTILATERAL FUND CLIMATE IMPACT INDICATOR (MCII) (DECISIONS 59/45, 62/62, 63/62, 64/51, 65/48, 66/53 AND 67/32)

Introduction

1. At its 67th meeting, the Executive Committee took decision 67/32 (b) which requested the Secretariat to finalise the development of the MCII for the different sectors as outlined in document UNEP/OzL.Pro/ExCom/67/34 in light of the comments received prior to and during the 67th meeting. The Executive Committee also requested the Secretariat through decision 67/32 (c) to present a fully-developed version of the Multilateral Fund Climate Impact Indicator (MCII) to the Executive Committee no later than its 69th meeting, and to propose options for its further implementation. Further, the Executive Committee requested the Secretariat through decision 67/32 (d) to inform it of the progress made and experience gained in applying the MCII to project submissions no later than its 70th meeting.

2. Prior to this decision, at its 59th meeting, the Executive Committee had requested in decision 59/45 to demonstrate the application of the MCII to a sub-set of project submissions, and to collect further data on the use of the MCII for its consideration. The Executive Committee discussed the resulting document at six consecutive meetings, leading to decision 67/32. During these discussions, Executive Committee members and implementing agencies provided a number of comments, related to principles, features and experience with the use of the MCII, and options for its future use.

Background

3. In document UNEP/OzL.Pro/ExCom/55/47, the Secretariat had presented a "Revised analysis of relevant cost considerations surrounding financing of HCFC phase-out", which also included a section on environmental issues and an annex which described an approach for evaluation of climate relevant emissions during the life cycle of a product containing HCFCs. The Executive Committee, in its decision 55/43, requested the Secretariat to further analyse if such an approach would provide a satisfactory and transparent basis for the prioritization of HCFC phase-out technologies to minimize other impacts on the environment, including on the climate, as originally envisioned in decision XIX/6 of the Nineteenth Meeting of the Parties; this analysis was provided in document UNEP/OzL.Pro/ExCom/57/59.

4. Through decision 57/33 the Executive Committee requested the Secretariat to prepare a document presenting examples of the application. Document UNEP/OzL.Pro/ExCom/59/51 informed the Committee on issues related to the "Prioritization of HCFC phase-out technologies to minimize other impacts on the environment". In this document, the Secretariat provisionally defined the scope of the indicator to be applied to the conversion of manufacturing capacity, its replacement or closures of such capacity and introduced the term "Multilateral Fund Climate Impact Indicator" (MCII). Subsequently, the concept of the MCII has been further developed and broadened. The Secretariat had provided a Microsoft Excel spread sheet tool for calculation of the MCII for the most challenging sectors, namely refrigeration and air conditioning, to Executive Committee members and implementing agencies. Based on these activities, the Executive Committee approved a decision at the 67th meeting as mentioned above.

Characteristics of the fully developed version of the MCII

General characteristics

5. The MCII provides a reliable numerical indication of the climate impact associated with ODS phase-out projects and programmes funded by the Multilateral Fund, much like "ODS phase-out" had been an indicator for the impact of a project on the ozone layer for several years. The MCII aims to be reliable without being too complex, and standardizes the calculations of the climate impact in a way which provides fair and comparable results between alternative technologies. It calculates the climate impact of a conversion project as the difference between the climate impact after and before conversion,

with the climate impact being calculated for the emissions over the product lifetime of both the substance, as well those related to the use of energy for the given application.

Integration into the multi-year agreement database

6. Document UNEP/OzL.Pro/ExCom/67/34 had already advised of the connection between multi-year agreement (MYA) database and the MCII. During the discussion at the 67th meeting, a number of members of the Executive Committee had indicated the intention to use the MCII, *inter alia*, to monitor the impact of the Multilateral Fund's activities on the climate. In order to do so, the climate impact of the different activities needs to be aggregated in a database, for which the existing MYA database provides a suitable basis.

7. The Twenty-fourth Meeting of the Parties, in its decision XXIV/11, requested the Executive Committee to consider the report on the 2012 evaluation of the financial mechanism of the Montreal Protocol as appropriate, in the process of continuously improving the management of the Multilateral Fund. Document UNEP/OzL.Pro/24/Inf.4 of October 2012 contains the "Evaluation of the financial mechanism of the Montreal Protocol: final report". Under the header "Effectiveness of technology transfer", the evaluation recommends to consider systematically tracking technology transfer. The explanation following this recommendation states "Technology selection is not systematically reported in project documentation, nor recorded in any data management system by the MLF. The lack of consistent data on technology source has not impacted results and achievements of the MLF; however, if effectiveness of technology transfer is to be evaluated in the future, a mechanism to systematically record technology selection should be created. This would enable future review of the technologies and substitutes selected for HCFC phase-out".

8. The integration of the MCII in the MYA database and the regular update of the MYA database through reports as part of tranche submissions by implementing agencies, as well as subsequently project completion reports have a number of benefits. It enables the data used for the climate impact calculation to be collected centrally, according to the latest available knowledge, and to track the climate impact of projects funded by the Multilateral Fund. At the same time, the integration leads to reflecting any post-approval changes in technology selection or changes relating to the amount of HCFC phase-out and alternative-technology phase-in. The existing Microsoft Excel tool will be maintained.

Presentation and transparency

9. The comments received prior to and during the 67th meeting regarding the MCII included remarks indicating that presentation and transparency of the MCII needed further improvement. They are related to three different areas:

(a) *Documentation:* The Secretariat is currently substantially updating and expanding the documentation of the MCII, in response to a number of comments received by members of the Executive Committee and implementing agencies. The outcome will be a short, two-page description of the principles of the MCII and a broader technical description including the assumptions and algorithms used. Both are to be downloadable through the internet;

(b) *Data entry*: Transparency and ease of use are being improved by changes of the data entry. These changes take into account comments from agencies indicating uncertainty about the type of data to be entered into the MCII. A particular issue was that the original concept, developed before most of the HCFC phase-out management plans (HPMPs) were submitted, was developed assuming that enterprises produced only a few different but clearly differentiated models, as had been the case during CFC phase-out. However, the subsequent submission of the HPMPs has shown the enterprise structure to be different and therefore, the structure of the available data. In several cases, enterprises adapt most of their products to client's needs, resulting in a large number of models to choose from, of which sometimes only few if any units are actually manufactured. Such enterprises could be found in the sub-sector of larger air-conditioning rooftop units. In other cases, sector plans encompass dozens of enterprises, leading to a very large numbers of different but similar models even if each enterprise produces only a very few of these. For those cases, the Microsoft Excel spread sheet currently used, requiring data entry by model, is a cumbersome tool. However, the underlying algorithm allows for simplified data entry, and the Secretariat is currently developing a data entry concept to share it with implementing agencies for their comments and for final insertion into the MYA database as well as, to the degree possible, the Microsoft Excel spread sheet. This data entry concept also takes into account the requirement to record technology selection (see paragraph 7); and

(c) *Output formats:* The Executive Committee has discussed a number of different meaningful uses for the MCII. The different uses can be addressed in parallel using the same data set and the same interim results, but necessitate a differentiation of output formats. As a consequence, the MCII is currently being expanded to cover a number of different output formats. For the purpose of obtaining an overview of the climate impact of Multilateral Fund activities, a simple and standardized output format is necessary[1]. A second format, developed on the basis of the currently used sheets, will be used for the purpose of providing the Executive Committee with sufficient detail for its decision making[2]. A new format will address the needs of the implementing agencies and enterprises when assessing different technological solutions[3], and a second new format will cover the need of countries through providing data consistent with the formats used for their reporting under the United Nations Framework Convention on Climate Change (UNFCCC)[4]. Finally, interim results of the calculation will be made available to be used as input for other research that governments might wish to undertake.

[1] The output includes: (a) HCFC phased out, (b) amount phased out, (c) alternative technology used, (d) amount of alternative substance(s) used, (e) direct (substance) climate impact, (f) indirect (energy) climate impact; as well as possible changes to (b), (c) and (d) with the related date; and the resulting changes of the MCII in (e) and (f)

[2] As compared to the current presentation of the results of the MCII to the Executive Committee, a new version provides the information in a prioritised way with the most important information and results at the top of the page, followed by critical interim results, input data and statements about the validity of the calculation (e.g. that the MCII is prediction prior to availability of actual data, and thus is indicative only)

[3] Output of future greenhouse gas emission and changes on an annual basis (table for next e.g. 15 years), and information on a per-unit basis (where applicable) for the refrigeration/air conditioning sectors providing emissions and energy consumption

[4] Overview of the projects in the country, with direct and indirect impacts as well as absolute emissions for each project for different years. If the Executive Committee requires doing so, this output could be amended to allow for the calculation of the impact of banning HCFC refrigeration/air conditioning equipment import. These calculations will be accessible for countries through the facility used to report country programme data

Country specific data

10. The Secretariat is currently in the process of reviewing the existing country specific data set, i.e. CO_2 emissions per kWh of electricity generated[5], as well as the weather conditions[6] to be used for the calculation of the MCII, in particular for refrigeration and air conditioning equipment. The Secretariat will make the related data for each country accessible to the respective country using the country programme website as an access point. The respective country can enter into a dialogue with the Secretariat regarding possible changes to the data set, should any country want to see such changes.

Sectors covered

11. The MCII is currently covering the different manufacturing sectors relevant for the phase-out of HCFCs. The servicing sector is presently not included, but can be added subsequently if the Executive Committee wishes to do so and if a relevant modelling approach is available. In this regard, the Secretariat would like to draw the attention of the Executive Committee to the document currently being prepared as a result of decision 68/11, requesting a discussion paper to be prepared for the 70th meeting outlining key issues and considerations involved in further promoting strategies, approaches and technologies to minimize any adverse climate impacts of HCFC phase-out in the refrigeration servicing sector. The Secretariat would also like to refer to the on-going discussion in the Executive Committee on maximising the climate benefits from the phase-out of HCFCs in the refrigeration servicing sector.

Sectors previously not included in the tool

12. The approach for the different sectors which previously had not been fully integrated into the MCII Microsoft Excel is presented below; further remarks on the refrigeration and air conditioning sectors can be found in the next section of this document.

(a) For the use of HCFCs in the solvent and, where applicable, in the process agent sectors it is assumed that all of the related substances are emitted in the same year in which the solvent or process agent had been produced or imported. The model will include a number of replacement technologies and their climate impact. However, in the solvent and process agent sectors alternatives are frequently very specific, consequently, the list of alternatives currently included in the database will need to be expanded, and the data input will provide for specific alternative technologies and their characteristics. For some alternative technologies the use of energy might increase to be entered in the process where the HCFC solvent or process agent is being replaced. The MCII will offer the opportunity to enter related data;

[5] CO_2 emissions per kWh are not a constant number for each country, but vary with the respective use of the different methods to generate electricity in the country during any given year; in addition, values obtained from different sources might or might not include in the calculation losses in electricity generation and distribution. Consequently, information about the CO_2 emissions per kWh for any country is only indicative; nevertheless, the changes are unlikely to influence the result of MCII calculations substantively. To maximise consistency, the Secretariat used a data source where information was available for almost all Article 5 countries for the year 2009, since data for this year was most widely available

[6] The weather data (frequency of occurrence of temperatures, associated mean humidity levels) is using a recent 10-year average of the measurements of weather stations, with one weather station selected for each climate zone in the country. The country-wide data is generated by providing weighted mean, the weighing based on the population estimated to live in each climate zone in the particular country

(b) The use of HCFCs in the fire fighting sector has no impact on the environment related to an increase or decrease in energy consumption. However, the release pattern of fire fighting agents is by their very nature delayed as compared to initial installation. Although this has little relevance for the MCII, it could be relevant for possible calculations of annual emissions for the UNFCCC. The typical emission factors depend very much on the use, and in particular with very high emissions in use of such agents for training purposes, comparatively lower emissions in military uses, followed by mobile and fixed applications. Currently, no pattern is available to clearly classify the applications and allow for emission analysis based on commonly agreed data. The MCII for the fire fighting sector will therefore request an assessment of the annually used amounts, alternative technologies and use pattern, which allows a simplifying calculation of emissions. The MYA database will store and, where applicable, allow an update of the related data, enabling the related impact on the climate to be integrated into the calculations of the overall impact of Multilateral Fund projects;

(c) The Secretariat considered a number of different options in trying to incorporate any changes in energy use related to the application of polyurethane and extruded polystyrene foam, in order to follow closely decision XIX/6 of the Nineteenth Meeting of the Parties. Three approaches are presented below and with related considerations:

(i) The most straight forward approach is to calculate the MCII based on the amount of HCFC used for foam blowing, the amounts of alternative blowing agents used for the same purpose after conversion, and the global warming potential (GWP) of both substances. This approach has so far been used in all climate impact calculations presented to the Executive Committee as part of HPMP submissions;

(ii) Alternatively it is possible to calculate the necessary changes in insulation thickness – and, with that, in blowing agent use - to achieve the same quality of insulation before and after conversion; such an approach had been proposed previously. This approach would use the results of the calculation presented under sub-paragraph (i) above as a basis, and amend it accordingly, to apply to all insulation foam uses. The approach necessitates reliable data on the quality of insulation used for different technologies[7]. This approach would be meaningful for those applications where the insulation thickness is actually varied, but not for other applications[8]. However, applications where insulation thickness is changed as the result of the conversion appears to be in a minority; and

[7] Obtaining a set of typical insulation quality values for both HCFC-blown foam and for foam blown with alternative technologies poses a certain challenge. In particular during time of relatively rapid development of alternatives, as can be seen in the foam sector today, these values are typically very contested between proponents and opponents of alternative technologies, and are frequently under-going change as a result of the continuous development of the exact chemical formulations used to blow foam. New technologies with an inherently lower level of formulation development can be assumed to enter the market with relatively moderate insulation performance but to have substantial improvement potential while established technologies will have often a better insulation performance but less potential for further improvement. The Executive Committee could suggest to the Parties a cooperation between the Multilateral Fund and TEAP for this particular purpose, to have TEAP develop and update regularly related data

[8] The Secretariat considered whether this approach could be a reliable approximation for increased energy consumption also in those cases where the insulation thickness would be maintained. In lieu of energy efficiency data, the MCII would be extended by a component which has some relation to energy consumption. For most alternatives the increase of insulation thickness as compared to HCFC technology would be only a few per cent, while the difference in GWP could be substantial (-90 per cent or more). It turns out that the emissions related to the increase in wall thickness are not a meaningful proxy for the increased energy use, since the dominating factor in the calculation will be the GWP of the alternative substance, not the insulation quality. As long as an insulation material has a very low GWP as compared to HCFC, the calculation of the effect in wall thickness would always provide a negligible change in overall climate impact a result, while with high GWP the opposite would hold true. A substantial change in insulation quality of a low-GWP alternative would therefore produce a smaller energy impact than a minor change in insulation quality of a high-GWP alternative. As a consequence, such an approach would not be a useful indicator for changes in energy consumption

(iii) The MCII incorporates programmes allowing the calculation of the energy consumption of refrigeration systems, in particular, refrigeration equipment insulated with different insulation foams and, hence, the difference in energy related climate impact. Such an approach could be applied to foam insulation of domestic or commercial refrigerators, insulation for walk-in coolers, transport refrigeration and reefers; i.e. in those applications where good insulation values are highly critical and which are meant to operate with a refrigeration system.[9] The Secretariat could implement this option in the changes now undertaken or at a later date if the Executive Committee so wishes[10] and if reliable values for the insulation quality of foams blown with different alternative technologies can be obtained[11]. This approach is only suitable for the above uses, which are not only very sensitive to insulation quality, but are also well described, sufficiently standardized to allow modelling, and are actually needing refrigeration to make up for insulation losses. Parameters for other uses, in particular panels for building insulation, vary too much[12] to allow inclusion in such a model.

At this point in time and based on the above considerations, the Secretariat is including only the approach under sub-paragraph (i) above in the MCII; the Executive Committee might wish to consider whether this should be extended to the approach under sub-paragraph (iii).

Air conditioning and refrigeration sectors

13. The MCII for the air conditioning and refrigeration sectors had been programmed in a Microsoft Excel spread sheet tool and was available for interested members of the Executive Committee and implementing agencies for testing purposes. As a consequence, a number of detailed comments had been received by the Secretariat which formed the basis for a number of changes and improvements currently undertaken. In particular five changes in the technical calculations are being carried out.

(a) The programme foresees the possibility to not only calculate the MCII assuming components of similar quality before and after conversion (baseline calculation), but also to have a separate calculation where the components, in particular the heat exchanger and the compressor, would be improved as compared to the baseline calculation. This functionality will probably be included in the MYA database version only, since that version allows greater flexibility with different options and display possibilities as compared to the Microsoft Excel tool. The results will be available in the different formats (MCII format and formats using annual emission data) in addition to those calculated in case of similar component quality; however, the outcome of the such variations will not be used for the aggregation of the overall climate impact of Multilateral Fund projects;

[9] The data to be entered would need to incorporate type of application, typical inner temperature (cooling/freezing), blowing agent use per unit; from these figures, a sufficiently representative model could be generated

[10] The Secretariat carried out a number of simplified calculations to understand the magnitude of the effect of increased electricity consumption on the climate impact of a refrigerator insulation foam conversion. The results for a change from HCFC-141b blown foam to a pentane-blown foam suggest that from the reduction in climate impact achieved by the conversion will be reduced measurably by the increase in energy consumption; depending on the parameters, these reductions of the positive effect of a low-GWP blowing agent could range from between almost zero for some to above 30 per cent for other cases; the effect is therefore not negligible

[11] See also footnote 7

[12] Parameters in this case would be type of energy used to make up for losses, and the load parameters of the application. Such parameters would be a) air conditioning whether an absorption or compression system is used for cooling, and, if applicable, the heat source for the absorption system; b) heat source used for (space) heating; c) insulation thickness; d) operating parameters like exposure to sunlight, air exchange through door openings and ventilation, internal heat sources, surface of windows, etc.

(b) The calculations will use the additional climate data available (see paragraph 10 above) and take into account the impact of various humidity levels in different climates on the energy consumption of air conditioning equipment;

(c) The calculations will be based not just on thermodynamic properties but also on transport properties[13] to ensure that, in particular, the differences between different technologies in heat exchange and pressure loss are more accurately taken into account;

(d) The current model is extended to include recent alternative technologies[14]; and

(e) Data entry for one largely standardized sub-sector, the room air conditioning sector, will be simplified to allow faster data entry into the MCII.

Status and schedule for full implementation

14. The development for the MCII has been finalised and is being implemented now. A new format for data entry into the MYA database has been developed, using the existing "enterprise data" option and taking into account the needs for the MCII and the changes associated with the results of the evaluation of the financial mechanism (see paragraph 7). This format is currently being documented to be shared with implementing agencies for their comments. As part of the work programme of the Senior Monitoring and Evaluation Officer the MYA database software is currently in the process of being updated to improve user experience, and include the necessary changes. Terms of reference are being developed to update the Microsoft Excel spread sheet software and develop the necessary software to be used on the MYA database server, providing the detailed descriptions necessary on the changes explained above. While the MYA database and, thus, the data collection side will be updated relatively fast, the overall changes in the software (Microsoft Excel and server) are likely to be completely implemented only by September 2013, with the completion of documentation scheduled to follow before the 71st meeting.

15. The implementation of the changes into the MCII and completion of the documentation will enable for review by a wider group of experts. The Secretariat will contact relevant experts to provide such input.

16. The changes in the MYA database will lead to more specific and a wider set of data being available, as well as increase the possibility of generating overall climate impact data. With the discussion of the guidelines for the preparation of HPMP stage II proposals, initiated at this meeting, preparation of such proposals may commence towards the end of the year, in time for the availability of the software. It appears therefore that information regarding the progress made and experience gained in applying the MCII to project submissions beyond what has been reported at the 67th meeting under a similar mandate would best be provided to the 72nd meeting, early in 2014.

[13] The original calculations were using thermodynamic properties of refrigerants (pressure, temperature, enthalpy, entropy, density), which, using certain calculation models, provide a theoretical result, being a good approximation for the energy consumption of the refrigeration cycle. The difference between the theoretical calculations and reality is to a substantial part related to transport properties (heat transfer values, viscosities, etc.); these can lead to an actual refrigeration cycle to have a performance close to the theoretical calculation, or show lower efficiency, depending on the properties of the substance. Consequently, transport properties provide a correction factor to the thermodynamic calculations. While the Secretariat is not foreseeing substantial changes in the results of the MCII because of this particular change, it will provide more meaningful information to manufacturers since the energy efficiency is more precisely estimated; at the same time, it will increase acceptance of the model

[14] This refers specifically to the use of HFC-32 and HFOs as refrigerants. It is also intended to provide a simple model for CO_2, but it is currently unclear whether it is possible to do so with a limited entry data set as it is currently foreseen for the other technologies. The Secretariat is investigating different ways forward, but can currently not forecast the outcome

Options for further implementation of the MCII

17. At the 67th meeting, the Executive Committee had engaged in a number of discussions related to the application of the MCII to different tasks. While a conclusion was not yet reached, it is possible to use the MCII for the different tasks with very minimum changes in the data entered, mainly by varying the presentation of the results; this approach is described in paragraph 9(c). The decision at the 67th meeting requested the Secretariat, inter alia, to propose options for the further implementation of the MCII. Since the last discussion document was presented to the 67th Executive Committee, the Secretariat has not been able to gain any significant new experiences to be in a position to propose options to this meeting as requested. The MCII will be available to implementing agencies and countries in both an online version (through the MYA database) as well as in a Microsoft Excel version for use during the preparation of stage II. Moreover, the MCII will provide a standardisation of the determination of climate impact data for HPMP stage II proposals. This should provide additional insight on how the tool can be used. The Secretariat would like to propose postponing further discussion on the use of the MCII until changes have been implemented, feedback received and the report on experience gained provided to the 72nd meeting early 2014.

Conclusion

18. The development of the MCII has been completed as requested in decision 67/32, and the different changes stemming from comments received prior to and during the 67th meeting as well as observations during the initial use phase are currently being implemented. The majority of the changes are related to expansion to other sectors, improvements in underlying data, documentation, data entry and data output. However, based on previous considerations as well as on the review of the financial mechanism noted by the Meeting of the Parties, the MCII will be centrally located with the MYA database as well as being available as a Microsoft Excel spread sheet. This will allow follow-up of the technology choice and possible changes of technology during implementation of enterprise conversions, as well as aggregation of the climate impact for the Multilateral Fund on a programme base. Countries will be able to interact, through the data base, both with comments related to the base data used as well as with reviewing the data generated for the activities in their country. The first stages of the preparation of the HPMP stage II will allow countries, implementing agencies and the Secretariat to gain experience with the use of the MCII, allowing a reflection of the experience and the opportunity for further improvements.

Recommendation

19. The Executive Committee might wish to consider:

(a) Noting the report on finalisation of the Multilateral Fund Climate Impact Indicator (MCII) provided in document UNEP/OzL.Pro/ExCom/69/34;

(b) Whether to request additional work to be undertaken by the Secretariat beyond that outlined in document UNEP/OzL.Pro/ExCom/69/34;

(c) Requesting the Secretariat to maintain a discussion forum on the MCII, to enable continued and transparent exchanges among implementing agencies, Executive Committee members and the Secretariat on the matter; and

(d) Requesting the Secretariat to provide the next report to the 72nd meeting on progress made and experience gained in applying the MCII to project submissions.

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