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Technical report on the technical analysis of the technical annex to the first biennial update report of Cambodia submitted in accordance with decision 14/CP.19, paragraph 7, on 6 October 2020

Summary

This technical report covers the technical analysis of the technical annex submitted on a voluntary basis, in the context of results-based payments, by Cambodia on 6 October 2020 through its first biennial update report in accordance with decision 14/CP.19. The technical annex provides data and information on the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks, which are activities included in decision 1/CP.16, paragraph 70, and covers the same national territorial forest area as the assessed forest reference level (FRL) proposed by Cambodia in its modified FRL submission of May 2017.

Cambodia reported the results of the implementation of these activities for 2015–2018, which amount to 163,166,240 tonnes of carbon dioxide equivalent and were measured against the assessed FRL of 78,953,951 tonnes of carbon dioxide equivalent per year.

The data and information provided in the technical annex are in overall accordance with the guidelines contained in the annex to decision 14/CP.19. The technical analysis concluded that the data and information provided by Cambodia in the technical annex are transparent and consistent with the assessed FRL established in accordance with decision 1/CP.16, paragraph 71(b), and decision 12/CP.17, section II. This report contains the findings from the technical analysis and a few areas identified for capacity-building and future technical improvement in accordance with decision 14/CP.19, paragraph 14.

Abbreviations and acronyms

AD	activity data
BUR	biennial update report
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
EF	emission factor
FRL	forest reference level
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	land use, land-use change and forestry
MoE	Ministry of Environment
MRV	measurement, reporting and verification
NFI	national forest inventory
NFMS	national forest monitoring system
N_2O	nitrous oxide
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
SEPAL	system for earth observations, data access, processing & analysis for land monitoring
TA	technical analysis
TTE	team of technical experts
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction

A. Introduction

1. This technical report covers the TA of the technical annex provided by Cambodia on 6 October 2020[1] in accordance with decision 14/CP.19, paragraph 7, included in its first BUR, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19. In the technical annex, Cambodia provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes resulting from the implementation of REDD+ activities. The submission of the technical annex is voluntary and in the context of results-based payments in accordance with decision 14/CP.19, paragraph 8. The TA was coordinated by Peter Iversen (secretariat).

2. The TA of the technical annex is part of the international consultation and analysis of BURs referred to in decision 2/CP.17, annex IV, paragraph 4, the objective of which is to increase the transparency of mitigation actions and their effects through analysis by the TTE in consultation with Cambodia and through a facilitative sharing of views, resulting in a separate summary report.[2]

3. Cambodia made its first FRL submission, in accordance with decision 12/CP.17, on 22 May 2017, which was subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. The assessed FRL was included as one of the elements of the technical annex to its first BUR in accordance with the guidelines contained in the annex to decision 14/CP.19. The findings from the technical assessment of the FRL are included in a separate report.[3]

B. Process overview

4. The TA of the first BUR of Cambodia took place from 30 November to 4 December 2020 as a desk analysis[4] and was undertaken by the following TTE drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Ahmad Wafiq Aboelnasr (Egypt), Alexey Vladimirovich Cherednichenko (Kazakhstan), Ricardo Fernandez (European Union), Muhammad Arif Goheer (Pakistan), Maria Ana Gonzalez Casartelli (Argentina), Karin Kindbom (Sweden), Nicolo Macaluso (Canada), Athmane Mehadji (Algeria), Sekai Ngarize (Zimbabwe), Dinh Hung Nguyen (Viet Nam), Marcela Itzel Olguin-Alvarez (Mexico), Orlando Ernesto Rey Santos (Cuba) and Atsushi Sato (Japan). Mr. Sato and Ms. Ngarize were the LULUCF experts who undertook the TA of the technical annex in accordance with decision 14/CP.19, paragraphs 10–13.

5. The TA of the technical annex provided by Cambodia was undertaken in accordance with the procedures contained in decisions 2/CP.17, 14/CP.19 and 20/CP.19. This technical report on the TA was prepared by the LULUCF experts in the TTE in accordance with decision 14/CP.19, paragraph 14.

6. During the TA and subsequent exchanges, the LULUCF experts and Cambodia engaged in technical discussions, and Cambodia provided clarifications in response to the questions raised by the LULUCF experts, in order to reach a common understanding on the identification of the capacity-building needs of the Party and areas for technical improvement.

7. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Cambodia for its review and comments. This technical report

[1] The first version of the technical annex was submitted on 11 September 2020; the modified technical annex was submitted on 6 October 2020 before the TA.

[2] FCCC/SBI/ICA/2020/TASR.1/KHM.

[3] FCCC/TAR/2017/KHM, published on 29 March 2018.

[4] Owing to the circumstances related to the coronavirus disease 2019, the TA of the BUR submitted by Cambodia had to be conducted remotely.

on the TA of the technical annex was prepared in the context of the modified technical annex submission. The LULUCF experts responded to the Party's comments and incorporated them into and finalized this technical report in consultation with Cambodia.

C. Summary of results

8. In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party in accordance with its respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Cambodia, on a voluntary basis, proposed a national FRL covering the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activities are being implemented in Cambodia's national territory. The assessed FRL of Cambodia is 78,953,951 t CO_2 eq/year.

9. The Party's FRL is based on its annual average historical CO_2 emissions and removals associated with reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for the historical reference period of 2006–2014. This FRL aims at assessing results for the historical reference period of 2015–2020. Cambodia reported the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2015–2018, calculated against the FRL, which amount to emission reductions of 35,245,948 t CO_2 eq/year for 2015–2016 and 46,337,172 t CO_2 eq/year for 2017–2018. For the entire period 2015–2018, the emission reduction is 40,791,560 t CO_2 eq annually and 163,166,240 t CO_2 eq in total.

II. Technical analysis of the information reported in the technical annex to the first biennial update report

A. Technical annex

10. For the technical annex to the first BUR submitted by Cambodia, see annex I.[5]

B. Technical analysis

11. The scope of the TA is outlined in decision 14/CP.19, paragraph 11, according to which the TTE shall analyse the extent to which:

(a) There is consistency in the methodologies, definitions, comprehensiveness and information provided between the assessed FRL and the results of the implementation of REDD+ activities;

(b) The data and information provided in the technical annex are transparent, consistent, complete and accurate;

(c) The data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 9;

(d) The results are accurate, to the extent possible.

12. The remainder of this chapter presents the results of the TA of the technical annex to the BUR according to the scope outlined in paragraph 11 above.

[5] In accordance with decision 14/CP.19, para. 14(a).

1. Consistency in the methodologies, definitions, comprehensiveness and information provided between the assessed reference level and the results in the technical annex

13. In accordance with decision 14/CP.19, paragraph 3, the data and information used by Parties for estimating anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes related to REDD+ activities undertaken by them should be transparent and consistent over time and with their established FRL in accordance with decision 1/CP.16, paragraph 71(b–c), and decision 12/CP.17, section II.

14. The LULUCF experts noted that Cambodia ensured overall consistency between its FRL and its estimation of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks in 2015–2018 by:

(a) Using consistent methodologies and data to generate AD using land-use maps and deriving land-use change areas by comparing land-use maps. All land-use maps for 2006, 2010, 2014, 2016 and 2018 were prepared under the same forest monitoring system and using the same stratification of forest type and type of land use or land cover (see para. 17 below for details). The minimum mapping unit was 25 ha in 2006 and 2010 and 5 ha in 2014, 2016 and 2018. As stated in the report on the technical assessment of Cambodia's FRL submitted in 2017,[6] the Party checked and made corrections using higher-resolution satellite imagery to avoid potential misclassification due to changes in the minimum mapping unit over time;

(b) Using consistent methodologies and data to generate EFs, in particular the same stratification of forest type and type of land use or land cover, and the same above- and below-ground biomass carbon stocks for each land stratification;

(c) Including the same two carbon pools: above-ground biomass and below-ground biomass;

(d) Including the same gas: CO_2;

(e) Covering the same area: entire national territory;

(f) Using the same method to calculate emissions and removals: applying the stock difference method by comparing the total carbon stocks of two consecutive land-use or land-cover maps, which implicitly assumes that all carbon stock changes associated with land-use or land-cover change occurred within the time interval from one land-use or land-cover map to the next (i.e. four years for the FRL and two years for the results). This method covers the carbon stock changes from all three activities through carbon losses due to forest land converted to non-forest land (deforestation), carbon losses due to change in forest type (forest degradation) and carbon gains due to change in forest type or land use from non-forest land to forest land (enhancement of forest carbon stocks);

(g) Using the same forest definition as that used in constructing its FRL (excluding rubber plantations, oil palm plantations and perennial crops as forest);

(h) Using the same forest type and land-use change category: excluding emissions and removals associated with land conversions from natural forest to forest plantation.

15. In view of the above, the LULUCF experts concluded that the results presented of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks are consistent with the assessed FRL. The LULUCF experts commend Cambodia for ensuring the consistency of the data and methodologies described in the FRL submission for the historical reference period of 2006–2014 and in the technical annex with the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2015–2018.

[6] FCCC/TAR/2017/KHM, para. 12.

2. Transparency, consistency, completeness and accuracy of the data and information provided in the technical annex

16. The LULUCF experts noted that the technical annex submitted by Cambodia contained most of the required information, but some essential data such as AD (land-use change matrix) for 2016–2018 were not included in the main text or the link provided in the technical annex. As part of the TA process, Cambodia provided additional information, in particular on a land-use change matrix for the result period and a calculation worksheet, and modified the submission to include the link to the information provided. The LULUCF experts commend Cambodia for its efforts to increase the transparency and ensure the completeness[7] of the data and information provided, allowing for the reconstruction of the results.

17. The stratification of land-use or land-cover type and forest type consists of nine natural forest types, two planted forest types, four cropland subcategories, two grassland subcategories, one wetlands subcategory, two settlements subcategories and two other land subcategories. Cambodia established an average above-ground biomass volume per unit of area for all subcategories, which is used to generate EFs in the context of the FRL and its results. The stratification and the established EFs are used for all calculations of emissions and removals for constructing the FRL and estimating the results.

18. The LULUCF experts noted that the AD and parameters are generated and used consistently for constructing the FRL and calculating the results; however, the applied approach listed in paragraph 14(b) and (f) above implicitly has an accuracy problem. See paragraph 35 below for details.

19. The LULUCF experts noted differences in the area of pine plantation in 2014 reported in the FRL submission (3,709 ha), in tables contained in the publication *Cambodia Forest Cover 2016* (3,709 and 3,710 ha) (MoE, 2018) and in the land matrices reported in these two documents (3,743 ha). During the TA process, Cambodia clarified that the value reported in the land matrices (3,743 ha) was correct and the other values resulted from a technical error. The LULUCF experts confirmed that the proposed FRL and its results were calculated using the data on the land matrices and the mistake did not affect the results.

20. According to decision 12/CP.17, paragraph 8, the FRL shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with the anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the Party's GHG inventory. The team assessing Cambodia's FRL noted that the Party did not maintain full consistency in terms of sources of AD and EFs with the GHG inventory included in its first BUR.[8] Category 3.B land in the Party's GHG inventory provided estimations of emissions and removals for 1990–2016 and used the same land maps for 2006, 2010 and 2014 with the same land classification system and the same EF (average carbon stock change in above- and below-ground biomass) in each land category. However, the estimation of the time series after 2014 in the Party's GHG inventory was made by linear extrapolation and not by using the land map in 2016. In addition, the estimated annual net emissions and removals were reported with slightly different numbers for the FRL submission and the GHG inventory for 2006–2010 (27,003 and 27,109 Gg CO_2 eq for the FRL and GHG inventory, respectively) and for 2010–2014 (130,905 and 131,011 Gg CO_2 eq for the FRL and GHG inventory, respectively). The LULUCF experts noted that this is also true for the estimated results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2015–2018.

21. Cambodia voluntarily submitted an uncertainty assessment in the technical annex. Due to technical difficulty, the uncertainty assessment was implemented using a slightly different estimation approach (the so-called stratified area estimate approach), which aggregated the detailed land classification (see para. 17 above) into two broad land categories: forest and non-forest. Then the carbon stock changes associated with land conversions from forest land to non-forest land and from non-forest land to forest land were

[7] "Complete" here means the provision of the information necessary for the reconstruction of the results.

[8] Available at https://unfccc.int/documents/232019.

calculated. The uncertainties of AD and EFs were established by sampling distribution. The overall uncertainty was integrated by the error propagation equation provided in the 2006 IPCC Guidelines using the calculated emissions and uncertainties. The assessed uncertainties based on this approach were 9.58 and 9.69 per cent for 2014–2016 and 2016–2018, respectively. The LULUCF experts noted that these uncertainties were associated with the emissions and removals that occurred due to land conversions from forest land to non-forest land and from non-forest land to forest land; these conversions constitute almost 70 per cent of the estimated results reported in the technical annex. However, the uncertainty relating to the emissions and removals associated with changes in forest type within forest land was not assessed because these emissions and removals were not calculated using the stratified area estimate approach.

22. In response to a question from the LULUCF experts, Cambodia clarified that most data (images and annual maps) are publicly available, which enables relevant stakeholders to cite them for reconstruction exercises, but the land-use matrix for 2016–2018 was not publicly available at the time of the TA. Following discussions with the assessment team, Cambodia included the link to the matrix in the modified submission. The LULUCF experts commend Cambodia for providing transparent information and continuing to improve the accuracy of its estimates.

23. The LULUCF experts consider that relevant stakeholders can reconstruct similar annual emission reduction values on the basis of the AD and EFs referred to in the technical annex and data in documents that are publicly available. However, it is unlikely that the same values can be reconstructed because numbers rounded to nearest whole numbers are used for reporting land matrices in the relevant documents, whereas the exact areas, including decimal places, are reported in the worksheets. In addition, below-ground biomass was calculated based on the relevant equation provided in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, rounded to two decimal places.

24. The LULUCF experts concluded that Cambodia provided the necessary information to allow for the reconstruction of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. The data and information provided in the technical annex are considered to be transparent, consistent, complete and accurate to the extent possible.

3. Consistency with the guidelines on elements to be included in the technical annex

25. Cambodia provided data and information on all the required elements in accordance with the guidelines contained in the annex to decision 14/CP.19, namely summary information from the final report containing the assessed FRL; results in t CO_2 eq/year, consistent with the assessed FRL; a demonstration that the methodologies used to produce the results are consistent with those used to establish the assessed FRL (as outlined in chap. II.B.1 above); a description of forest monitoring systems and the institutional roles and responsibilities in the MRV of the results; the information necessary for the reconstruction of the results (as outlined in chap. II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c–d), have been taken into account.

26. In its submission, Cambodia provided a summary table with the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks for 2015–2018, consistent with the assessed FRL and allowing for the reconstruction of the results. The emission reductions achieved, including removals from the activity enhancement of forest carbon stocks, which were calculated using a pixel-based method, are listed in tables 4–5 of the technical annex and amount to 35,245,948 t CO_2/year for 2015–2016 and 46,337,172 t CO_2/year for 2017–2018.

27. The LULUCF experts noted that Cambodia provided a description of the NFMS and a summary of the institutional roles and responsibilities for the MRV of the results in the technical annex, together with weblinks for accessing further information. The roles and responsibilities of the agencies and institutions involved in the MRV were transparently explained. During the consultation process, Cambodia explained that the NFMS has been enhanced since its publication in 2015. Cambodia provided updated information in terms of

collecting AD for area and area change, stating that it is now able to conduct land-use change analysis every two years, including developing annual composites using SEPAL[9] and Google Earth Engine, and including new satellite data sources from Sentinel and Planet that were not specified in the 2015 report. Cambodia also highlighted that it (1) integrates analysis of uncertainties using ground true data, (2) establishes time-series analysis and sampling using high resolution collected from drone campaigns and from images freely available online to generate reference data, (3) tests how to analyse forest fragmentation to better understand forest degradation and (4) works on developing an early warning system for detecting deforestation.

28. During the TA, Cambodia provided information on progress in implementing the NFMS to design and develop the NFI, in particular in generating EFs for each forest type. Cambodia indicated that with regard to developing EFs, the Party has conducted several field campaigns to collect biophysical data, develop new allometric equations and update the EF values. Cambodia has developed biomass models for flooded forest and upland forest (multi-species models for deciduous forest), and produced two technical reports on developing emission and removal factors for flooded forest in the Tonle Sap region and upland forest. The LULUCF experts commend Cambodia for sharing this information.

29. The forest monitoring system used is a national system covering all national territory. The NFMS is under the authority of three main agencies with a mandate to manage the forest resources in Cambodia, namely the General Department of Administration for Nature Conservation and Protection of the MoE, and the Forestry Administration and Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries. The roles and responsibilities of each agency are clearly explained in the technical annex. The agencies have a shared responsibility to operate and improve the NFMS. The system uses a combination of remote sensing and ground-based forest inventories and surveys, and has two main components: MRV and monitoring. The MRV component uses a satellite land monitoring system to generate AD and information on forest area and forest loss, and it provides information on land use or land cover for other monitoring purposes. Cambodia produces spatial data and information on land-use or land-cover change every two years, integrating methodologies and techniques to process and analyse spatial information using mainly satellite images from Landsat Enhanced Thematic Mapper and Sentinel 2 with medium and high spatial resolution. The monitoring component of the NFMS provides information on the effect of policies and measures developed to address drivers of deforestation and forest degradation and on forest management. This component also includes data management. The combined use of field data and remote sensing enables the Party to generate information, in particular on forest land, for use in GHG inventories.

30. According to decision 11/CP.19, paragraph 4(b), the NFMS should enable the assessment of different types of forest in the country, including natural forest. Cambodia uses geographic information systems to quantify change in each period and to monitor forests in each region, thereby facilitating detailed mapping by forest type and region. The generation of detailed disaggregated data supports the detection of deforestation in monitored areas. During the TA, Cambodia explained that the NFI is under development and will enable the Party to continue to update biomass values and revise associated parameters by forest type and EFs, consequently facilitating more accurate estimates of biomass. Cambodia also indicated that litter, deadwood and soil organic carbon pools are expected to be included in future FRLs through the implementation of Cambodia's first NFI, if sufficient funds to implement the NFI become available.

31. During the consultation process, Cambodia explained that, under the NFMS, monitoring of activities in forests is carried out by the three key agencies responsible for forest management referred to in paragraph 29 above. All three agencies have a similar reporting mechanism whereby any illegal activities reported are sent by a provincial department to the central office on a monthly, quarterly, biannual and annual basis. The Party clarified that, under the Community Forestry and Community Protected Area agreement with the Ministry of Agriculture, Forestry and Fisheries and the MoE, communities have the right

[9] SEPAL is a project of the Forestry Department of the Food and Agriculture Organization of the United Nations. Available at https://sepal.io/.

to patrol their forests. The Party provided information that indicated the MoE is in the process of establishing the Cambodia Environmental Management Information System and the Protected Area Monitoring Platform at the national level to better coordinate the monitoring activities of forests by integrating not only local communities but also civil society and national and international non-governmental organizations.

32. Cambodia provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For the estimation of emissions and removals in forest land and its related land conversions, Cambodia used the methodology provided in the 2006 IPCC Guidelines for estimating carbon stocks in forest land converted to other land uses. Accordingly, the emissions from deforestation and forest degradation and removals from the enhancement of forest carbon stocks were estimated for 2015–2018 by combining AD (i.e. areas of annual land-use change) with the appropriate EF (i.e. carbon stocks associated with the corresponding forest type). However, the application of the methodologies for the case of carbon gain calculation is not completely in line with the guidance provided in the 2006 IPCC Guidelines (see para. 35 below). During the consultation process, Cambodia highlighted that there are planned improvements for maintaining consistency between GHG inventory and REDD+ activities, and noted it will include all updates, improvements and methodological changes applied in the updated FRL in the next GHG inventory submitted by the Party.

33. Cambodia included in its FRL and estimation of results the most significant pools and non-CO_2 GHGs. The LULUCF experts commend Cambodia for expressing its intention to obtain better information on soil organic carbon and non-CO_2 gases with the aim of including them in future FRL submissions and estimates of results as part of the stepwise approach.

4. Accuracy of the results proposed in the technical annex

34. The LULUCF experts noted that the Party's estimation of the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks in the national area of Cambodia was undertaken using a transparent and consistent approach. The LULUCF experts commend Cambodia for its significant long-term efforts to build up a robust NFMS that is capable of providing transparent estimates of emissions from deforestation.

35. Both the established FRL and the results obtained in 2015–2018 from the implementation of the activities are based on the estimation of carbon stock changes in living biomass calculated as the difference in biomass amount before and after land conversions. Cambodia explained the estimation as the stock difference approach, and estimated AD as the area of each forest type or land-use type, and EFs as the difference between biomass before and after land conversions. The carbon stocks for the years of land mapping (i.e. 2006, 2010, 2014, 2016 and 2018) were aggregated as a national total, and the difference in total carbon stocks divided by the years of the mapping interval (i.e. four years for 2006–2010 and 2010–2014, and two years for 2014–2016 and 2016–2018) were presented as annual emissions for the corresponding years. Following the technical exchange during the technical assessment of the FRL, Cambodia excluded emissions and removals due to land conversion from natural forest to forest plantation. The LULUCF experts noted that this calculation will not provide an accurate estimation of carbon stock changes for the following reasons:

(a) The methodology in the 2006 IPCC Guidelines for estimating biomass carbon stock change due to land conversion consists of two elements. First is the initial change in biomass carbon stocks, which compares biomass stocks before land conversion and immediately after the conversion. Second is the subsequent carbon stock change due to carbon gains occurring in the new land use, such as through plant growth and carbon losses due to harvesting or a disturbance. Biomass stocks immediately after a conversion to non-forest land are generally zero. Under the current approach in Cambodia, carbon stock change is calculated only on the basis of the equation of the initial carbon stock change, and the biomass stock immediately after the conversion was set as the average biomass stock of the new land use. The LULUCF experts note this approach is appropriate only when the biomass stock of new land use is zero (i.e. for deforestation), and might make sense when forest type naturally changes without being subject to harvesting or clearance of biomass. However, for other conversions the correct estimate should be zero for the biomass stock immediately after

land conversion, and subsequent carbon gain should be calculated using an annual removal estimate (increment of volume or growth ratio) in line with the guidance provided in the 2006 IPCC Guidelines. Cambodia indicated that it will include more accurate carbon gain estimates in future REDD+ submissions;

(b) The interval between years of mapping (transition period of land-use change) was four years for constructing the FRL (using 2006, 2010 and 2014) and two years for calculating the results (using 2014, 2016 and 2018). The current approach is to assume that the change from the average biomass stock in the previous mapping year to the new average biomass stock in the next mapping year occurs within the transition period (four years for the FRL or two years for the results). Thus, the implied annual accumulation ratio for the same type of land-use change is not consistent in the FRL and the results. For example, under non-forest land converted to plantation forest, above-ground biomass stock changes from 0 to 100 t dry matter/ha during the transition periods. The implied annual removal ratios are 25 t dry matter/ha/year ((100 – 0)/4)) for the FRL and 50 t dry matter/ha/year ((100 – 0)/2)) for the results.

36. As mentioned in paragraph 35 above, Cambodia agreed this area needs to be improved. Cambodia will include corrected estimates for these values in future REDD+ submissions. The Party noted that the implementation of the NFI is closely linked to this improvement.

C. Areas identified for technical improvement

37. The LULUCF experts concluded that the following areas for technical improvement identified in the report on the technical assessment of Cambodia's FRL[10] also apply to the provision of information on the results of the implementation of the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks:

(a) Improve the accuracy of estimating EFs by using more levels or criteria in the stratification;

(b) Implement the recently designed NFI and use the resulting improved national EFs for future FRL submissions;

(c) Obtain better information on the litter, deadwood and soil organic carbon pools with the aim of including the information in the FRL as part of the stepwise approach;

(d) Consider the inclusion of non-CO_2 gases.

38. Furthermore, the LULUCF experts noted that Cambodia could consider the following areas for technical improvement:

(a) Improve the accuracy of estimating removals due to forest regrowth by using annual growth ratio or considering the transition period (see para. 35 above);

(b) Implement a full uncertainty assessment, including carbon stock changes occurring within forest land (i.e. caused by changes in forest type) (see para. 21 above);

(c) Provide consistent numbers for forest areas in relevant reports (see para. 19 above).

D. Comments and responses of the Party

39. During the consultation process, Cambodia noted a number of areas of capacity-building needs. Addressing those needs could potentially enable Cambodia to improve its data and methodologies, and include additional activities and gases in future FRL submissions. After exchanges with the LULUCF experts, Cambodia identified the following capacity-building needs:

[10] FCCC/TAR/2017/KHM.

(a) Further improvement of methodologies for estimating AD and EFs;

(b) Improvement of NFMS allowing for the production of more data;

(c) Preparation of a regulation framework for implementing REDD+ projects.

III. Conclusions

40. The LULUCF experts conclude that Cambodia reported the results of the implementation of three activities in the entire national territory: reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks. The estimation of emissions and removals covered carbon stock changes associated with land-use changes from and to forest land, as well as changes in forest type within forest land, except for natural forest conversion to forest plantation. The results include estimates of emissions and removals of CO_2 from two carbon pools: above-ground biomass and below-ground biomass, for 2015–2018. The results of the activities were reported using methodologies, definitions, assumptions and information consistent with those used for the assessed FRL.

41. The LULUCF experts consider the data and information provided in the technical annex to be transparent, consistent, complete and accurate.

42. The LULUCF experts found that the data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 9.

43. The results are accurate to the extent possible, based on the assumptions used. However, the LULUCF experts note that some technical improvements in terms of accuracy are identified.

44. In conclusion, the LULUCF experts commend Cambodia for showing a strong commitment to the continuous improvement of the data and information used for calculating the results, in line with the stepwise approach, which are consistent with those used to establish its assessed FRL. Some areas for future technical improvement and capacity-building needs identified by Cambodia have been identified in this report. At the same time, the LULUCF experts acknowledge that such improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.[11] The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Cambodia.[12]

[11] In accordance with decision 2/CP.17, para. 57.

[12] In accordance with decision 14/CP.19, paras. 12–13.

Annex I

Technical annex to the biennial update report

Owing to the complexity and length of the submitted technical annex to the BUR, and in order to maintain the original formatting, the technical annex is not reproduced here. It is available on the UNFCCC website at https://unfccc.int/BURs.

Annex II

Summary of the main features of the proposed results of the implementation of the activities referred to in decision 1/CP.16, paragraph 70, based on information provided by Cambodia

Key elements		*Remarks*
Results reported	35 245 948 t CO_2 eq/year for 2015–2016 46 337 172 t CO_2 eq/year for 2017–2018	Presented as emission reduction amounts for two periods. See paragraph 9 of this document
Results period	2015–2018	See paragraph 9 of this document
Assessed FRL	78 953 951 t CO_2 eq/year	Based on annual average historical CO_2 emissions during the reference period. See document FCCC/TAR/2017/KHM (submitted on 29 March 2018) for details. See also the modified version of the proposed FRL submitted on 22 May 2017, available at https://redd.unfccc.int/files/camfrl_may_22_2017.pdf. See paragraphs 3 and 8 of this document
Reference period	2006–2014	See paragraph 9 of this document
National/subnational	National	Construction of the FRL and calculation of the results were implemented at the national level. The NFMS covers the entire national territory. A comparison of land maps indicated the coverage of forest land gradually decreased from more than half of the national territory before 2010 to less than half since 2014. See paragraphs 8, 14(e) and 29 of this document
Activities included	Reducing emissions from deforestation Reducing emissions from forest degradation Enhancement of forest carbon stocks	The numbers from the FRL and the results were presented as being integrated from all three activities. Emissions and removals that occurred were associated with land-use changes from and to forest land as well as changes in forest type within forest land, except for natural forest conversion to planted forest. See paragraphs 9 and 14(h) of this document
Pools included	Above-ground biomass Below-ground biomass	See paragraphs 14(c) and 33 of this document
Gas included	CO_2	See paragraph 14(d) of this document
Consistency between assessed FRL and the results	Methods, definitions and information used for the assessed FRL are consistent with the results	Consistent parameters, land-use maps and estimation equations were applied for both the assessed FRL and the results. See paragraphs 14, 15, 17 and 18 of this document
Description of NFMS and institutional roles	Included	See paragraphs 27–31 of this document
Identification of future technical improvements	Included	Some areas for future technical improvement were identified. See paragraphs 37–38 of this document

Annex III

Documents and information used during the technical analysis

Reference documents

First modified FRL submission of Cambodia. Available at https://redd.unfccc.int/submissions.html?country=khm.

"Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels". Annex to decision 13/CP.19. Available at https://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf.

"Guidelines for submissions of information on reference levels". Annex to decision 12/CP.17. Available at https://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf.

IPCC. 1997. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. JL Houghton, LG Meira Filho, B Lim, et al. (eds.). Paris: IPCC/Organisation for Economic Co-operation and Development/International Energy Agency. Available at https://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html.

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

MoE. Cambodia Forest Cover 2016, 2018. Available at: https://redd.unfccc.int/uploads/54_3_cambodia_forest_cover_resource__2016_english.pdf.

National Forest Monitoring System of Cambodia. 2015. Available at https://redd.unfccc.int/uploads/54_1_cambodia_nfms__sept_17.pdf.

Report on the TA of the proposed FRL of Cambodia submitted in 2017. FCCC/TAR/2017/KHM. Available at https://redd.unfccc.int/submissions.html?country=khm.