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Report of the technical assessment of the forest management reference level submission of Denmark submitted in 2011

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Contents

I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of Denmark on its forest management reference level (FMRL), submitted on 14 April 2011 in accordance with decision 2/CMP.6. The TA took place (as a centralized activity) from 23 to 27 May 2011 in Bonn, Germany, and was coordinated by the UNFCCC secretariat. The TA was conducted by the following team of nominated land use, land-use change and forestry experts from the UNFCCC roster of experts: Mr. N.H. Ravindranath (India), Mr. Robert Waterworth (Australia), Mr. Walter Oyhantcabal (Uruguay), Ms. Naoko Tsukada (Japan), Mr. Lucio Santos (Colombia) and Ms. Marina Vitullo (Italy). Mr. N.H. Ravindranath and Mr. Robert Waterworth were the lead reviewers, The TA was coordinated by Ms. María José Sanz-Sánchez (UNFCCC secretariat).

2. In accordance with the "Guidelines for review of submissions of information on forest management reference levels" (decision 2/CMP.6, appendix II, part II), a draft version of this report was communicated to the Government of Denmark, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Proposed reference level

3. Denmark provided two reference level estimates, one including harvested wood products (HWP) (0.359 million tonnes of carbon dioxide equivalent (Mt CO_2 eq) per year) and another assuming instantaneous oxidation of HWP (0.243 Mt CO_2 eq per year). Denmark provided the reference level assuming instantaneous oxidation of HWP for transparency reasons only. The proposed FMRL is therefore 0.359 Mt CO_2 eq per year. In response to the recommendations of the expert review team (ERT) during the TA, Denmark's revised FMRL is 0.409 Mt CO_2 eq per year including HWP and 0.3337 Mt CO_2 eq per year assuming instantaneous oxidation of HWP (see annex).

II. General description of the reference level

A. Overview

4. The FMRL is based on a 'business as usual' scenario. The 'business as usual' scenario indicates increased harvesting compared with the historical rates from the period 1990–2009. The projected increase in harvesting is driven by the age-class structure of the forests in Denmark, with many forests becoming available for harvest between 2013 and 2020. This increased harvesting rate reduces the net removals currently reported by Denmark under forest management.

5. The methods used to estimate emissions and removals for the FMRL are described transparently and are largely consistent with the current methods used by the Party to account for emissions and removals from forest management under the Kyoto Protocol and forest land remaining forest land under the Convention. Denmark does not currently report emissions from HWP in its greenhouse gas (GHG) inventory and the FMRL submission represents the first time that Denmark has estimated emissions for HWP.

B. How each element of footnote 1 to paragraph 4 of decision 2/CMP.6 was taken into account in the construction of the reference level

1. Historical data from greenhouse gas inventory submissions

6. Denmark has used historical data from its national GHG inventory submissions in developing the models used to calculate the FMRL. The historical data is consistent with the latest submitted and reviewed national inventory report (NIR) (2010).

2. Age-class structure

7. The current age-class structure of Denmark's forests includes a large proportion of trees of over 100 years of age which are now available for harvest. In its FMRL submission, Denmark provided information on the age-class distribution for beech and oak showing the large proportion of older forests.

8. The age-class structure of the forest is dealt with explicitly in the modelling method used to develop the FMRL and is the main driver of the increased emissions from forest management projected for 2013–2020.

9. The expert review team (ERT) recommended that, in order to increase transparency, Denmark provide further information on the silvicultural practices used in the Danish forests. In particular, the ERT requested information on the ages at which thinning occurs and the expected range of rotation lengths for each species. This request was made to allow those reading the submission to more easily assess the impact of age-class structure on expected harvesting rates. In response to the request, Denmark provided the ERT with a detailed description of silvicultural practices (see annex). The ERT thanks Denmark for this further information and recommends that the country include a summary of these details in a revised submission.

3. The need to exclude removals from accounting in accordance with decision 16/CMP.1, paragraph 1

10. This is achieved by the provisions for factoring out (see para. 34 below).

4. Other elements

Forest management activities already undertaken

11. The FRML has been constructed using data from the national forest inventory (NFI) and existing silvicultural guidelines. All areas of forest not accounted for under afforestation and reforestation are included in the FMRL. Therefore, any forest management activities already undertaken are included in the 'business as usual' estimate.

Projected forest management activities under a 'business as usual' scenario

12. Denmark has applied a 'business as usual' scenario to estimate the FMRL. Under this scenario harvesting rates are expected to increase as more forest becomes available for harvest. This is consistent with existing management practices and the age-class structure of the forests.

Continuity with the treatment of forest management in the first commitment period

13. Denmark elected forest management for the first commitment period. The FMRL proposed by Denmark uses a 'business as usual' projection rather than the accounting rules applied for the first commitment period. The area of forest and the data and methods used to estimate emissions are consistent with current reporting.

C. Pools and gases

Pools and gases included in the reference level and consistency with inclusion of pools in the estimates

14. Denmark has included above- and below-ground biomass, litter and dead wood pools in its FMRL. This is not consistent with the current reporting for forest management and forest land remaining forest land, which includes estimates for mineral and organic soils. The ERT recommends that Denmark includes estimates for the mineral and organic soil pools in the FMRL. In its response to the ERT, Denmark included mineral and organic soil pools in the revised FMRL (see para. 3 above and annex below)..

15. Denmark has not included emissions from fertilization, drainage of soils, liming or biomass burning in the FMRL. In its 2011 NIR, Denmark reported emissions from drainage of soils under forest land remaining forest land. To ensure consistency with current reporting, the ERT recommends that Denmark include nitrous oxide (N_2O) from the drainage of soils in the FMRL. In its response to the ERT, Denmark included the N_2O emissions from the draining of soils in the revised FMRL (see para. 3 above and annex below).

D. Approaches, methods and models used

1. Description

16. The data and methods used to develop the FMRL are obtained from the NFI, the forest census of 1990 and 2000, and time series mapping of forest area for 1990 and 2005. The data are consistent with those used to develop estimates for forest management and forest land remaining forest land in the NIR and have been subject to review by previous ERTs.

17. Estimates of above- and below-ground biomass for the period 2013–2020 are calculated using data from the NFI and projected harvesting rates. As the second phase of sampling for the NFI is not yet complete, Denmark has used a regression approach based on the currently available plot data to complete the estimates of carbon stock in 2009 and 2010 for the purposes of calculating the FMRL. This approach ensures time-series consistency between the historical and projected estimates. The ERT notes that Denmark will replace the regression-based estimates for 2009 and 2010 with the NFI-based estimates once the next round of the NFI is complete. The ERT commends the intention of Denmark to make this technical correction.

2. Transparency and consistency

18. Denmark provided the ERT with a comprehensive document on the methods used to estimate the FMRL. The construction and methods used to calculate the FMRL have been completed in a transparent manner.

19. Denmark has used the same methods and models as applied in the 2011 NIR, with the exception of HWP. Therefore, the data for carbon pools reported is comparable and consistent with the current estimates for forest management.

20. The ERT noted that transparency could be improved by including some additional information on the issues set out below. In response, Denmark provided a detailed description of silvicultural practices and wood products modelling. The ERT notes that a summary of these descriptions should be included in the revised FMRL submission, including information on the following:

(a) The silvicultural regimes used in the projections;

(b) Validation and verification of the projections model, including how well the model is able to represent past harvesting rates;

(c) Correcting small errors in the tables supplied in the FMRL submission;

(d) Providing further information on the HWP model assumptions.

E. Description of the construction of the reference level

1. Area under forest management

21. The area of forest management in Denmark encompasses all forest land that is not reported under Article 3, paragraph 3, of the Kyoto Protocol. The area is consistent with the reporting of forest management for the first commitment period, considering only forest established before 1990.

22. Denmark currently has a small amount of deforestation that removes lands from forest management. The projected FMRL does not assume any deforestation for 2013–2020. This is a conservative approach.

23. The ERT noted that the small area of forest in Greenland (approximately 200 ha) is not included in the FMRL. While the ERT acknowledges that this is a very small area compared with the total area under forest management, it suggests that for completeness this area could be included in a revised submission. In response, Denmark has indicated that the forest area in Greenland is expected to remain unchanged and with a stable carbon pool up to 2020, since there is no harvest or products expected. The ERT notes that the influence of the area of forest in Greenland on the FMRL is expected to be zero and agrees with Denmark's approach.

2. Relationship of the forest land remaining forest land category with the forest management land activity reported previously under the Convention and the Kyoto Protocol

24. Denmark has applied the same definition of forest as applied during the first commitment period. The most common broadleaved forest tree species in Denmark is beech.

3. Historical and assumed harvesting rates

25. The historical harvesting rates are consistent with those documented in the NIR.

26. Denmark has assumed that forest harvesting rates will increase in the period 2013–2020 as the proportion of trees in the mature age class of the forest increases and more forests become available for harvest. The increase in harvest in 2013–2020 is based on the age-class structure of the forest and a probability function which determines the likelihood of an area of forest being harvested based on its species, age and productivity class (see Johannsen et al., 2010). This method is consistent with other countries' methods of calculating projected reference levels and is a common method for estimating annual levels of harvest in the forestry sector.

27. The parameters used in the transition probability function are derived from the 1990 and 2000 forest census data (see Nord-Larsen and Heding, 2002). The parameter sets are based on data from the census, which has not been updated for 10 years. The ERT recommended that Denmark provide further information on the validation of the model, such as comparing the projection model results with the actual age and area of harvest for

each species since 1990. In response, Denmark provided further information on the model validation (see annex).

28. Denmark also notes that there are a number of biological reasons for not postponing the harvesting, such as an increased risk of wind throw and fungal attack, which reduces wood quality and therefore value (see annex).

29. In the FMRL, the quantity of litter remains stable while the amount of dead wood decreases slightly from 2013 to 2020. It may be expected that an increase in harvesting will also lead to increases in the dead wood and litter pools as slash material and below-ground biomass is left on site following harvest. The ERT recommended that Denmark provide further information on the reason for this lack of increase in the FMRL. Denmark provided the ERT with a detailed response (see annex), noting that while such an effect may be expected under traditional forestry activities, the increased use of slash material for bioenergy is likely to prevent large increases occurring, and may lead to a decrease.

4. Harvested wood products

30. Denmark has used the data supplied in *Projection of Net-Emissions from Harvested Wood Products in European Countries for the Period 2013–2020* (Rüter, 2011). This ensures consistency with other European countries. The HWP model uses first-order decay rates consistent with document FCCC/KP/AWG/2010/18/Add.1, chapter II, annex I, paragraph 27. Imports and exports of wood products have been excluded from the estimates.

31. Denmark has used the overarching estimates developed for European countries as described in paragraph 30 to estimate the emissions from HWP. The ERT notes that the over-arching document does not contain the key information required to assess the model and its results for each country. The ERT recommended that, for transparency, further information be included in the submission, in particular information on the split of the HWP inflow to the different decay classes and the effect of using five-year averages to develop the legacy pool for the period 1900 to 1963. Denmark provided the ERT with a detailed response (see annex), noting issues with the HWP model, and developing new estimates using it will use country-specific data.

32. HWP is expected to be a net source of emissions from 2013 to 2020. At first glance this appears to conflict with an increasing rate of harvesting over the same period. Denmark has noted that this difference is due to the expected decrease in consumption of domestically produced wood and the increase in the amount of wood used for energy (instantaneous oxidation). The ERT recommended that Denmark provides further explanation of this trend in the submission, in particular the effect of the legacy pools on these emissions. Denmark provided the ERT with a detailed response including a revised HWP value (see annex).

5. Disturbances in the context of force majeure

33. Denmark has not included any natural disturbances in its FMRL for the purposes of including force majeure. Denmark notes that the main disturbance that may affect forests (windstorms) is not likely to cause a significant proportion of emissions over the period 2013–2020. Furthermore, Denmark notes that timber from forests damaged by windstorms will be utilized, resulting in reduced harvesting in other areas and thereby partially balancing the effects of the disturbance. Therefore, while the effects of recent windstorms are not explicitly included in the FMRL, their effects are implicitly included through changes in harvesting schedules and the subsequent measurement of affected areas by the NFI.

6. Factoring out

34. Use of a projected reference level which includes age-class structure is considered to factor out dynamic age-class effects. With the present state of scientific knowledge, the effects of elevated CO_2 concentrations and indirect nitrogen deposition are considered to be approximately the same in the reference level and in the estimated period (i.e. the commitment period), and therefore they can be assumed to factor out.

F. Policies included

35. The FMRL is based on the existing Danish Forest Act (2004), which was still operating in December 2009. There were no changes to forest policy between April 2009 and December 2009 that would affect the FMRL calculation. Denmark is working on a new renewable energy plan which is expected to increase the use of wood for energy. However, as this policy was not in place as at December 2009 and is still being developed, it has not been accounted for in developing the FMRL.

III. Conclusions and recommendations

36. Denmark made its FMRL submission on 14 April 2011. The ERT concludes that the FMRL submission of Denmark and its revision has been prepared and reported in accordance with decision 2/CMP.6. In the course of the TA, the ERT formulated a number of recommendations, the issues were largely of a minor nature and related to issues of comparability, completeness and transparency, and many of them were addressed in the revised FMRL (see annex).

Annex

Documents and information used during the technical assessment

A. Reference documents

National greenhouse gas inventory of `Denmark submitted in 2010. Available at <http://unfccc.int/5270.php>.

National greenhouse gas inventory of Denmark submitted in 2011. Available at <http://unfccc.int/5888.php>.

Submission of information on the forest management reference levels by Denmark, 28 February 2011. Available at <http://unfccc.int/files/home/application/pdf/awgkp_denmark_2011.pdf>.

Johannsen VK, Nord-Larsen T and Suadicani K. 2011. *Submission of Information on Forest Management Reference Levels by Denmark*. Forest & Landscape Denmark Working Paper 58-2011. Copenhagen: University of Copenhagen.

Johannsen VK, Nord-Larsen T, Riis-Nielsen T, Bastrup-Birk A, Vesterdal L and Moller IS. 2010. *Revised: Acquiring and Updating Danish Forest Data for Use in UNFCCC*. Forest & Landscape Denmark Working Paper 54-2010. Copenhagen: University of Copenhagen. \

Nord-Larsen T, Heding N. 2002. Træbrændselsressourcer fra danske skove over 1⁄2 ha - opgørelse og prognose 2002. Arbejdsrapport nr. 36, Skov & Landskab (FSL), Hørsholm, 78s. ill.

Rüter S. 2011. *Projections of Net-Emissions from Harvested Wood Products in European Countries for the Period 2013–2020*. Institute of Wood Technology and Wood Biology Working Paper 2011-01. Hamburg: Johann Heinrich von Thünen-Institut.

B. Additional information provided by the Party[1]

1. Further information on the silvicultural practices used in the Danish forests

In classic Danish forestry, focus is the sustainable production of wood. This is most easily achieved in forests divided into even-aged forest stands containing only one tree species. Regeneration of forest stands is done by clearfelling and subsequent planting of the new stand. From planting to clearfelling, the stand is usually treated by frequent things. As a rule of thumb, thinnings are carried out with a frequency corresponding to about a tenth of stand age. In coniferous species, the market for wood chips and risk of windthrow has created a silvicultural practise of frequent, heavy thinnings in stands less than 14-15 m tall (when the stand becomes susceptible to windthrow) and subsequently management without thinnings until clearfelling.

Rotation age depends largely on the tree species and growing conditions. For spruce on fertile, clayey soils in the eastern part of the country, the desired rotation age is 40-50 years. On gravely soils in eastern Jutland and northern Zealand the desired rotation age is 60-70 years and on sandy soils in western and northern Jutland rotation age may be 80-90 years. However, frequent windthrows, attacks by bark beetles, and debilitation by root rot often shortens the actual rotation age significantly.

[1] Reproduced as received from the Party.

For deciduous species, the desired rotation age differs among individual tree species. As a rule of thumb the desired rotation age for beech is about 120 years. On less fertile soils, rotation age may be 150 years or more whereas on fertile soils rotation age may be 90 years. For oak the desired rotation age is 150 years, but may be 110-120 years on fertile soils. The rotation age of sycamore and ash is somewhat shorter and is probably 70-90 years. The rotation age of birch and alder is even less and is probably 40-60 years.

In recent decades, the focus of Danish forestry has shifted significantly towards sustainability on a broader sense. Focus is more prominently on near-natural forestry with continuous forest cover of indigenous and thus locally adapted tree species. Thus, in deciduous self-seeding species clearfelling has been superseded by a long regeneration phase in which trees are retained for shelter and seeding for extended periods of time. Among the coniferous species, stands are often regenerated by sherlterwood harvesting in which a shelter of spruce is underplanted with silver fir, douglas fir, or deciduous species, such as beech or oak. The transition will take effect gradually and may in the long run change the harvest rates. An opposing effect on the harvest rates will be induced by the increasing demand for biomass. The effect of both changing silvicultural systems and changing demand can not be estimated based on current data, and hence the utilized harvest rates are based on best current knowledge.

2. Deadwood and litter pools evolution

The pool of deadwood and litter may be affected by the increasing harvest rates. But - the expected increasing demand for biomass for energy is expected to affect also the amount of slash material left on site following harvest. Furthermore - the data for the two pools are based on NFI data since 2002, and the close linkage to the silvicultural system and harvest rates have not been established. Hence there is still no data based source for estimating a change in the deadwood and litter pools.

3. Comparison of actual and predicted harvest

When the model was initially built Denmark validated the model results by running the projection simulation and comparing the predicted and actual estimates for the period 2000- 2009 as mentioned in the report section 4.1.4. This is part of the basis for the adjustment of the prognosis of harvest, as the models for harvesting and the recorded true harvest differs.

4. Harvest import and export of non coniferous industrial roundwood.

Denmark has as one of rather few countries positive emissions from HWP in 2013-2020.
This can seem a little surprising as the inflow of carbon is increasing from 286000 ton C in 1964-1968 to 302000 ton C in 2005-2009 and to 311000 ton C in 2013-2020. Anyway, the overall inflow is only increased because there has been an increase of the inflow of paper from 71600 ton C in 1964-1968 to 158800 ton C in 2005-2009 and to 163600 ton C in 2013-2020.The inflow of HWP with longer life time has decreased.

There are three main inflows of HWP with longer life times. (1) sawnwood of conifer, (2) sawnwood of non conifer and (3) particleboards. The development of their inflows can be seen in figure 1.

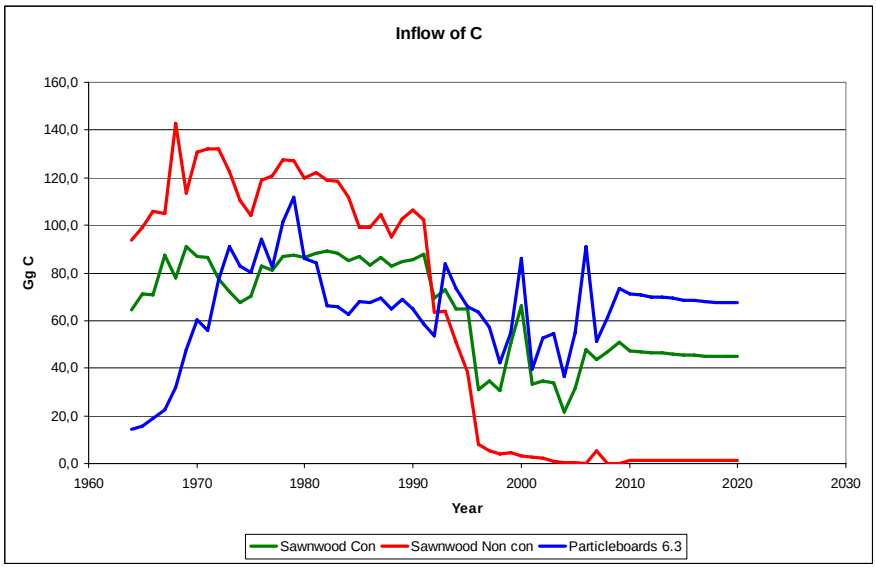

Figure 1. Inflows 1964-2020 of sawnwood of conifer, sawnwood of non conifer and particleboards.

It can be seen that there has been a decrease in the inflow of coniferous sawnwood from 74300 ton C in 1964-1968 to 44100 ton C in 2005-2009 and to 45100 ton C in 2013-2020.

The decrease in inflow from non coniferous sawnwood is much more drastical. The inflow has decreased from 109300 ton C in 1964-1968 to 1100 ton C in 2005-2009 and 1200 ton C in 2013-2020.
Inflow from particleboards has been increasing rapidly until 1980 and has afterwards slightly decreased. The inflow in 1964-68 was 20700 ton increasing to 66400 ton C in 2005-2009 and slightly increasing to 68400 in 2013-2020.

The inflow is defined as the production of the HWP multiplied with a conversion factor multiplied with a ratio. The conversion factor is a constant calculating the inflow in Gg C from 1000 m^3. The production is data imported from the UN ECE timber statistic. The production of coniferous sawnwood, non coniferous sawnwood and particleboards is shown in figure 2.

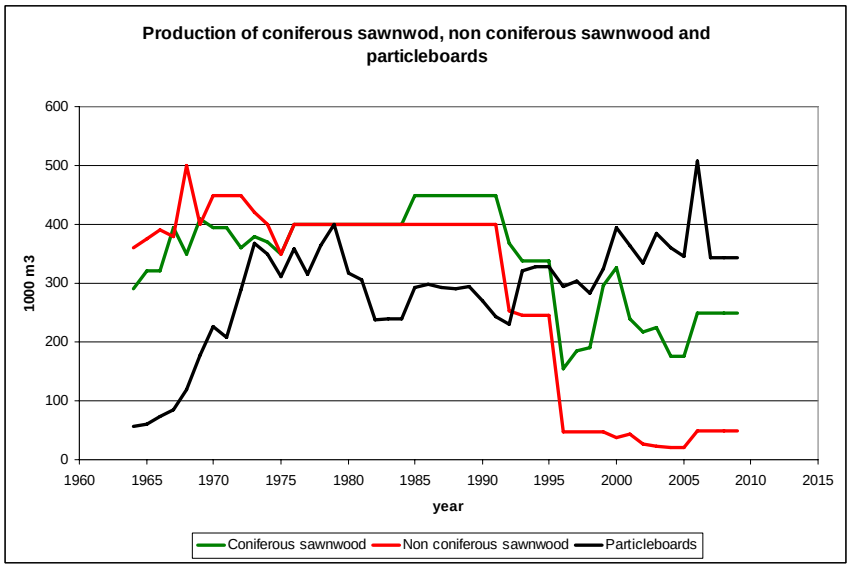

Figure 2 The production of coniferous sawnwood, non coniferous sawnwood and particleboards.

It can be seen that the statistic shows a decrease in the production of coniferous sawnwood from 335000 m^3 in 1964-1968 to 235000 m^3 in 2005-2009.
The decrease in the production of non coniferous sawnwood is more dramatic. The production has decreased from 401000 m3 to 44000 m3 in 2005-2009. A decrease of 90% in the production of non coniferous sawnwood. It is hard to see Junckers Industries (a large Danish Industry) in this picture.
The production of particleboards has increased from 79000 m3 in 1964-1968 to 376000 m3 in 2005-2009, but most of the increase took place from 1964-1980.
The ratio is calculated as seen in figure 3. Expressed in words the ratio is the consumption of domestically produced industrial roundwood divided by the total consumption of industrial roundwood. In other words the ratio seeks to find the proportion of the production of HWP produced of domestically produced roundwood.

$$ratio_{INDRW\ consumption\ from\ dom\ harvest} = \frac{(Production_{INDRW} - Export_{INDRW})}{(Production_{INDRW} + Import_{INDRW} - Export_{INDRW})}$$

Figure 3. The calculation of the ratio.

In figure 4 you can see the development of the ratios.

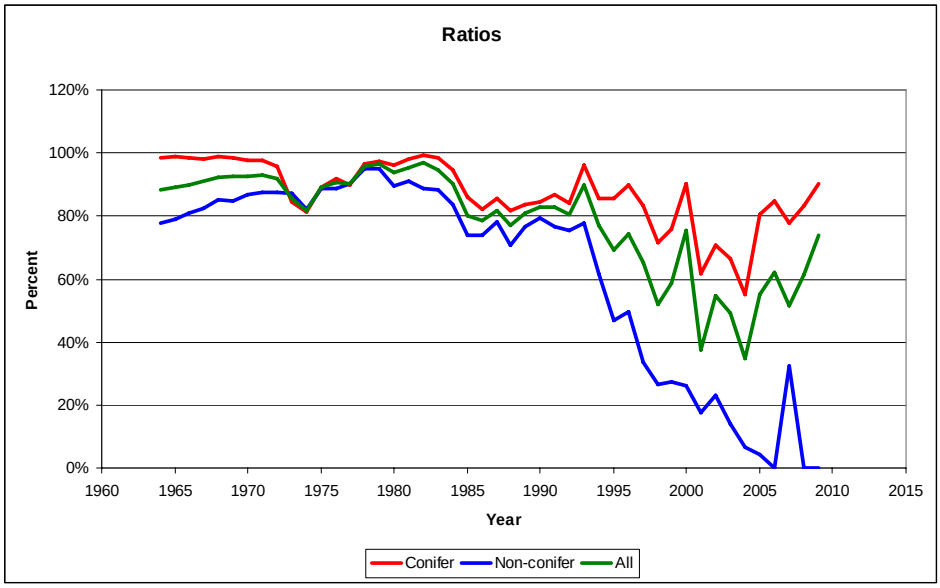

Figure 4. The development of the ratios.

As expected all ratios are decreasing. This is a logical consequence of globalisation. The ratio for conifer decrease from 99 % in 1964-1968 to 83 % in 2005-2009.
The ratio for non conifers decrease from 81% in 1964-1968 to 7% in 2005-2009 and in 3 out of 5 years the ratio is zero. The consequence of this should be that there is no production of HWP based on domestically produced non coniferous roundwood. This is of course not true, and therefore something is wrong in the calculation of the ratio of non coniferous industrial roundwood.
Three data sources are included in the calculation of the ratio: The production, the import and the export of industrial roundwood.

The numbers for non coniferous are shown in figure 5.

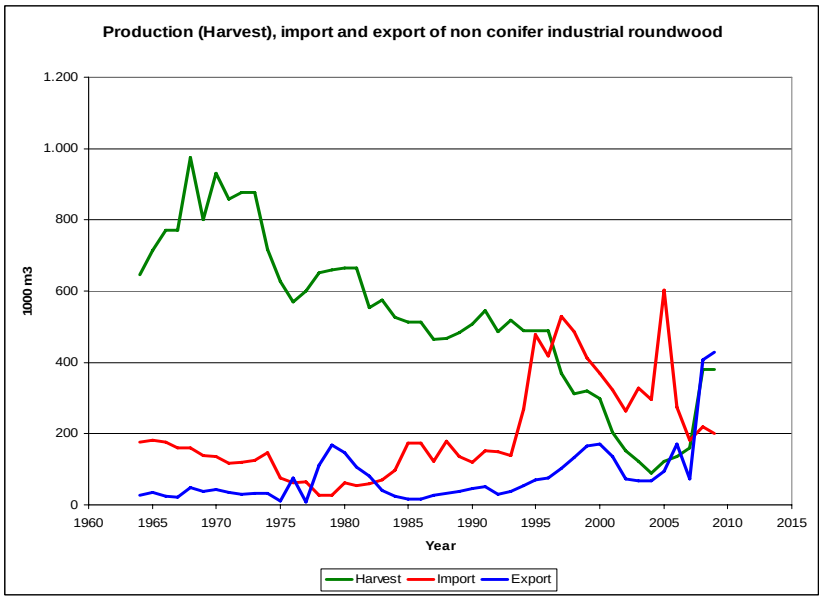

Figure 5. Production, import and export of non coniferous industrial roundwood.

As it can be seen the production of non coniferous industrial roundwood has decreased from 776000 m3 in 1964-1968 to 236200 m3 in 2005-2009. A 70% reduction in harvesting of industrial roundwood in non conifers is a very dramatic reduction.
The import has increased from 171000 m3 in 1964-1968 to 296500 m3 in 2005-2009, but there are large variation over the years.
The export has increased from 31000 m3 in 1964-1968 to 234700 in 2005-2009 and in the last two years the export is estimated to over 400.000 m3. Export of 400000 m3 out of a domestic production of 236200 m3 is not possible, and therefore some re-export must take place. Anyway it has been agreed that re-export is not included in the calculations.

Let us have a look at the consumption of domestically produced industrial roundwood (the numerator) and the total consumption of industrial roundwood (the denomerator) (figure 6.

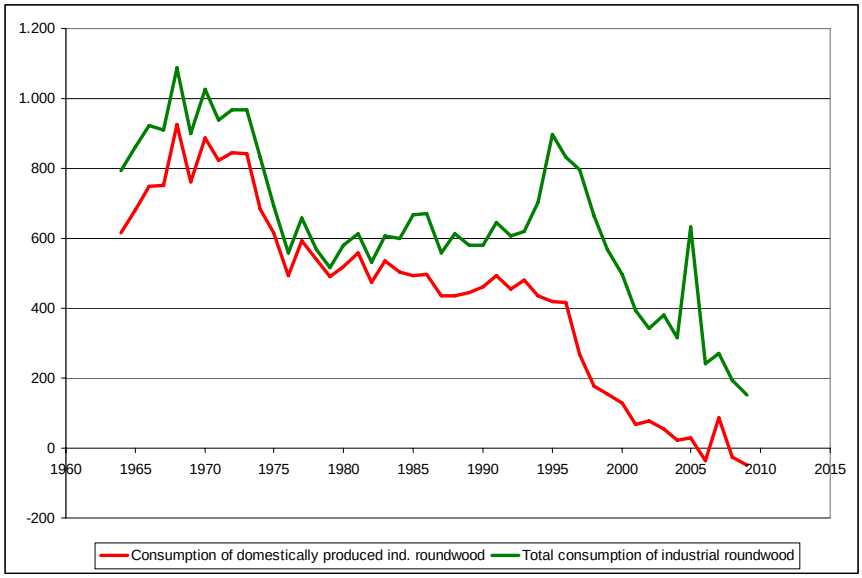

Figure 6. Consumption of domestically produced industrial roundwood

Figure 6 highlights some of the problems calculating numbers by subtraction. The uncertainty can become very big. If for example the production is a little underestimated and the export is a little overestimated the consumption of domestically produced industrial roundwood (the subtraction between the two numbers) will be heavily underestimated. This in turn will result in an underestimation of the ratio.
The consumption of industrial roundwood has decreased from 915000 m3 in 1964-1968 to 298000 m3 in 2005-2009. A 67 percent decrease in the consumption of industrial roundwood in Denmark.
Another problem is tropical roundwood. Denmark has registered export of tropical roundwood since 1964, but no import has been registered. The yearly export in 1964-1968 was 10000 m3 and it increased to 54100 m3 in 2005-2009 (figure 7).

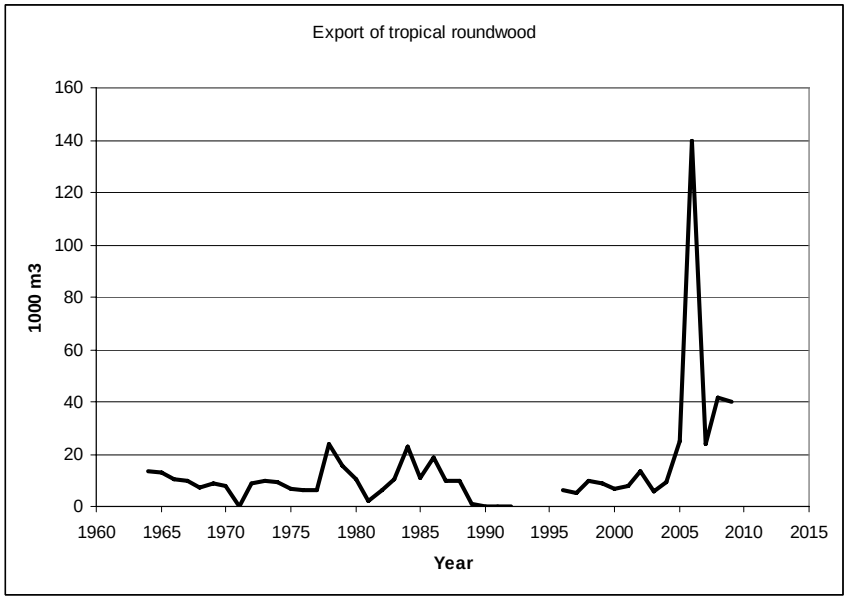

Figure 7. Export of tropical roundwood.

Conclusion
The net emissions from HWP produced of domestically grown roundwood can partly be explained by some misleading and most certainly incorrect statistical data especially of non-coniferous roundwood production, import and export and non-coniferous sawnwood production. More reliable data must be demanded and produced for the period of 2013-2020. Careful validation of the data must take place before delivered to FAO, UNECE and other international bodies.

In relation to the calculation of the reference levels - and the inclusion of HWP in these - it has been decided to utilise national produced spreadsheet calculations rather than the common calculations developed for most European countries. This will allow for a full transparency of the estimation and contain key information required to assess and validate the results for Denmark. The estimates do not differ significantly from the estimates in the first submission and will be included in the revised submission in August 2011. If possible - the difference in the two calculations will be identified and explained in the revised submission.

5. Response to recommendations

(a) Include the mineral soil and organic soil pools in the FMRL;

The mineral soil and organic soil pool have been included in the FMRL. The levels of 2009 is expected to be valid throughout the period of 2013-2020. This equals annual net change in carbon stock in mineral and organic soils of a total of -9,06 GgC - equalling -33,22 GgCO2eq annually (conversion 44/12). The tables have been updated with the values.

Based on the Report of supplementary information for LULUCF under the Kyoto protocol for 2009.

(b) Include N_2O emissions from the draining of soils in the FMRL;

The N_2O emissions from the draining of soils in the FMRL have been included in the FMRL. The levels of 2009 is expected to be valid throughout the period of 2013-2020.

Total for organic soils of 0,01 Gg N2O-N - and Total for mineral soils of 0,03 Gg N2O-N - resulting in an overall emission of 124 GgCO2eq (conversion 310). The tables have been updated with the values.

Based on the Report of supplementary information for LULUCF under the Kyoto protocol for 2009.

(c) Include the small area of forest in Greenland;

The forest area in Greenland of approx. 200 ha is expected to remain unchanged and with a stable carbon pool in the period. There is no harvest or products expected. The influence on the FMRL is 0.

(d) Provide further information on the age-class structure and silviculture applied in Danish forests and the validation of the harvest projection model.

The validation and recalculation is included above and the tables have been updated with the new values for HWP. Supplementary inforamtion on Harvested Wood Products:

Kjell Suadicani, Forest and Landscape Denmark

As it can be seen in the Report of the technical assessment of the forest management reference level submission of Denmark submitted in 2011 under Annex B Additional information provided by the party § 4. Harvest import and export of non coniferous industrial roundwood I can clearly be seen that there is seriously errors in the statistical data for the production import and export of non coniferious industrial roundwood.

Especially the errors in the period from 2006 to 2009 have consequences for the calculations of the carbon emissions from HWP because the numbers in this period form the basis for the prognosis.

The problem has been discussed with the forest owners association which has been responsible for the collection of data to FAOSTAT and EUROSTAT until 2009. Until 2007 or so the data was based on special runnings of data delivered from Statistics Denmark, but because of the costs this is not longer possible. Therefore The Danish Forest Owners Association has decided not to accept the task of delivering data to EUROSTAT. The Forest Owners Association states that the data especially from the last years are not very precise.

The problem has also been discussed with the Association of the Danish Wood Industries. They have delivered data for the mean annual production, import, and export of non coniferous industrial roundwood and the production of sawnwood for the period 2006 to 2009, which after some analysis discussion and adjustments with Forest and Landscape Denmark have been accepted by both parties as the best estimates available. The average data for the period 2006-2009 have replaced the data from EUROSTAT in the calculations.

6. Revised FMRL tables.

Revised Reference level

Member State	Proposed Reference Level ($GgCO_2eq$ per year)	
	applying first order decay function for HWP	assuming instantaneous oxidation of HWP
Denmark	409	333.7

Historical and projected emissions and removals

	Net Removals (-) or Net Emissions (+) ($GgCO_2eq$ per year) (1)																		
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	average of 1990-2007
FM applying first order decay function for HWP (2)	-973	-1,096	-740	-1,216	-872	-1,083	-690	-695	-552	-275	698	976	655	792	909	397	-457	-1,019	-291
FM assuming instantaneous oxidation of HWP (3)	-754	-893	-793	-1,005	-841	-1,003	-942	-1,002	-1,002	-614	464	448	251	377	336	260	-291	-1,160	-454
Disturbances in the context of force majeure (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Net Removals (-) or Net Emissions (+) ($GgCO_2eq$ per year) (1)													
	2008	2009	2010	2011	2012	average of 2008-2012	2013	2014	2015	2016	2017	2018	2019	2020	average of 2013-2020
FM applying first order decay function for HWP (2)	-1,832	-951	287	291	289	-383	282	282	289	286	493	524	544	573	409
FM assuming instantaneous oxidation of HWP (3)	-1,867	-895	292	266	246	-391	231	220	213	208	411	437	462	488	334
Disturbances in the context of force majeure (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(1) GHG inventory 2010 OR 2011 OR any other source

(2) emissions/removals from HWP estimated using the the product categories, half lives and methodologies as suggested in para 27, page 31 of FCCC/KP/AWG/2010/CRP.4/Rev.4.

(3) provided for transparency reasons only

(4) for MS using JRC/IIASA/EFI projections, the GHG emissions from forest fires can be included. The other disturbances are not separately quantified.

Harvest rate (roundwood overbark/underbark, 1000 m^3)				
2000	2005	2010	2015	2020
3672	2962	2721	2613	2572

C pools and GHG sources included in the reference level

	Change in C pool included in the reference level						GHG sources included in the reference level					
	Above-ground biomass	Below-ground biomass	Litter	Dead wood	Soil		Fertilization	Drainage of soils	Liming	Biomass burning		
					mineral	organic	N2O	N2O	CO2	CO2	CH4	N2O
Denmark	yes	yes	yes	yes	yes	yes	no	yes	no	no	no	no

"Yes/No" indicate if the pool or gas is included or not in the projections used to set the reference level. A carbon pool is not included only if it is expected to be not a source in the second commitment period. In any case, full consistency will be ensured with paragraphs 12 quater, 12 quinquies and 25 of the document FCCC/KP/AWG/2010/CRP.4/Rev.4

For Member States using projections from IIASA/EFI models, as elaborated by JRC, the information on the coverage of pools and gases is taken from KP reporting (if available) or from UNFCCC reporting. In the latter case, if "living biomass" is reported, it is assumed that it contains both aboveground and belowground biomass; If "dead organic matter" is reported, it is assumed that it contains both dead wood and litter.