Wood in peat fuel – impact on the reporting of greenhouse gas emissions according to IPCC Guidelines

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Abstract

The production and use of peat fuel is a significant source of emissions in the Finnish national greenhouse gas inventory. About 10–15% of the total greenhouse gas emissions in Finland can be attributed to the production and combustion of peat. The peat fuel contains about 2.6% (range 1.2 to 12.5%, calculated from the energy content of the peat) non-decomposed large pieces of wood: stem wood and stumps. Earlier, this wood in peat was separated from the peat before combustion because the large woody pieces caused problems in the combustion process. Nowadays, the large pieces of wood in peat fuel is increasingly crushed, milled, and combusted with the rest of the peat.

The emissions from the non-decomposed large pieces of wood in peat have been treated differently in the inventory, depending on the practice. When the wood in peat has been separated from the peat before combustion, it has been treated as a renewable biomass fuel and the CO2 emissions have not been included in total national emissions. In cases where peat including wood has been combusted without separation, the emissions from the wood in peat have been treated as emissions from peat. Peat is treated comparable to fossil fuels in the inventory and CO2 emissions are included in national total emissions.

Wood in peat is on average as old as other plant material of which the peat is formed. The time scale to mitigate the climate change is of the order of 100 to 300 years according to the IPCC stabilization scenarios. If the turnover rate of a carbon pool exceeds this time scale, the use of this pool has not been seen as renewable from the view point of climate change mitigation.

National greenhouse gas inventories under the United Nations Framework Convention on Climate Change (UNFCCC) should be prepared using methodologies given in IPCC Guidelines and good practice reports. Time series consistency is an important requirement. The IPCC guidelines do not give direct guidance how wood in peat should be treated – as renewable biomass fuel or as peat. The scientific considerations support treating the wood in peat as part of the peat (referred as Option 1 in this report). The wood in peat could also be considered in the inventory as other wood – a renewable biomass fuel (Option 2).

Consistent time series for treatment of wood in peat would require recalculations in the inventory. In Option 1, the base year (1990) emissions would increase more than the current year emissions. In Option 2, the base year emissions would not change much, but current year emissions would be lowered. For both options, the impact of implementing the changes would be relatively small, the change in the total emissions in the Finnish inventory would be approximately 0.2% (0.1–1.0%) for Option 1 and 0.3% (0.1–1.4%) for Option 2. The impact on the total emissions was calculated assuming that the average share of wood in peat would apply also for peat extracted for combustion and that all wood in peat had been separated in the base year, and that currently all wood in peat is combusted as part of the peat. The share of wood in peat combusted has large regional differences, the methods used to estimate the share are uncertain, and also the data on the treatment of wood in peat in combustion is based on rough estimates. The range in the values reflects mainly regional differences, not the uncertainty of the nationwide average value.

The IPCC good practice guidance report encourages recalculations that result in more accurate and complete estimates. It also encourages countries to peer review and validate the refinements before they are being implemented, especially if the base year will change as a result. Continuing the current practice (Option 3) has a relatively small impact on the total emissions and the emission trend. It overestimates current year emissions compared with the base year, and is therefore conservative. Recalculations using Option 1 or Option 2 would require improvements in the estimates on the wood content in peat combusted and wood separated from peat before combustion. Any recalculation should be reinforced with transparent reporting and documentation.

Peat contains also decomposed or partly decomposed woody material which is mixed with the rest of the decomposed plant material which forms the peat. These wood-based components have been combusted with the rest of the peat and the treatment of emissions in the inventory has been consistent.

Especially drained peatlands can contain a tree cover which is removed before the peat production begins. The treatment of the emissions from combustion of this woody material as renewable biomass has been consistent in the inventory.

This report addresses only the treatment of the old, non-decomposed large woody pieces in peat, not the treatment of the other wood-based material described in the two above paragraphs.

Keywords peat, wood, biomass, greenhouse gas inventories		
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Preface

In the national greenhouse gas inventory of Finland the emissions from large non-decomposed pieces of wood in peat fuel have been reported differently, depending on the practice. When this wood in peat has been separated from the peat, the CO_2 emissions from combustion have been estimated as emissions from renewable biomass fuels and have not been included in the national total emissions. When this wood in peat has been crushed into the peat and combusted together with the rest of the peat, the CO_2 emissions have been estimated as for peat, i.e. included in the national total emissions.

The aim of this report was to evaluate how the large non-decomposed pieces wood in peat should be reported in the national greenhouse gas inventory of Finland, and whether some changes to the current practice would be needed. The evaluation is based on the IPCC guidelines and good practice guidance for national greenhouse gas inventories, scientific literature, interviews with experts, as well as practical consideration on availability of activity data and other parameters needed in inventory preparation.

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Contents

1. Introduction

The production and use of peat as a fuel is a significant source of emissions in the Finnish national greenhouse gas inventory. About 10–15% of the total greenhouse gas emissions in Finland can be attributed to the production and combustion of peat. According to the Finnish national greenhouse gas inventory, emissions due to peat combustion were 9.3 Mt CO_2 in 2002. The emissions from peat production were estimated to amount to 3.5 Mt CO_2 equivalents (about 1 Mt CO_2 and 1 kt CH_4 (about 0.02 Mt CO_2 equivalents) from active peat production areas and about 2.5 Mt CO_2 from areas reserved for peat production). The corresponding CO_2 emission for peat combustion for 1990 (the base year for Kyoto Protocol emission limitation/reduction commitments) were 5.9 Mt CO_2, the emissions from peat production have been reported as 3.5 Mt CO_2 equivalents for the whole period 1990–2002 (Ministry of the Environment, 2004).

The estimates from the peat production areas as well as the emissions from the areas reserved for peat production are very uncertain. The ongoing Finnish research programme "Greenhouse Impact of the use of Peat and Peatlands in Finland" has as the objective to produce better estimates for this category by improving both the associated emissions factors and data on the areas of the production sites. The emissions from combustion of peat are known relatively accurately (Pipatti 2001; Monni & Syri 2003). However, the treatment of wood in the peat fuel needs further clarification.

About 30% of Finland's total land area is covered by peatlands comprising different types of boreal, wooded and open bogs and fens. Peat consists mainly of organic material formed through stratification and decomposition of litter formed by different mire plants. In Finland the peat accumulation has taken place after the ice age, during thousands of years (Mäkilä and Toivonen 2004). Part of the plant material is only partially decomposed. Peat includes also large pieces of non-decomposed wood (such as stem wood and stumps) – the share of wood in peat has been estimated to be 1.2–12.5% (mean value 2.6%) from the energy content of peat (Vesterinen 2003a, Virtanen et al. 2003). This wood in peat is largely as old as the rest of the peat material. The wood consists of the wood of the trees grown on the peatland during its long history. The exceptions are stumps and pieces of wood that may be left on the peat extraction sites when treed peatlands are cleared for the peat production.

Due to changes in the peat production, extraction and treatment techniques, the treatment of the large pieces of non-decomposed wood has been different in the national greenhouse gas inventories for the years 1990–2002. In the beginning of the 1990's, most of the wood in peat was separated from the extracted peat, and burned separately. The emissions from the combustion of this wood were treated as renewable biomass and

were not included in the national totals in the Finnish inventory in accordance with the IPCC methodologies (see Sections 3.1 to 3.3). In later years, the prevailing practice has been that the large woody pieces in peat have not been extracted separately, but crushed, milled and combusted with the rest of the peat, and all resulting CO_2 emissions have been included in the inventory totals.

Peat contains also decomposed or partly decomposed woody material which is mixed with the rest of the decomposed plant material which forms the peat. These woody components have been combusted with the rest of the peat and the treatment of emissions in the inventory has been consistent.

In the reporting of greenhouse gas emissions to the Climate Convention and under the Kyoto Protocol the methodologies in the Revised IPCC 1996 Guidelines for National Greenhouse Gas Inventories (IPCC 1997) as elaborated by the good practice reports (IPCC 2000; IPCC 2003) should be used. The guidelines require among others consistent reporting of the emissions throughout the reporting period from 1990 onwards. The treatment of wood in peat in the Finnish inventory should therefore follow the same principles for the whole period. The IPCC Guidelines and good practice reports provide limited guidance on how to estimate the emissions from peat production and combustion. It is not clear whether wood contained in peat should be classified as renewable biomass (emissions from renewable biomass fuels are not included in national totals according to the IPCC methodology) or as a fossil fuel (peat is classified as a fossil fuel in the IPCC methodology).

This study aims to clarify how emissions from combustion of the large woody pieces in peat fuel should be reported in the national greenhouse gas inventory based on scientific assessment and the general guidance in the IPCC Guidelines and good practice reports. The emissions from combustion of the above mentioned decomposed or partly decomposed woody material as well as wood from trees growing on the peatlands are not addressed further in this report. All references to "wood in peat" in the report refer to the old large non-decomposed woody pieces in the peat unless otherwise specified. Alternative options to report the emissions from combustion of the wood in the peat fuel in the national greenhouse gas inventory are proposed. The practicability and data needed to implement the options is discussed. The significance of the issue for the Finnish greenhouse gas inventory is also addressed.

2. Wood in peat

2.1 Origin of wood in peat

There are many types of peatlands in Finland. The general feature of the peatlands is that they have been formed in the course of thousands of years due to incomplete decomposition of plant material under anaerobic conditions caused by a water table that reaches (or nearly reaches) the surface of the land. The carbon balances of peatlands are complicated and vary depending on the type of the peatland and annual variations in climate. The peatlands in Finland have been estimated to be effective sinks for carbon. The rate of carbon sequestration into peat has been estimated to have increased from 2.2 Mt C/a (about 10 Mt CO_2) in 1900, when peatlands were undrained, to 3.6 Mt C/a (about 13.2 Mt CO_2) at present, when approximately 60% of the peatlands have been drained for forestry (Minkkinen et al. 2002). The peatlands are also significant sources of CH_4 emissions, which compensate for the carbon sink impact to a large extent. The carbon sequestration by the peatland can vary much for different peatland types, and also for specific sites by year depending on the climatic conditions. Peatlands can also be carbon sources under specific conditions. Carbon balances in Finnish peatlands have been studied extensively (see e.g., Laiho et al. 1996; Laine et al. 1996; Mälkki and Frilander 1997; Minkkinen 1999, Crill et al. 2000, Uppenberg et al. 2001 and Minkkinen et al. 2002).

In the Finnish Research Programme on Climate Change (SILMU 1990–1995) peat is defined as incompletely decomposed plant matter, with a mineral (ash) content of less than 10% of dry matter (Kanninen 1992). Most peatlands in Finland have been and are treed. Trees have been introduced to the areas especially during dryer periods of their thousand year old histories. Presently 60–70% of peat production areas were previously drained for forestry, and they may have tree stands of considerable volumes at the time of preparation for peat production. Dead woody material from the trees preserve well under the water-table. Wood decomposes usually very poorly under anaerobic conditions which are prevailing in peatlands. The wood in peat is estimated on average to be as old as the other plant material of which the peat is formed. Surface layers of peatlands may however contain also litter, stumps and roots of trees that have been felled before the peat extraction has started.

2.2 Wood in peat in the national greenhouse gas inventory

The average share of wood in Finnish peatland soils has been estimated to be 2.6% of the energy content of the peat (Virtanen et al. 2003). The estimate is valid for the total energy content of peat and the total amount of wood in peat in Finnish peatlands. The

wood content varies in different parts of Finland. This variation has been estimated to be 1.2–12.5% expressed as percentage of the energy content of the peat (Virtanen et al. 2003). The average values of wood in the peat combusted have not been estimated and these values could vary annually depending on the production areas for the peat combusted.

In Finland, wood in peat was earlier separated from the peat fuel. The wood was collected to the edge of the peat production area and chipped. Woodchips were then used in the nearby power plants. The CO_2 emissions were reported as emissions from renewable biomass and not included in the total national greenhouse gas emissions. The reasons for this are very practical: the energy statistics do not differentiate the sources of wood.

Since about 1980 new technologies have been gradually developed and used in peat production and the wood in peat has been increasingly mixed in the produced peat fuel. When the amount of wood in peat is small, and the pieces of wood are small as well, the wood in peat is milled with a cutter and mixed in the peat fuel. The emissions from combustion of the wood in peat are included in national inventory, as the fuel is identified as peat in energy statistics.

The inventory compiler has been faced with the issue of "wood in peat" only recently. There is a methodological inconsistency in the reporting of the wood in peat, as the wood in peat has been reported partly as renewable biomass and partly as peat in inventories for the period of 1990–2002.

The co-combustion of peat and wood from renewable sources (such as industrial wood residues and wood harvested for combustion) is common in Finland. Here the wood is clearly renewable and treated as such in the national greenhouse gas inventory. The two issues are separate and should not be mixed up.

2.3 Wood content in peat - methods and uncertainties in the estimates

There are alternative techniques/methods to estimate the wood content in peat. A so-called “plicting” method has used for the estimates on the content of large pieces of non-decomposed wood above. The Geological Survey (GTK) has studied Finnish peat reserves since 1943, and has used this method to estimate the wood in peat systematically since 1975 (Virtanen et al. 2003). A two meter long bar is sticked into the peatland to identify pieces of wood in the peat. The hit rate X (Equation 1),

$$X = n*100/ (N*h) \quad (1),$$

where n is the number of hits, N is the number of plicting points and h is the mean depth of the plicting point, is used to estimate the amount of wood in the peat, with the help of the an experimental relationship (Pavlov's curve) between the hit rate and the wood content (%). The uncertainties of the method are not known. The plicting points can be unevenly distributed in the peatland under study and wood pieces which are so small that they are not detected by the "plicting" are not taken into account in the estimate of the wood content.

The results of the plicting have been used to estimate the amount of large pieces of wood in the peatlands. The estimates for different regions have varied from 0.1 to 2.5% which equals 0.5[1]–12.5% of the energy content of the peat. The uncertainties in the plicting method have been estimated to be large, but quantitative estimates on the uncertainties are not available.

Some individual case studies, in which the results of the plicting method have been compared with the amount of wood in peat extracted from the field, have been made. These indicate that the "plicting" method underestimates the wood content in peat; in some cases the relative error has been as large as 75% (Paappanen and Leinonen, 2003).

Other methods like determining the wood content from samples of peat fuel have been developed and studied. These are not usually comparable to the plicting method as they estimate also other woody fractions in the wood.

2.4 CO2 emission factor for peat combustion - impact if wood in peat would be considered as a renewable biomass fuel

The IPCC default value for CO_2 emissions from peat combustion is 106 g CO_2 /MJ. This value has been used in the Finnish national greenhouse gas inventory. It corresponds well with the results of a recent study on the estimation of the emission factor based on analyses of peat delivered at Finnish power plans during the period of May 2002 - May 2003 (Vesterinen 2003a). The average emission factor calculated based on the analyses was 105.9 g CO_2/MJ (range 105.3–106.5 g CO_2/MJ). The water content in peat has a significant impact on the emission factor. The corresponding average emission factor for dry peat is 95.8 g CO_2/MJ (range 95.3–96.4 g CO_2/MJ). So far, as peat fuel is not dried before combustion, the use of the default value 106 g CO_2/MJ in the Finnish inventory is recommended and in line with Finnish

[1] The lowest value of the range applies for Lapland. This value has not been used in study.

measurements to determine the actual country-specific value. The wood contained in peat has not been taken into account in the measurements (Vesterinen 2003a, b).

If wood in peat would be regarded as a renewable biomass fuel for which the CO_2 emissions would not need to be included in the total inventory – then the emission factor for combustion of the mixture of peat and wood should be lowered. The mean value of 2.6% wood in peat (percentage calculated from the energy content of peat) would give a reduction of 2.8 g CO_2/MJ in the emission factor. In the upper range of the estimated wood content in peat a decrease 13.3 g CO_2/MJ (wood content 12.5%) would be the result and in the lower range 1.3 g CO_2/MJ (wood content 1.2%). The range for the emission factor for combustion of peat would then be 92.7–104.7 g CO_2/MJ, when the value 106 g CO_2/MJ (IPCC default value) is taken as the reference. The average value of the emission factor would be 103.2 g CO_2 /MJ. The lower range the value 92.7 g CO_2 /MJ is similar in size with the value for combustion of coal (IPCC default value 93 g CO_2 /MJ).

Estimates for wood content in the peat fuel combusted in Finland since 1990 are not available, and further work would be needed to determine this. The average values of wood in peat in Finland could serve as a preliminary estimate.

3. IPCC Guidelines and good practice guidance reports

3.1 General considerations

It is not quite clear how the wood in peat should be considered in estimating the CO_2 emissions from combustion. There are two basic alternatives, to consider

i. wood in peat as peat (a fossil fuel in the IPCC categorisation), or
ii. wood in peat as renewable biomass.

In the following sections, solutions to the problem are sought from the IPCC Guidelines and good practice reports.

3.2 General principles, source/sink and fuel categories, and definitions

National greenhouse gas inventories under the United Nations Framework Convention on Climate Change (UNFCCC) should be prepared using methodologies given in the Revised 1997 IPCC Guidelines for National Greenhouse Gas Inventories (abbreviated as IPCC Guidelines in this report) (IPCC 1997), the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (abbreviated as GPG2000) (IPCC 2000) and the Good Practice Guidance for Land Use, Land-Use Change and Forestry (abbreviated as GPG-LULUCF) (IPCC 2003). The IPCC Guidelines and good practice reports encourage the use of national methods, but these should be consistent with the general framework for estimating and reporting emissions/removals given in the reports.

The good practice guidance reports complement the IPCC Guidelines. The IPCC good practice reports define inventories consistent with good practice as those which contain neither over- nor underestimates so far as can be judged, and in which uncertainties are reduced as far as is practicable. Good practice further supports the development of inventories that are transparent, documented, consistent over time, complete, comparable, assessed for uncertainties, subject to quality control and assurance, efficient in the use of resources available to inventory agencies, and in which uncertainties are reduced as better information becomes available. These main principles have been adopted by the UNFCCC and apply to all inventory reporting.

The common reporting framework is given in the Reporting Instructions of the IPCC Guidelines. The IPCC source/sink categories are Energy, Industrial Processes, Solvent

and Product Use, Agriculture, Land Use, Land-Use Change and Forestry (LULUCF) and Waste. Emissions from peat combustion are addressed in the Energy sector; emissions associated with drainage of peatlands as well as peat extraction are addressed in the LULUCF sector. Part of the guidance on emissions/removals from drainage of peatlands and peat extraction is included in appendices to indicate the preliminary nature of the guidance. Countries do not have to prepare estimates for the categories in the appendices.

3.3 Specific guidance on peat and wood in peat

The common reporting framework includes common terms and definitions for fuel categories. Peat is defined in the category of solid fuels which includes also coal and coal products. Wood is defined as a biomass fuel. The CO_2 emissions from biomass fuels should be estimated but not included in the total national emissions.

The definition of peat in the IPCC Guidelines is *"combustible, soft, porous or compressed sedimentary deposit of plant origin with a high water content (easily cut, of light to dark brown colour)"*. Biomass is defined in the GPG-LULUCF as *"organic material both aboveground and belowground, and both living and dead, e.g. trees, crops, grasses, tree litter, roots etc. Biomass includes the pool definition for above - and belowground biomass"*.

GPG-LULUCF does not give a definition for peat. Peat soil (also histosol) is defined as "*a typical wetland soil with a high water table and an organic layer of at least 40 cm thickness (poorly drained organic soil)"*. Organic soils are given a lengthy definition originating from FAO (1998) based on the thickness of the soils and its organic matter content. The origin of the organic matter - woody or other plants - is not addressed.

The pool definitions given in the GPG-LULUCF are in Table 1.

The IPCC Guidelines or good practice reports give no specific guidance whether wood in peat should be considered as part of the peat or as e.g. dead organic matter.

According to the pool definitions in the GPG-LULUCF peat is considered as soil organic matter. Wood could be considered as part of the peat as the peat definitions given do not distinguish between the origins of the organic matter - woody or other plant material. Soil organic matter is excluded from the biomass definition which encompasses only aboveground or belowground biomass.

Dead wood pool is defined to include all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil (see Table 1). This definition could be applied to wood in peat. In the methodology for forest lands in the GPG-LULUCF to estimate changes in the carbon stock for the dead wood pool cover gains and losses e.g. due to harvesting and disturbances. The default factors cover a time period of 20 years - this time scale is not applicable to peat formation where the changes cover a period of thousands of years. National factors would be needed.

The methodology for peat extraction in the Wetland section of the GPG-LULUCF assumes that the dead organic matter pool is not significant in peat extraction lands. If a country has data on dead organic matter, it can be included in the estimates under Tier 2 or 3 methods. As above for forest land - the changes of the dead wood pool should include both gains and losses of carbon. If the wood in peat would be considered as part of the dead wood pool, then the wood harvested with the peat in lands converted to peat extraction should be considered as a loss term (causing emissions). The CO_2 emissions from the combustion of the wood would then not be reported to avoid double counting.

Table 1. Definitions for terrestrial pools given in chapter 3 in GPG-LULUCF.

Pool		Description (see also note below)
Living Biomass	Aboveground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage. Note: In cases where forest understorey is a relatively small component of the above-ground biomass carbon pool, it is acceptable for the methodologies and associated data used in some tiers to exclude it, provided the tiers are used in a consistent manner throughout the inventory time series as specified in Chapter 5 of *GPG-LULUCF* (Cross-cutting Issues).
	Belowground biomass	All living biomass of live roots. Fine roots of less than (suggested) 2mm diameter are often excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead Organic Matter	Dead Wood	Includes all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.
	Litter	Includes all non-living biomass with a diameter less than a minimum diameter chosen by the country (for example 10 cm), lying dead, in various states of decomposition above the mineral or organic soil. This includes the litter, fumic, and humic layers. Live fine roots (of less than the suggested diameter limit for below-ground biomass) are included in litter where they cannot be distinguished from it empirically.
Soils		Includes organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series. Live fine roots (of less than the suggested diameter limit for below-ground biomass) are included with soil organic matter where they cannot be distinguished from it empirically.
Note: National circumstances may necessitate slight modifications to the pool definitions used here. Where modified definitions are used, it is good practice to report upon them clearly, to ensure that modified definitions are used consistently over time, and to demonstrate that pools are neither omitted nor double counted.		

4. Options for consistent reporting of "wood in peat" in the finnish greenhouse gas inventory

Questions regarding how wood in peat should be considered include:

i. the role of the age of wood in peat in considering whether it should be treated as a renewable biomass fuel, and
ii. practical issues like data availability/needs for inventories are addressed here (e.g. how do statistics cover "wood in peat").

The time of renewal has been an important factor in the defining a fuel as “biomass fuel” or “fossil fuel” (Savolainen et al. 1994). Is it justified from a scientific point of view to consider wood in peat as a CO_2 emission neutral fuel (biomass fuel), or is it reasonable to treat wood in peat as peat (comparable to fossil fuel)? The time scales relevant for the stabilisation of the CO_2 concentration in the atmosphere are according to the IPCC Third Assessment report (IPCC 2001) in the order of 100–300 years. About half of emitted amount of CO_2 will be in the atmosphere after 100 years. The renewal time of forests (average age of harvested wood) in Finland is around 60–80 years; in the Northern Finland the renewal times can be longer and in temperate and in tropical climates shorter. Because the renewal time is clearly shorter than the time horizon considered for the stabilisation of atmospheric concentration, these biomass sources can be regarded as renewable for climate considerations. However, the age of the wood in peat is typically several thousand years. The treatment of wood in peat should according to these considerations be comparable to the rest of peat material or fossil fuels as its age exceeds clearly many times the time horizon for the stabilisation of the atmospheric CO_2 concentration.

The reported emissions and removals in national greenhouse gas inventories should be recalculated to improve the accuracy of the estimates and to ensure consistency in time series when improved data becomes available or methods used in preparing the estimates are changed. In this case, recalculations would require data on the amount of "wood in peat" combusted separately and with the peat for the period from 1990 to the current year and beyond. This data is not available at present. The resources needed to get this data as well as the significance of the recalculations are important factors when considering the feasibility of recalculations in this issue.

In this section two options to for consistent reporting of "wood in peat" are given. Pros and cons of the alternatives for recalculation (Option 1 and Option 2 below), as well as continuing reporting of the emissions as is currently done (Option 3 below), are presented. Implications of applying the options to the Finnish greenhouse gas inventory are discussed.

4.1 Option 1: Wood in peat treated as other organic material in peat (comparable to fossil fuel)

Pros:

This alternative is probably most in agreement with the scientific character of the wood in peat. Wood in peat is about as old as other dead plant material forming the peat, and carbon in wood has accumulated from the atmosphere by the same mechanism as other carbon in peat. The exception is wood derived from the tree stand prevailing at the site at the time of preparation of the peat production field which is "contemporary" wood, analogous to wood biomass.

Cons:

Corresponding changes in the greenhouse gas inventory would require data on the amount of wood in peat that was separated and combusted as biomass during 1990–2000. It is not clear, whether these data have been collected, or if reliable estimates of the amounts can be made. Recalculations in national inventories that increase the base year emissions (or decrease current emissions) will be scrutinised in inventory reviews under the UNFCCC. All changes will need to be justified with increased accuracy of the estimates, and may need to be backed with statistical data or measurements.

The figures in the energy statistics would differ from the data in the greenhouse gas inventory, unless the corresponding changes would be made there. This may be impossible for the past years. Data collection for future inventories would need to be improved to produce annual data on wood in peat and its fate.

Implications to the Finnish greenhouse gas inventory:

Emissions in the year 1990–2002 should, if this alternative would be chosen, be increased by the amount of wood in peat that was combusted separately and for which the CO_2 emissions were not included in the inventory.

The significance of the recalculations in the inventory is estimated as follows: CO_2 emissions due to peat combustion were 5.9 Mt CO_2 in 1990. Assuming that all wood in peat was separated in the base year 1990 and that the average wood content in peatlands, 2.6% (range 1.2–12.5%) wood in peatland soil estimated from the energy content of peat would be applicable also in 1990, the emissions would be increased with 0.2 Mt CO_2 (range 0.1–0.8 Mt CO_2) and the emissions from peat combustion would be 6.1 Mt CO_2 (6.0–6.8 Mt CO_2). This would mean an increase of 2.6% (1.2–12.5%) in the CO_2 emissions from peat production. The increase in the total national emissions would

be only 0.2% (0.1–1.0%). The estimate is calculated using the default emission factor for peat combustion.

It is unclear whether and how the recalculation should address the emissions of the non-CO_2 gases. These are very much dependent on the combustion technology and conditions. The emissions are calculated using emission factors which are different for wood and peat combustion - and different technologies. E.g. CH_4 emission factor are on average higher for wood that for peat, for N_2O emissions the situation is vice versa.

In this option, the increase in the base year emissions would be relatively small. The uncertainties of the figure are also large, as information on how much of the wood had been separated in 1990 was not available for the calculations. A reliable estimate of this value would be needed for the recalculation. The more recent years would need to be recalculated according to the same principles, but in case the statement that most wood in peat is currently crushed and combusted with the peat is true, these emissions would not change at all or very little. Reliable data to back these assumptions would be needed.

The data on CO_2 emissions from biomass combustion would need to be changed accordingly in the inventory. These would however have no implications on the total national emissions.

4.2 Option 2: Wood in peat treated as CO_2 emission neutral wood (biomass fuel)

Pros:

In cases where the wood is combusted separately from the peat this option could use the data wood consumption in the energy statistics without modifications.

Cons:

Scientific considerations do not support this alternative.

Recalculations in the inventory would be needed to reduce the emissions from peat to account for wood in peat combusted with the peat in recent inventories.

The figures in the energy statistics would differ from the data in the greenhouse gas inventory, unless the corresponding changes would be made there. This may be

impossible for the past years. Data collection for future inventories would need to be improved to produce annual data on how much wood in peat is combusted with the peat.

Wood harvested with the peat would need to be included in the inventory in the LULUCF sector to follow the guidance in the GPG-LULUCF.

Implications to the Finnish greenhouse gas inventory:

The emissions from peat combustion from 1990–2002 would need to be recalculated. The base year emissions would change very little or not at all under the assumption that wood in peat in 1990 was separated almost totally from the peat before combustion. The more recent year emissions from peat combustion would become lower. The CO_2 emissions from peat combustion in 2002 were 9.3 Mt CO_2. Assuming that all wood in peat was combusted with the peat and using the assumption above for the wood content, the emissions in 2002 would be reduced by 0.2 Mt CO_2 (0.1–1.2 Mt CO_2). The impact on the total emissions in 2002 would be about 0.3% (0.1–1.4%). The impact of Option 2 in 2002 is slightly larger than that of Option 1 on the base year emissions as the amount of peat combusted in 2002 is larger than that in the base year. If peat combustion would remain at the current level in the commitment period 2008–2012, this would be the order of magnitude of the maximum reductions in the Finnish emissions.

Again, the impact on the estimated non-CO_2 emissions would be more difficult to estimate. It is likely that the impact is small.

In this option, the CO_2 emissions from peat combustion could be lowered (the emission factor for the woody fraction would be equal to zero). The CO_2 emissions from the wood in peat would also need to be estimated and included in the emissions from biomass fuels (these are not included in the total national emissions but reported to the UNFCCC for completeness). The total amount of wood harvested would also need to be increased accordingly in the LULUCF Sector.

4.3 Option 3: Wood in peat is treated as biomass when combusted separately, otherwise as peat - current practice

Pros:

There would be no need for recalculations in the inventory or data collection. Energy statistics and activity data used in the inventory would be consistent.

Cons:

Scientific considerations do not support this alternative.

The treatment of wood in peat would be inconsistent in the greenhouse gas inventories. One of the main principles in inventory preparation is to produce consistent time series. However, as maintaining this small inconsistency in the inventory would decrease base year emissions and increase current emissions, it should not lead to any adjustments under the Kyoto Protocol.

Implications to the Finnish greenhouse gas inventory:

The treatment of wood in peat would be inconsistent, and disadvantageous for Finland. The impacts on the total emissions would however be small when the current best estimates on the wood content in peat are used in the estimates, in the order of 0.2–0.3% (range less than 0.1 - to a little more than 1%). However, the wood content of peat varies much, and the method for estimating the wood in peat may underestimate (or overestimate) its share in peat fuel.

5. Discussion

Peat is an important domestic fuel in Finland and its production and combustion a significant source in the Finnish greenhouse gas inventory. The estimation of CO_2 emissions from wood in peat has not captured the changes in its combustion, and the emissions have been reported in an inconsistent way in the Finnish greenhouse gas inventory. The reasons for this have been lack of data on the issue as well as practical. The current data collection and energy statistics support treating wood in peat as peat, when combusted with the peat, and as wood (biomass fuel) when separated from the peat and combusted separately. There is also no specific direct guidance on this issue in the IPCC Guidelines and good practice reports.

The percentage of wood in peat is estimated to differ considerably in Finnish peatlands, regional differences are significant. The mean value of wood in peat has been estimated to be 2.6% from the energy content of peat (Virtanen et al. 2003). Two options for consistent treatment of wood in peat in inventories have been put forward in this report, in addition to continuing current reporting practice (Option 3). These options are - treating wood in peat as other organic material in peat comparable to fossil fuel (Option 1) or as a renewable biomass (Option 2). Both options have a similar impact on the Finnish emission reduction burden under the Kyoto Protocol under the assumptions that peat combustion would remain at current level in the commitment period. Applying the options could reduce this burden by 0.2–0.3% (the range is from less than 0.1% to a little more than 1%) using current estimates of the wood content in peat soils and assuming that wood in peat was separated almost totally from peat in the base year 1990, and that it would be almost totally be mixed with peat during the commitment period when combusted.

The Option 2, considering wood in peat as a renewable biomass fuel would lower the average emission factor for peat with approximately 3 g CO_2 /MJ (the present default value is 106 g CO_2 /MJ). The wood content percentage 12.5% estimated for the Päijät-Häme area would give a larger reduction in the emission factor, 13 g CO_2 /MJ. This would lower the emission factor very close to the emissions factor of coal (93 g CO_2/MJ). This kind of a change could increase the competitiveness of peat in the energy markets.

The scientific considerations support that wood in peat should be considered as peat when estimating the CO_2 emissions (Option 1). To be consistent, also wood which has been extracted with the peat but burned separately should be considered as peat (Option 1). Re-evaluation of the 1990 inventories might then give some benefit to Finland as the emission level of 1990 would be increased. The amount of increase in base year emissions (1990), if estimated on the basis of mean value of wood in peat (2.6%), is

rather small, only about 0.2 Mt CO_2. Hence, Option 3 (continuing current practice) is in practice quite close to the Option 1 from the view point of the greenhouse gas inventory. If in the future some peat fuel users select separating wood from peat, this could lead to somewhat uneconomic use of resources from the national viewpoint.

Applying both Option 1 and 2 would require additional resources for data collection and possibly measurements of the wood content in peat fuel; the resources needed for implementing recalculations in the inventory should neither be underestimated.

There are also other gaps in knowledge and uncertainties which influence on the emissions of peat, especially when the whole peat production chain is considered. These may have impacts on the emissions that are much larger than the impact of wood in peat. These are being considered in the Research Programme on Greenhouse Impacts of the Use of Peat and Peatlands in Finland, among others in the project Greenhouse Impact of the Energy Use of Peat and Peatlands – Estimation of the Greenhouse Impact for Alternative Peat Production Chains.

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Peat is an important fuel in Finland. Peatlands which are used in the production of the peat fuel, contain also wood. This wood has once grown on the peatland but been buried in the peat during the thousands of the years of the development of the peatland. The report considers how this wood should be taken into account in the context of emission reporting under the United Nations Framework Convention on Climate Change.

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