CHAPTER 4

METHODOLOGICAL CHOICE AND IDENTIFICATION OF KEY CATEGORIES

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4 METHODOLOGICAL CHOICE AND IDENTIFICATION OF KEY CATEGORIES

ELABORATION OF VOLUME 1, CHAPTER 4 OF THE 2006 IPCC GUIDELINES.

4.1 INTRODUCTION

Elaboration of section 4.1 of the *2006 IPCC Guidelines*.

This chapter addresses how to identify *key categories*[1] in a national inventory. Methodological choice for individual source and sink categories is important in managing and where possible reducing the overall inventory uncertainty. Generally, inventory uncertainty is lower when emissions and removals are estimated using the most rigorous methods provided for each category or subcategory in the sectoral volumes of these *Guidelines*. However, these methods generally require more extensive resources for data collection, so it may not be feasible to use more rigorous method for every category of emissions and removals. It is therefore *good practice* to identify those categories that have the greatest contribution to overall inventory uncertainty in order to make the most efficient use of available resources. It is also important to identify categories which contribute significantly to the national totals to ensure that they are compiled accurately and that the data needed to update their estimates is sufficiently maintained. By identifying these *key categories* in the national inventory, inventory compilers can prioritise their efforts and improve their overall estimates.

4.1.1 Definition

Update of Section 4.1.1 of the *2006 IPCC Guidelines*.

Key categories are inventory categories which individually, or as a group of categories (for which a common method, emission factor and activity data are applied) are prioritised within the national inventory system because their estimates have a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level, the trend, or the level of uncertainty in emissions or removals. Whenever the term *key category* is used, it includes both source and sink categories.

4.1.2 Purpose of the key category analysis

Elaboration of Section 4.1.2 of the *2006 IPCC Guidelines*.

Key category analysis helps the "Inventory Management System" (see section 1.5 of chapter 1) identify the priority categories for which the methods, activity data, emission factors and other parameters should be maintained, more rigorously checked and reviewed and, where necessary, improved.

- **Maintained**: Making sure the methods, data flows and country specific emission factors are kept up to date and available for important regular estimate updates.
- **More rigorous checking and review**: Making sure that specific QA/QC activities are implemented for key categories. It is *good practice* to give additional attention to *key categories* with respect to quality assurance and quality control (QA/QC) as described in Chapter 6, Quality Assurance/Quality Control and Verification, and in the sectoral volumes.
- **Improvement**: Improving accuracy of estimates and reducing overall uncertainty using higher tiered (more accurate) methods. In general, more detailed higher tier methods should be selected for *key categories*. Inventory compilers should use the category-specific methods presented in sectoral decision trees in Volumes 2-5. For most sources/sinks, higher tier (Tier 2 and 3) methods are suggested for *key categories*, although this is not always the case. For guidance on the specific application of this principle to *key categories*, it is *good practice* to refer to the decision trees and sector-specific guidance for the respective category and additional *good practice guidance* in chapters in sectoral volumes. In some cases, inventory compilers may be unable to adopt a higher tier method due to lack of resources. This may mean that they are unable to collect the required

[1] In Good Practice Guidance for National Greenhouse Gas Inventories (*GPG2000*, IPCC, 2000), the concept was named 'key source categories' and dealt with the inventory excluding the LULUCF Sector.

data for a higher tier or are unable to determine country specific emission factors and other data needed for Tier 2 and 3 methods. In these cases, although this is not accommodated in the category-specific decision trees, a Tier 1 approach can be used, and this possibility is identified in Figure 4.1 of the *2006 IPCC Guidelines*. It should in these cases be clearly documented why the methodological choice was not in line with the sectoral decision tree. Any *key categories* where the good practice method cannot be used should have priority for future improvements.

It is *good practice* for each country to identify and communicate its national *key categories* in a systematic and objective manner as presented in this chapter. Such a process will help countries to prioritise available resources for (key) category methods, data sources and assumptions and will lead to improved inventory quality, as well as greater confidence in the estimates that are developed.

4.1.3 General approach to identify key categories

Elaboration of Section 4.1.3 of the *2006 IPCC Guidelines*.

Key category analysis should be applied in all circumstances of inventory compilation no matter how simple or basic the inventory is. A category can be identified as a key for different reasons. These include:

- **Level**: Their absolute level of contribution to the overall GHG totals for a particular year of interest.
- **Trend**: Their change across a time series. Particularly important for categories that are showing increasing trends across a time series.
- **Uncertainty**: If the contribution of a category's uncertainty to total inventory uncertainty in a particular year, or the trend uncertainty is high then the category should be identified as key.
- In addition to making a **quantitative determination** of *key categories*, it is *good practice* to consider the qualitative criteria for identifying categories that are likely to need prioritised attention (e.g. expected significant trends, categories not estimated or with suspected high uncertainty) as described in more detail in Section 4.3.3.

Section 4.3 presents the detailed methodology for the above cases of key category analysis under two approaches. Approach 1 where key category analysis is done without incorporating uncertainties and approach 2 where information on uncertainties is included.

As explained in section 4.1.2 above, the main objective of key category analysis is to identify and prioritise key categories within the inventory management system. Therefore, it is helpful to consolidate the different analysis of the level and trend with and without uncertainty analysis into a single summary list of key categories. This makes engagement with key stakeholders easier and communication of the key prioritise possible. Further guidance on combining the different key category analysis is presented in section 4.4 below.

Guidance on reporting and documentation of the key category analysis is provided in Section 4.5. Section 4.6 gives examples for *key category* identification.

4.2 GENERAL RULES FOR IDENTIFICATION OF KEY CATEGORIES

Update of section 4.2 of the *2006 IPCC Guidelines*.

The results of the *key category* identification will be most useful if the analysis is done at the appropriate disaggregation level of categories. Table 4.1 provides guidance on the aggregation levels to consider. Countries should adapt their own level of aggregation aligned with their methods, data sources and assumptions used with a minimum level of disaggregation presented in Table 4.1 to national circumstances. Countries using Approach 2 will probably choose the same level of aggregation that was used for the uncertainty analysis. Disaggregation to very low levels of subcategories that are all covered by a single method and use of emission factor should be avoided since it will split an important aggregated category into many small subcategories that may be no longer considered as *key*. The following guidance describes *good practice* in determining the appropriate level of disaggregation of categories to identify *key categories*:

- **IPCC Category and method aligned category group level:** The analysis should be performed at the level of IPCC categories or subcategories at which the IPCC methods are applied in the inventory. Table 4.1

provides a guide to this level. Countries may choose to perform the quantitative analysis at a more disaggregated level than suggested in this table. This can be justified where methods applied to the disaggregated subcategories are different. In this case, possible cross-correlations between categories and/or subcategories should be taken into account when performing the key category analysis[2]. When using Approach 2, the assumptions about such correlations should be the same when assessing uncertainties and identifying key categories (see Chapter 3, Uncertainties).

- **Individual gas level:** Each greenhouse gas emitted from each category should be considered separately, unless there are specific methodological reasons for treating gases collectively (e.g. the same method, data sources and assumptions are applied and uncertainties are similar). For example, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are emitted from road transportation. The key category analysis for this source should be performed for each of these gases separately because the methods, assumptions, emission factor data sources and related uncertainties differ for each gas. In contrast, a collective analysis of all chemical species of hydrofluorocarbons (HFCs) is appropriate for a sub category of 'Product Uses as Substitutes for Ozone Depleting Substances' where their emissions are estimated using a single model/method, and a common set of data sources and assumptions.

- **Emissions and removals**: If data are available, the analysis should be performed for emissions and removals separately within a given category. For example, the land use categories and the pool estimates can include emissions and removals that may cancel or almost cancel at the aggregated level for the categories presented in Table 4.1 resulting in an aggregated net estimate that does not qualify as a *key category* despite the components (emissions and removals separately) being significant. This separation of emissions and removals is also important where methods, data sources and assumptions are different for estimating emissions and removals for a category. l. Similar considerations may apply in the Energy and IPPU (Industrial Processes and Product Use) Sectors, for example, in a situation where CO_2 is being captured for storage.

- **Indirect N_2O** emissions from deposition of NO_x and other nitrogen compounds from categories other than AFOLU (Agriculture, Forestry and Other Land Use) Sectors are included in the key category analysis in category 5A, Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3. However, the *2006 IPCC Guidelines* do not provide decision trees or methodological guidance for estimating emissions from NO_x and NH_3, and therefore identification of indirect N_2O as key does not have an effect on the methodological choice.

Aggregation of categories for key category analysis

Table 4.1 presents guidance on the aggregation of categories for which estimation methods are provided in the sectoral volumes. Countries should always separate by gas, as uncertainties and assumptions are usually different (e.g. between CO_2, N_2O, CH_4). Gasses can be aggregated where the methods, data sources, assumptions and likely uncertainties are the same for a group of gases (e.g. F-Gases for some categories). Countries should only disaggregate by subcategory or fuel beyond the level suggested where activity data, assumptions and/or emission factors are from different sources and/or uncertainties are likely to be significantly different. Once the level of aggregation has been finalised, the inventory compiler should determine if certain subcategories are particularly significant and highlight them for particular consideration. Usually, for this purpose, the subcategories can be ranked according to their contribution to the aggregate *key category*. Those subcategories that contribute together more than 60 percent to the *key category* should be treated as particularly significant. If countries develop estimates for new categories or gases for which GWPs become available, these should be added to the analysis under Miscellaneous for the appropriate sector. It is not possible to include gases for which no GWP is available since the analysis is performed using CO_2-equivalent emissions[3].

[2] Most correlations between categories can be avoided by using the aggregation level of this table. Some correlations remain, e.g., in fuel use between stationary combustion and transportation and for HFCs. In practice, the effect of correlations for key category analysis should be taken into account in the disaggregation level used for the Approach 2 assessment (for more advice on correlations in uncertainty analysis, see Chapter 3.)

[3] The methodology is also applicable for other weighting scheme, but for the derivation of threshold for Approach 1 and 2 and for the examples in Section 4.5 CO_2-equivalent values were calculated using the global warming potentials (GWP) over a 100 year horizon of the different greenhouse gases, provided by the IPCC in its Third Assessment Report (TAR).

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TABLE 4.1
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1[a]

Source and Sink Categories to be Assessed in Key Category Analysis		**Gases to be Assessed separately [c]**	**Category aggregation/disaggregation Considerations[4]**
Category Code [b]	**Category Title [b]**		
Energy			
1A1 & 1A2	Energy and manufacturing Industry Fuel Combustion Activities	CO_2, N_2O, CH_4	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors (e.g. energy balances and default or average country specific emission factors) with similar uncertainties can be aggregated. Common reasons for disaggregation can include differences in uncertainty for estimates of emissions for different fuels (disaggregation by main fuel type) or the application of tier 2 or 3 methods for categories or sub-categories.
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2, N_2O, CH_4	Disaggregation could be considered where data for different fuels is sourced from different data providers and different methods are used for small and major airports.
1A3b	Fuel Combustion Activities - Transport - Road transportation	CO_2, N_2O, CH_4	Disaggregate by fuel if fuel data is sourced from different data providers and likely to have different levels of accuracy.
1A3c	Fuel Combustion Activities - Transport - Railways	CO_2, N_2O, CH_4	Disaggregation could be considered where data (e.g. on fuels) is sourced from different data providers and different methods are used for different types of transport
1A3d	Fuel Combustion Activities - Transport - Water-borne Navigation	CO_2, N_2O, CH_4	Disaggregation could be considered where data (e.g. on fuels) is sourced from different data providers and different methods are used for different types of transport.
1A3e	Fuel Combustion Activities - Transport - Other Transportation	CO_2, N_2O, CH_4	Disaggregation could be considered where data (e.g. on fuels) is sourced from different data providers and different methods are used for different types of transport.
1A4	Fuel Combustion Activities - Other Sectors	CO_2, N_2O, CH_4	
1A5	Fuel Combustion Activities - Non-Specified	CO_2, N_2O, CH_4	
1B	Fugitive emissions from fuels	CO_2, CH_4	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely

[4] Only disaggregate further by subcategory, fuel and/or gas where activity data and emission factors are from different sources and/or uncertainties are significantly different.

			differences in uncertainty. Estimates compiled from a common set of activity data and emission factors (e.g. energy balances or industry data and default or average country specific emission factors) with similar uncertainties can be aggregated. Common reasons for disaggregation can include differences in uncertainty for estimates of emissions for different parts of fuel exploration and distribution, technologies or the application of tier 2 or 3 methods for categories or sub-categories.
1C	Carbon Dioxide Transport and Storage	CO_2	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors (e.g. energy balances or industry data and default or average country specific emission factors) with similar uncertainties can be aggregated.
1	Miscellaneous	CO_2, CH_4, N_2O	Assess whether other sources in the Energy Sector not listed above should be included. Key category analysis has to cover all emission sources in the inventory. Therefore, all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
Industrial Processes and Product Use			
2A1	Mineral industry - Cement Production	CO_2	
2A2	Mineral Industry - Lime Production	CO_2	Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated. Common reasons for disaggregation can include the application of tier 2 or 3 methods for categories or sub-categories.
2A3	Mineral Industry - Glass Production	CO_2	Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated. Common reasons for disaggregation can include the application of tier 2 or 3 methods for categories or sub-categories.

TABLE 4.1 (CONTINUED)
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1 [a]

Source and Sink Categories to be Assessed in Key Category Analysis		Gases to be Assessed separately	Category aggregation/disaggregation Considerations
Category Code [b]	**Category Title [b]**		
2A4	Mineral Industry - Other Process Uses of Carbonates	CO_2	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated.
2B1	Chemical Industry - Ammonia Production	CO_2	
2B2	Chemical industry - Nitric Acid Production	N_2O	
2B3	Chemical industry - Adipic Acid Production	N_2O	
2B4	Chemical industry - Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated.
2B5	Chemical industry - Carbide Production	CO_2, CH_4,	
2B6	Chemical industry - Titanium Dioxide Production	CO_2	
2B7	Chemical Industry - Soda Ash Production	CO_2	
2B8	Chemical Industry - Petrochemical and Carbon Black Production	CO_2, CH_4	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated.
2B9	Chemical Industry - Fluorochemical Production	HFCs, PFCs, SF_6, and other halogenated gases should be aggregated.	If this category is key, the inventory compiler should determine which subcategories/gases (e.g., HFC-23 from HCFC-22 production) are significant.
2C1	Metal Industry - Iron and Steel Production	CO_2, CH_4	
2C2	Metal Industry - Ferroalloys Production	CO_2, CH_4	
2C3	Metal Industry - Aluminium Production	PFCs should be aggregated., CO_2	PFCs should be assessed jointly. CO_2 should be assessed separately.
2C4	Metal Industry - Magnesium Production	CO_2 SF_6, PFCs, HFCs, other halogenated	Methods for HFCs, PFCs and other halogenated gases are only provided at Tier 3 level. If they are not included in the inventory it is good practice to use

		gases should be aggregated.	qualitative considerations (see Section 4.3.3.).
2C5	Metal Industry - Lead Production	CO_2	
2C6	Metal Industry - Zinc Production	CO_2	
2D	Non-Energy Products from Fuels and Solvent Use	CO_2	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated.
2E	Electronics Industry	SF_6, PFCs, HCFs, other halogenated gases can be aggregated.	If this category is key, the inventory compiler should determine which subcategories are significant.
2F1	Product Uses as Substitutes for Ozone Depleting Substances - Refrigeration and Air Conditioning	HFCs and PFCs can be aggregated.	These categories should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated.
2F2	Product Uses as Substitutes for Ozone Depleting Substances - Foam Blowing Agents	HFCs can be aggregated.	
2F3	Product Uses as Substitutes for Ozone Depleting Substances - Fire Protection	HFCs, PFCs can be aggregated.	
2F4	Product Uses as Substitutes for Ozone Depleting Substances - Aerosols	HFCs, PFCs can be aggregated.	
2F5	Product Uses as Substitutes for Ozone Depleting Substances - Solvents	HFCs, PFCs can be aggregated.	
2F6	Product Uses as Substitutes for Ozone Depleting Substances - Other Applications	HFCs, PFCs can be aggregated.	
2G	Other Product Manufacture and Use	SF_6, and PFCs can be aggregated N_2O treated separately	All PFC gases and SF_6 should be assessed jointly. If this category is key, the inventory compiler should determine which subcategories are significant. N_2O should be assessed separately.
2	Miscellaneous	CO_2 , CH_4, N_2O should be assessed separately HFCs, PFCs and SF6, other halogenated gases can be aggregated	Assess whether other sources in the Industrial Processes and Product Use Sector not listed above should be included. Key category analysis should cover all emission sources in the inventory. Therefore, all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
Agriculture, Forestry and Other Land Use			

3A1 & 3A2	Livestock: Enteric Fermentation & Manure Management	CH_4, N_2O	If different methods are used to estimate emissions for enteric fermentation and manure management, then it is best to disaggregate enteric fermentation and manure management. If there are also differences in the data sources, assumptions applied and uncertainties for the different animal numbers and or management practices then these should also be disaggregated. If a common approach (e.g. carbon/nitrogen balance approach) is used across enteric fermentation and manure management then the categories should be disaggregated according to the key uncertainties in activity data, assumptions, emission factors etc.
3B1a	Forest Land Remaining Forest Land	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B1b	Land Converted to Forest Land	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B2a	Cropland Remaining Cropland	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B2b	Land Converted to Cropland	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B3a	Grassland Remaining Grassland	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B3b	Land Converted to Grassland	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.

3B4ai	Peatlands Remaining Peatlands	CO_2, N_2O	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B4aii	Flooded land remaining Flooded land	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B4b	Land Converted to Wetlands	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B5a	Settlements Remaining Settlements	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3B5b	Land Converted to Settlements	CO_2	Assess emissions, removal and carbon stock change separately. If there are differences in the data sources, assumptions applied and uncertainties for different pools (biomass, DOM, mineral soils, organic soils) then these should be assessed separately.
3C1	Biomass Burning	CH_4, N_2O	
3C2	Liming	CO_2	
3C3	Urea Application	CO_2	
3C4	Direct N_2O Emissions from Managed soils	N_2O	If there are differences in the data sources, assumptions applied and uncertainties for different pools (mineral soils, organic soils) then these should be assessed separately.
3C5	Indirect N_2O Emissions from Managed soils	Indirect N_2O	If there are differences in the data sources, assumptions applied and uncertainties for different pools (mineral soils, organic soils) then these should be assessed separately.
3C6	Indirect N_2O Emissions from Manure Management	Indirect N_2O	
3C7	Rice Cultivations	CH_4	
3D1	Harvested Wood Products	CO_2	Use of key category analysis is optional.
3	Miscellaneous	CO_2, CH_4, N_2O	Assess whether other sources or sinks in the AFOLU Sector not listed above should be included. Key category analysis

			has to cover all emission sources and sinks in the inventory. Therefore, all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
Waste			
4A	Solid Waste Disposal	CH_4	This category should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. Estimates compiled from a common set of activity data and emission factors with similar uncertainties can be aggregated. E.g. if there are significant differences in methodology and uncertainty for different types of solid waste disposal (managed and unmanaged sites) these should be disaggregated.
4B	Biological Treatment of Solid Waste	CH_4, N_2O	
4C	Incineration and Open Burning of Waste	CO_2, N_2O, CH_4	
4D	Wastewater Treatment and Discharge	CH_4, N_2O	This category should be disaggregated according to methods, data sources, assumptions applied and know or likely differences in uncertainty. E.g. if there are significant differences in methodology and uncertainty for different types of wastewater treatment (domestic or industrial wastewater and or different discharge routes) these should be disaggregated.
4	Miscellaneous	CO_2, CH_4, N_2O	Assess whether other sources in the Waste Sector not listed above should be included. Key category analysis has to cover all emission sources in the inventory. Therefore, all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
5A	Indirect N_2O Emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	Indirect N_2O	
5B	Other	CO_2, N_2O, CH_4, SF_6, PFCs, HCFs	Include sources and sinks reported under 5B. *Key category* assessment has to cover all emission sources in the inventory. Therefore, all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.

[a] In some cases, inventory compilers may modify this list of IPCC categories to reflect particular national circumstances.

[b] The categories should include the respective codes and be consistent with the IPCC terminology.

[c] All the gases in this column are to be assessed separately unless stated otherwise where gases can be assessed jointly. There may also be some new gases other than those listed here, and those should be assessed separately.

[d] In the quantitative key category analysis, conversion of forestland is spread out under the different land-use change categories. Countries should identify and sum up the emission estimates associated with forest conversion to any other land category and compare the magnitude to the smallest category identified as key. If its size is larger than the smallest category identified as key, it should be considered key.

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4.3 METHODOLOGICAL APPROACHES TO IDENTIFY KEY CATEGORIES

No refinement.

4.3.1 Approach 1 to identify key categories[5]

Update and elaboration of Section 4.3.1 of the *2006 IPCC Guidelines*.

Approach 1 to identify *key categories* assesses the influence of various categories of sources and sinks on the *level*, and possibly the *trend*, of the national greenhouse gas inventory. When the inventory estimates are available for several years, it is *good practice* to assess the contribution of each category to both the level and trend of the national inventory. If only a single year's inventory is available, a level assessment should be performed.

Approach 1 can readily be accomplished using a spreadsheet analysis. Tables 4.2 and 4.3 in the following sections illustrate the format of the analysis. Separate tables are suggested for the level and trend assessments because it is necessary to sort the results of the analysis according to two different columns. It is more difficult to track the process if the analyses are combined in the same table. In Table 4.2, columns A through C and Table 4.3 A through D are inputs of the national inventory data. Section 4.6 illustrates the application of the Approach 1 to the Finnish inventory.

LEVEL ASSESSMENT

The contribution of each source or sink category to the total national inventory level is calculated according to Equation 4.1:

EQUATION 4.1
KEY CATEGORY LEVEL ASSESSMENT = | SOURCE OR SINK CATEGORY ESTIMATE |/TOTAL CONTRIBUTION

$$\boldsymbol{L_{x,t} = \left|E_{x,t}\right| / \sum_y \left|E_{y,t}\right|}$$

Where:

$L_{x,t}$ = level assessment for source or sink x in latest inventory year (year t);

$\left|E_{x,t}\right|$ = absolute value of emission or removal estimate of source or sink category x in year t;

$\sum_y \left|E_{y,t}\right|$ = total contribution, which is the sum of the absolute values of emissions and removals in year t calculated using the aggregation level chosen by the country for key category analysis. Because both emissions and removals are entered with positive sign[6], the total contribution/level can be larger than a country's total emissions less removals[7].

Key categories according to Equation 4.1 are those that, when summed together in descending order of magnitude, add up to 95 percent of the sum of all $L_{x,t}$.

Table 4.2 presents a spreadsheet that can be used for the level assessment. An example of the use of the spreadsheet is given in Section 4.5.

[5] Section will be elaborated for an appropriate country example (Iceland, Brazil, Finland etc.) once approach for trend and KCA ranking is agreed.

[6] Removals are entered as absolute values to avoid an oscillating cumulative value Lx,t as could be the case if removals were entered with negative signs, and thus to facilitate straightforward interpretation of the quantitative analysis.

[7] This equation can be used in any situation, regardless of whether the national greenhouse gas inventory is a net source (as is most common) or a net sink.

TABLE 4.2
SPREADSHEET FOR THE APPROACH 1 ANALYSIS – LEVEL ASSESSMENT

A	B	C	D	E	F	G
IPCC Category group	**Greenhouse Gas**	**Latest Year Estimate $\lvert E_{x,t}\rvert$ [in CO_2-eq. units]**	**Absolute Value of Latest Year Estimate $\lvert E_{x,t}\rvert$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of Column E**	**Rank of Absolute Value of Latest Year Estimate Column D**
Total			$\sum_y \lvert E_{y,t}\rvert$	1		

Where:

Column A: = description of IPCC category group (see section 4.2 above);

Column B: = greenhouse gas from the category;

Column C: = value of emission or removal estimate of category x in latest inventory year (year t) in CO_2-equivalent units;

Column D: = absolute value of emission or removal estimate of category x in year t;

Column E: = level assessment following Equation 4.1;

Column F: = cumulative total of Column E;

Column G: = rank of Absolute Value of Latest Year Estimate Column D.

Inputs to Columns A-C will be available from the inventory. The total of Column C presents the net emissions and removals unless emissions and removals are presented separately. In Column D, absolute values are taken from each value in Column C. The sum of all entries in Column D is entered in the total line of Column D (note that this total may not be the same as the total net emissions and removals). In Column E, the level assessment is computed according to Equation 4.1. Once the entries in Column E are computed, the categories in the table should be sorted in descending order of magnitude according to Column E. After this step, the cumulative total summed in Column E can be calculated into Column F. *Key categories* are those that, when summed together in descending order of magnitude, add up to 95 percent of the total in Column F. Where the method is applied correctly, the sum of entries in Column E must be 1. The rationale for the choice of the 95 percent threshold for the Approach 1 builds on Rypdal and Flugsrud (2001) and is presented in *GPG2000*, Section 7.2.1.1 in Chapter 7.

It is also *good practice* to examine categories identified between threshold of 95 percent and 97 percent carefully with respect to the qualitative criteria (see section 4.3.3).

The level assessment should be performed for the base year of the inventory and for the latest inventory year (year *t*). If estimates for the base year have changed or been recalculated, the base year analysis should be updated. Key category analysis can also be updated for other recalculated years. In many cases, however, it is sufficient to derive conclusions regarding methodological choice, resource prioritisation or QA/QC procedures without an updated key category analysis for the entire inventory time series. Any category that meets the threshold for the base year or the most recent year should be identified as *key*. However, the interpretation of the results of the key category analysis should take longer time series than the most recent year into account if key category analyses are available. This is because some categories having emissions/removals that fluctuate from year to year may be identified as *key categories* in one year but not in the next year. Therefore, for categories between thresholds of 95 and 97 percent it is suggested to compare the most recent key category analysis with the assessments for three or more previous years. If a category has been *key* for all or most previous years according to the either level or trend assessments or both (the two assessments should be considered separately), they should be identified as *key* in the latest year estimate except in cases where a clear explanation can be provided why a category may no longer be *key* in any future years. These additional categories should be addressed in the reporting table for *key categories* by using a column for comments (see Table 4.4 and reporting table for *key categories* in Section 4.4 for more information). The qualitative criteria presented in Section 4.3.3 may also help to identify which categories with fluctuating emissions or removals should be considered as *key categories*.

TREND ASSESSMENT[8]

The purpose of the trend assessment is to identify categories that may not be large enough to be identified by the level assessment, but whose trend contributes significantly to the trend of the overall inventory, and should therefore receive particular attention. The Trend Assessment can be calculated according to Equation 4.2 if more than one year of inventory data are available.

EQUATION 4.2
TREND ASSESSMENT (APPROACH 1)

$$T_{x,t} = \left|E_{x,t} - E_{x,0}\right|$$

Where:

$T_{x,t}$ = trend assessment of source or sink category x in year t as compared to the overall difference between the base year (year 0) and the target year (year t);

$E_{x,0}$ and $E_{x,t}$ = value of emission or removal estimate of source or sink category x in year 0 and year t;

$\left|E_{x,0} - E_{x,t}\right|$ = absolute value of the change in emission or removal estimate of source or sink category x between year 0 and year t.

The trend of category refers to the change in the source or sink category emissions or removals over time, computed by subtracting the base year (year 0) estimate for source or sink category *x* from the latest inventory year (year *t*) estimate and dividing by the absolute value of the overall difference between the base year (year 0) and the target year (year t) total inventories (the inventory trend).

The trend assessment identifies categories whose trend is different from the trend of the total inventory, regardless whether category trend is increasing or decreasing, or is a sink or source. Categories whose trend diverges most from the total trend should be identified as *key*, when this difference is weighted by the level of emissions or removals of the category in the base year.

Table 4.3 outlines a spreadsheet that can be used for the Approach 1 Trend Assessment.

TABLE 4.3
SPREADSHEET FOR THE APPROACH 1 ANALYSIS – TREND ASSESSMENT

A	B	C	D	E	F	G	H
IPCC Category group name	**Greenhouse Gas**	**Base Year Estimate $E_{x,0}$**	**Latest Year Estimate $E_{x,t}$**	**Trend Assessment $T_{x,t}$**	**% Contribution to Trend**	**Cumulative Total of Column F**	**Rank of trend assessment Column E**
Total				$\sum_y T_{y,t}$	1		

Where:

Column A : = description of IPCC category group (see section 4.2 above);

Column B: = greenhouse gas from the category;

Column C : = base year estimate of emissions or removals from the national inventory data, in CO_2-equivalent units. Sources and sinks are entered as real values (positive or negative values, respectively);

[8] Subsection will be elaborated for an appropriate country example (Iceland, Brazil, Finland etc.) once approach for trend and KCA ranking is agreed.

Column D : = latest year estimate of emissions or removals from the most recent national inventory data, in CO_2-equivalent units. Sources and sinks are entered as real values (positive or negative values, respectively);

Column E: = trend assessment from Equation 4.2;

Column F: = percentage contribution of the category to the total of trend assessments in last row of Column F, i.e., $T_{x,t}/\sum_y T_{y,t}$;

Column G : = cumulative total of Column E, calculated after sorting the entries in descending order of magnitude according to Column G;

Column H: = Rank of Absolute Value of Latest Year Estimate Column D.

The entries in Columns A, B and D should be identical to those in columns A, B and C in the Table 4.2, for the Approach 1 analysis - Level Assessment. The base year estimate in Column C is always entered, while the latest year estimate in Column D will depend on the year of analysis. The value of $T_{x,t}$ (which is always positive) should be entered in Column E for each category of sources and sinks, following Equation 4.2, and the sum of all the entries entered in the total line of the table. The percentage contribution of each category to the total of Column E should be computed and entered in Column F. The categories (i.e., the rows of the table) should be sorted in descending order of magnitude, based on Column F. The cumulative total of Column F should then be computed in Column G. Key categories are those that, when summed together in descending order of magnitude, add up to more than 95 percent of the total of Column E. An example of Approach 1 analysis for the level and trend is given in Section 4.6.

The trend assessment treats increasing and decreasing trends similarly. However, for the prioritisation of resources, there may be specific circumstances where countries may not want to invest additional resources in the estimation of *key categories* with decreasing trends. Underlying reasons why a category showing strong decreasing trend could be *key* include activity decrease, mitigation measures leading to reduced emission factors or abatement measures (e.g., F-gases, chemical production) changing the production processes. In particular, for a long-term decline of activities (not volatile economic trends) and when the category is not *key* from the level assessment, it is not always necessary to implement higher tier methods or to collect additional country-specific data if appropriate explanations can be provided why a category may not become more relevant again in the future. This could be the case e.g., for emissions from coal mining in some countries where considerable number of mines are closed or where certain production facilities are shut down. Regardless of the method chosen, countries should endeavour to use the same method for all years in a time series, and therefore it may be more appropriate to continue using a higher tier method if it had been used for previous years.

For other reasons of declining trends such as the introduction of abatement measures or other emission reduction measures, it is important to prioritise resources for the estimation of such categories that were identified as *key* in the trend assessment. Irrespective of the methodological choice, inventory compilers should clearly and precisely explain and document categories with strongly decreasing trends and should apply appropriate QA/QC procedures.

KEY CATEGORY ANALYSIS FOR A SUBSET OF INVENTORY ESTIMATES

The IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (*GPG-LULUCF*, IPCC, 2003) provided guidance on how to conduct a key category analysis using a stepwise approach, identifying first the *key* (source) categories for the inventory excluding LULUCF (Land Use, Land-Use Change and Forestry), and secondly repeating the key category analysis for the full inventory including the LULUCF categories to identify additional *key categories*. This two step approach is now integrated into one general approach. However, inventory compilers may still want to conduct a key category analysis using a subset of inventory estimates. For example inventory compilers may choose to include only emission sources in order to exclude the effects of removals from the level assessment or in order to exclude the influence of different trends for carbon fluxes from the other emission trends (see examples in Tables 4.7 and 4.8). It is *good practice* to document on what subsets the analysis was performed and the differences in results comparing with an integrated analysis.

4.3.2 Approach 2 to identify key categories

No refinement.

4.3.3 Qualitative criteria to identify key categories

Update of Section 4.3.3 of the *2006 IPCC Guidelines*.

In some cases, the results of the Approach 1 or Approach 2 analysis of *key categories* may not identify all categories that should be prioritised in the inventory system. If quantitative key category analysis has not been carried out due to lack of completeness in the inventory, it is *good practice* to use qualitative criteria to identify *key categories.* The criteria below address specific circumstances that may not be readily reflected in the quantitative assessment. These criteria should be applied to categories not identified in the quantitative analysis, and if additional categories are identified they should be added to the list of *key categories*. It is particularly important to consider these criteria if the trend assessment has not been compiled. Although it is important to implement a trend assessment as part of *good practice* if data are available, early identification using qualitative criteria could be used until such assessment is available. Followings are the examples of points in qualitative criteria.

- *Mitigation techniques and technologies*: If emissions from a category have decreased or removals have increased through the use of climate change mitigation techniques, it is *good practice* to identify such categories as *key*. This will ensure that such categories are prioritised within the inventory and that better quality estimates are prepared to reflect the mitigation effects as closely as possible. It will also ensure that the methods used are transparent with respect to mitigation which is important for assessing inventory quality.
- *Expected growth*: The inventory compiler should assess which categories should be designated as key because they are likely to show significant increase of emissions or decrease of removals in the future. The inventory compiler may use expert judgement to make this determination. It is encouraged to identify such categories as *key*.
- *No quantitative assessment of Uncertainties performed*: Where Approach 2 including uncertainties in the key category analysis is not used, inventory compilers are still encouraged to identify categories that are assumed to contribute most to the overall uncertainty as *key*, because the largest reductions in overall inventory uncertainty can be achieved by improving estimates of categories having higher uncertainties. The qualitative consideration should take into account whether any methodological improvements could reduce uncertainties significantly. This could, for example, be applied to a small net flux results from the subtraction of large emissions and removals, which can imply a very high uncertainty.
- *Completeness*: Neither the Approach 1 nor the Approach 2 gives correct results if the inventory is not complete. The analysis can still be performed, but there may be *key categories* among those are not estimated. In these cases, it is *good practice* to examine qualitatively potential *key categories* that are not yet estimated quantitatively by applying the qualitative considerations above. The inventory of a country with similar national circumstances can also often give good indications on potential *key categories*. Chapter 2, Approaches to Data Collection, gives suggestions for methods to approximate activity data that can be used to compile preliminary estimates of emissions/removals from a category. This preliminary analysis can be used to conclude whether a category potentially can be *key* and prioritise data collection of this category.

4.4 REPORTING AND DOCUMENTATION

Elaboration of section 4.4 of the *2006 IPCC Guidelines*.

It is *good practice* to clearly document the results of the key category analysis in the inventory report. This information is essential for explaining the choice of method for each category. In addition, inventory compilers should list the criteria by which each category was identified as *key* (e.g., level, trend, or qualitative), and the method used to conduct the quantitative key category analysis (e.g., Approach 1 or Approach 2). Tables 4.2 and 4.3 should be used to record the results of the key category analysis. Table 4.4 should be used to present a summary of the key category analysis. The notation keys: L = *key category* according to level assessment; T = *key category* according to trend assessment; and Q = *key category* according to qualitative criteria; should be used to describe the assessment method used. The Approach used to identify the *key category* should be included as L1, L2, T1 or T2. In the column for comments, reasons for a qualitative assessment can be provided.

TABLE 4.4
SUMMARY OF KEY CATEGORY ANALYSIS

Quantitative method used: Approach 1/Approach 1 and Approach 2				
A	**B**	**C**	**D**	**E**
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	**Identification criteria**	**Comments**

Key category analysis is designed to inform the Inventory Management System and various stakeholders on the priorities for maintenance and improvement of the inventory. Therefore, the detailed analysis can be aggregated into a single informative list of the categories identified as key and why as suggested above in Table 4.4. In addition, inventory compilers could consider a means of prioritisation using category rankings across the different analysis and their combination. Ideally, this summary should also highlight the tier at which the estimates are estimated to give an indication of the scope for further improvement.

Tables 4.2 and 4.3 above include a column to rank the categories in order of importance according to their absolute values (for the level assessment) or their change relative to the overall inventory change (trend assessment) and relative positions in the cumulative ordering. Each set of analysis can then be combined by combining the rankings for a relevant set of analysis. The simple example in Table 4.4a below presents the simple combination of key category analysis for level 2015 and trend.

Once the key categories for each analysis have been identified and ranked, they can be combined. A suggestion for combining the rankings into a single weighted ranking is presented below in Equation 4.3:

EQUATION 4.3
KEY CATEGORY ANALYSIS COMBINATION OF RANKINGS

$$\boldsymbol{FinalRank_x = \frac{(Sum\ of\ rank_{x,a-n})/(count\ of\ key\ category_x\ appearances)}{\sum(Sum\ of\ rank_{x,a-n})/(count\ of\ key\ category_x\ appearances)}}$$

Where:

$FinalRank_x$ = the final combined ranking for a category of the combined rankings from the individual key category analysis;

$Rank_{x,a-n}$ = the combined ranking for a category based on its ranking for each analysis and its appearances as a *key category*.

TABLE 4.4A
SUMMARY KEY CATEGORY ANALYSIS TABLE SHOWING COMBINED RANKING AND USEFUL ANNOTATIONS TO HIGHLIGHT REASONS FOR KEY CATEGORY IDENTIFICATION. ICELAND EXAMPLE USING SIMPLE COMBINATION OF APPROACH 1 LEVEL (2015) AND TREND (1990 – 2015).

			Level 2015				Trend (1990 - 2015)				Combined		Notes
Category	Gas	Tier used for estimate	Rank	2015 (Gg CO2eq)	% Contribution	% Cumulative	Rank	difference 2015 - base year (Gg CO2eq)	% Contribution	% Cumulative	Combined Ranking	Final Ranking	
Metal Production - aluminium Production	CO2	Tier 3	1	1,302	32%	32%	1	1,163	34%	34%	1	1	High ranking KC for level and increasing trend. Maintaining data quality is critical.
Metal Production - aluminium Production	PFCs	Tier 3		104	3%	97%	2	- 391	12%	46%	2	2	Not a KC for level but KC for decreasing trend. Check that there are no reversals in technology ot increased emissions
Road Transport	CO2	Tier 1	2	809	20%	52%	3	300	9%	55%	2.5	3	High ranking KC for level and increasing trend. Maintaining data quality is critical. Possibly increase to tier 2.
Agriculture/Fishing	CO2	Tier 1	3	451	11%	63%	4	- 200	6%	61%	3.5	4	High ranking KC for level and decreasing trend
Metal Production - Ferroalloys	CO2	Tier 2	4	399	10%	73%	5	191	6%	67%	4.5	5	High ranking KC for level and increasing trend
Water - borne Navigation	CO2	Tier 2	5	333	8%	81%	6	176	5%	72%	5.5	6	Mid ranking KC for level and increasing trend
Managed waste disposal sites	CH4	Tier 2	6	188	5%	86%	7	173	5%	77%	6.5	7	Mid ranking KC for level and increasing trend
Product Uses as Substitutes for ODS - Refrigeration and stationary air-conditioning	HFCs	Tier 1	7	171	4%	90%	8	171	5%	82%	7.5	8	Mid ranking KC for level and increasing trend
Manufacturing Industries & Construction	CO2	Tier 1		43	1%	98%	9	- 159	5%	87%	9	9	Not KC for level but KC for decreasing trend
Other emission from Energy Production	CO2	Tier 1	8	160	4%	94%	11	99	3%	93%	9.5	10	Low ranking KC for level and increasing trend.
Unmanaged waste disposal sites	CH4	Tier 1		-	0%	100%	10	- 127	4%	90%	10	11	Not KC for level but low ranking KC for decreasing trend
Cement Production	CO2	Tier 3		-	0%	100%	12	- 52	2%	95%	12	12	Not KC for level but low ranking KC for decreasing trend
Total Key Categories				**3,814**	**94%**			**1,344**	**95%**				
Other categories not key categories (see detailed KCA tables)				233	6%			- 131					
Total GHG inventory (Gg CO2eq)				**4,047**	**100%**			**1,213**					

4.5 EXAMPLES OF KEY CATEGORY ANALYSIS[9]

The application of the Approach 1 and 2 to the Finnish greenhouse gas inventory for the reporting year 2003 is shown in Tables 4.5 to 4.11. Both the level and the trend assessment were conducted using estimates of emissions, removals and uncertainties from the national inventory of Finland (Statistics Finland, 2005). Although a qualitative assessment was not conducted in this example, it was not anticipated that additional categories would have been identified.

The results of the Approach 1 Level Assessment are shown in Table 4.5 with *key categories* in bold. The results of the Approach 1 Trend Assessment are shown in Table 4.6, with *key categories* in bold. Tables 4.7 and 4.8 present an Approach 1 Level and Trend key category analysis using a subset of emissions and removals. In this example, it was decided to include other categories (reported in Tables 4.5 and 4.6) than CO_2 from category 3B (Land). The results of Approach 2 Level and Trend Assessments are provided in Tables 4.9 and 4.10. Table 4.11 finally summarises the results of the key category analysis.

[9] Section will be elaborated in the SOD for an appropriate country examples (Iceland, Brazil, Finland etc.) once approach for trend and KCA ranking is agreed.

TABLE 4.5
EXAMPLE OF APPROACH 1 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (with key categories in bold)

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,t}$ (Gg CO_2-eq)	$\lvert E_{x,t} \rvert$ (Gg CO_2-eq)	$L_{x,t}$	**Cumulative Total of Column F**
3B1a	**Forest land remaining Forest land**	**CO_2**	**-21 354**	**21 354**	**0.193**	**0.193**
1A1	**Energy Industries: Solid**	**CO_2**	**17 311**	**17 311**	**0.157**	**0.350**
1A3b	**Road Transportation**	**CO_2**	**11 447**	**11 447**	**0.104**	**0.454**
1A1	**Energy Industries: Peat**	**CO_2**	**9 047**	**9 047**	**0.082**	**0.536**
1A1	**Energy Industries: Gas**	**CO_2**	**6 580**	**6 580**	**0.060**	**0.595**
1A4	**Other Sectors: Liquid**	**CO_2**	**5 651**	**5 651**	**0.051**	**0.646**
1A2	**Manufacturing Industries and Construction: Solid**	**CO_2**	**5 416**	**5 416**	**0.049**	**0.695**
1A2	**Manufacturing Industries and Construction: Liquid**	**CO_2**	**4 736**	**4 736**	**0.043**	**0.738**
1A1	**Energy Industries: Liquid**	**CO_2**	**3 110**	**3 110**	**0.028**	**0.767**
3B3a	**Grassland Remaining Grassland**	**CO_2**	**2 974**	**2 974**	**0.027**	**0.793**
3C4	**Direct N_2O Emissions from managed soils**	**N_2O**	**2 619**	**2 619**	**0.024**	**0.817**
4A	**Solid Waste Disposal**	**CH_4**	**2 497**	**2 497**	**0.023**	**0.840**
1A2	**Manufacturing Industries and Construction: Gas**	**CO_2**	**2 174**	**2 174**	**0.020**	**0.859**
3A1	**Enteric Fermentation**	**CH_4**	**1 537**	**1 537**	**0.014**	**0.873**
1A2	**Manufacturing Industries and Construction: Peat**	**CO_2**	**1 498**	**1 498**	**0.014**	**0.887**
2B2	**Nitric Acid Production**	**N_2O**	**1 396**	**1 396**	**0.013**	**0.900**
1A5	**Non-Specified: Liquid**	**CO_2**	**1 083**	**1 083**	**0.010**	**0.909**
2D	**Non-Energy Products from Fuels and Solvent Use**	**CO_2**	**830**	**830**	**0.008**	**0.917**
1A3e	**Other Transportation**	**CO_2**	**651**	**651**	**0.006**	**0.923**
3C5	**Indirect N_2O Emissions from managed soils**	**N_2O**	**592**	**592**	**0.005**	**0.928**

TABLE 4.5 (CONTINUED)
EXAMPLE OF APPROACH 1 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (WITH KEY CATEGORIES IN BOLD)

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,t}$ **(Gg CO_2-eq)**	$\lvert E_{x,t} \rvert$ **(Gg CO_2-eq)**	$L_{x,t}$	**Cumulative Total of Column F**
2F1	**Refrigeration and Air Conditioning**	**HFCs, PFCs**	**578**	**578**	**0.005**	**0.933**
3B4ai	**Peatlands remaining Peatlands**	**CO_2**	**547**	**547**	**0.005**	**0.938**
1A3d	**Water-borne Navigation**	**CO_2**	**519**	**519**	**0.005**	**0.943**
1A3b	**Road Transportation**	**N_2O**	**516**	**516**	**0.005**	**0.948**
2A2	**Lime Production**	**CO_2**	**513**	**513**	**0.005**	**0.952**
2A1	Cement Production	CO_2	500	500	0.005	0.957
3A2	Manure Management	N_2O	461	461	0.004	0.961
1A5	Non-Specified: Gas	CO_2	363	363	0.003	0.964
1A3a	Civil Aviation	CO_2	316	316	0.003	0.967
1A4	Other Sectors: Biomass	CH_4	307	307	0.003	0.970
3C2	Liming	CO_2	277	277	0.003	0.972
1A1	Energy Industries: Peat	N_2O	226	226	0.002	0.975
1A4	Other Sectors: Gas	CO_2	225	225	0.002	0.977
3A2	Manure Management	CH_4	222	222	0.002	0.979
3B2a	Cropland Remaining Cropland	CO_2	211	211	0.002	0.980
2	Miscellaneous	CO_2, HFCs, PFCs, SF_6	168	168	0.002	0.982
1A1	Energy Industries: Solid	N_2O	162	162	0.001	0.983
2A3 and 2A4	Limestone and Dolomite Use[a]	CO_2	148	148	0.001	0.985
1A3c	Railways	CO_2	134	134	0.001	0.986
1A4	Other Sectors: Peat	CO_2	131	131	0.001	0.987
4D	Wastewater Treatment and Discharge	CH_4	128	128	0.001	0.988
4D	Wastewater Treatment and Discharge	N_2O	102	102	0.001	0.989
3C1	Biomass Burning	CO_2	91	91	0.001	0.990
1A2	Manufacturing Industries and Construction: Solid	N_2O	90	90	0.001	0.991
1A2	Manufacturing Industries and Construction: Biomass	N_2O	81	81	0.001	0.992
1A1	Energy Industries: Biomass	N_2O	80	80	0.001	0.992
1B2aii	Oil - Flaring[b]	CO_2	63	63	0.001	0.993
2F4	Aerosols	HFCs	63	63	0.001	0.994
1A4	Other Sectors: Biomass	N_2O	61	61	0.001	0.994
1B2b	Fugitive Emissions from Fuels - Natural gas	CH_4	52	52	0.000	0.995
1A1	Energy Industries: Gas	N_2O	51	51	0.000	0.995

TABLE 4.5 (CONTINUED)
EXAMPLE OF APPROACH 1 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (WITH KEY CATEGORIES IN BOLD)

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,t}$ **(Gg CO_2-eq)**	$\lvert E_{x,t} \rvert$ **(Gg CO_2-eq)**	$L_{x,t}$	**Cumulative Total of Column F**
1A3b	Road Transportation	CH_4	47	47	0.000	0.995
1A4	Other Sectors: Liquid	N_2O	47	47	0.000	0.996
1A2	Manufacturing Industries and Construction: Liquid	N_2O	41	41	0.000	0.996
2G	Other Product Manufacture and Use	N_2O	40	40	0.000	0.997
1A1	Energy Industries: Biomass	CH_4	31	31	0.000	0.997
1A1	Energy Industries: Liquid	N_2O	30	30	0.000	0.997
1A2	Manufacturing Industries and Construction: Peat	N_2O	29	29	0.000	0.997
1A4	Other Sectors: Solid	CO_2	25	25	0.000	0.998
2F2	Foam Blowing Agents	HFCs	25	25	0.000	0.998
2G	Other Product Manufacture and Use	SF_6	22	22	0.000	0.998
2A3 and 2A4	Soda Ash Use[a]	CO_2	20	20	0.000	0.998
1A2	Manufacturing Industries and Construction: Gas	N_2O	19	19	0.000	0.998
1A2	Manufacturing Industries and Construction: Biomass	CH_4	19	19	0.000	0.999
1A1	Energy Industries: Solid	CH_4	16	16	0.000	0.999
1A4	Other Sectors: Liquid	CH_4	15	15	0.000	0.999
1B2a	Fugitive Emissions from Fuels – Oil	CH_4	10	10	0.000	0.999
2C1	Iron and Steel Production	CH_4	9	9	0.000	0.999
1A5	Non-Specified: Liquid	N_2O	9	9	0.000	0.999
1A1	Energy Industries: Gas	CH_4	9	9	0.000	0.999
3C1	Biomass Burning	CH_4	8	8	0.000	0.999
1A1	Energy Industries: Peat	CH_4	7	7	0.000	0.999
1A2	Manufacturing Industries and Construction: Liquid	CH_4	7	7	0.000	0.999
1A1	Energy Industries: Liquid	CH_4	7	7	0.000	0.999
1A3e	Other Transportation	CH_4	6	6	0.000	1.000
1A2	Manufacturing Industries and Construction: Gas	CH_4	6	6	0.000	1.000
3	Miscellaneous	CH_4	6	6	0.000	1.000
2B8	Petrochemical and Carbon Black Production	CH_4	5	5	0.000	1.000
1A3e	Other Transportation	N_2O	5	5	0.000	1.000
1A3d	Water-Borne Navigation	CH_4	5	5	0.000	1.000
1A3a	Civil Aviation	N_2O	4	4	0.000	1.000
1A3d	Water-Borne Navigation	N_2O	4	4	0.000	1.000

TABLE 4.5 (CONTINUED)
EXAMPLE OF APPROACH 1 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (WITH KEY CATEGORIES IN BOLD)

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,t}$ **(Gg CO_2-eq)**	$\lvert E_{x,t} \rvert$ **(Gg CO_2-eq)**	$L_{x,t}$	**Cumulative Total of Column F**
4	Miscellaneous	N_2O	3	3	0.000	1.000
1A2	Manufacturing Industries and Construction: Peat	CH_4	3	3	0.000	1.000
1A2	Manufacturing Industries and Construction: Solid	CH_4	2	2	0.000	1.000
1A5	Non-Specified: Liquid	CH_4	2	2	0.000	1.000
1A5	Non-Specified: Gas	N_2O	2	2	0.000	1.000
1A4	Other Sectors: Peat	N_2O	2	2	0.000	1.000
1A4	Other Sectors: Gas	N_2O	1	1	0.000	1.000
1A4	Other Sectors: Peat	CH_4	1	1	0.000	1.000
1A3c	Railways	N_2O	1	1	0.000	1.000
3C1	Biomass Burning	N_2O	1	1	0.000	1.000
1A4	Other Sectors: Solid	CH_4	1	1	0.000	1.000
1A5	Non-Specified: Gas	CH_4	0.4	0.4	0.000	1.000
1A4	Other Sectors: Solid	N_2O	0.3	0.3	0.000	1.000
1A3a	Civil Aviation	CH_4	0.3	0.3	0.000	1.000
1A4	Other Sectors: Gas	CH_4	0.3	0.3	0.000	1.000
1A3c	Railways	CH_4	0.2	0.2	0.000	1.000
Total			67 729	110 438	1	

[a] Example was based on 2003 inventory of Finland, and therefore glass production could not be separated as recommended in these *Guidelines*. This does not affect categories identified as *key*.

[b] Example was based on 2003 inventory of Finland, and therefore flaring was separated from other fugitive emissions from oil (1B2a). According to these *Guidelines*, all emissions under 1B2a should be treated together in key category analysis. This would not affect categories identified as *key* in this example.

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TABLE 4.6
EXAMPLE OF APPROACH 1 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (with key categories in bold)

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend Assessment** $E_{x,t}$	**% Contribution to Trend**	**Cumulative Total of Column G**
3B1a	**Forest Land remaining Forest Land**	**CO_2**	**-23 798**	**-21 354**	**0.078**	**0.147**	**0.147**
1A1	**Energy Industries: Solid**	**CO_2**	**9 279**	**17 311**	**0.042**	**0.079**	**0.227**
1A3b	**Road Transportation**	**CO_2**	**10 800**	**11 447**	**0.040**	**0.076**	**0.302**
1A4	**Other Sectors: Liquid**	**CO_2**	**6 714**	**5 651**	**0.040**	**0.075**	**0.378**
1A2	**Manufacturing Industries and Construction: Solid**	**CO_2**	**6 410**	**5 416**	**0.038**	**0.072**	**0.450**
3B3a	**Grassland Remaining Grassland**	**CO_2**	**-1 071**	**2 974**	**0.037**	**0.069**	**0.519**
1A1	**Energy Industries: Peat**	**CO_2**	**3 972**	**9 047**	**0.035**	**0.066**	**0.585**
1A1	**Energy Industries: Gas**	**CO_2**	**2 659**	**6 580**	**0.029**	**0.054**	**0.639**
4A	**Solid Waste Disposal**	**CH_4**	**3 678**	**2 497**	**0.028**	**0.053**	**0.692**
3C4	**Direct N_2O Emissions from managed soils**	**N_2O**	**3 513**	**2 619**	**0.024**	**0.046**	**0.738**
1A2	**Manufacturing Industries and Construction: Liquid**	**CO_2**	**4 861**	**4 736**	**0.022**	**0.042**	**0.780**
3B2a	**Cropland Remaining Cropland**	**CO_2**	**1 277**	**211**	**0.017**	**0.031**	**0.811**
3A1	**Enteric Fermentation**	**CH_4**	**1 868**	**1 537**	**0.012**	**0.022**	**0.833**
2B2	**Nitric Acid Production**	**N_2O**	**1 595**	**1 396**	**0.009**	**0.017**	**0.849**
1A2	**Manufacturing Industries and Construction: Gas**	**CO_2**	**2 094**	**2 174**	**0.008**	**0.016**	**0.865**
1A2	**Manufacturing Industries and Construction: Peat**	**CO_2**	**1 561**	**1 498**	**0.007**	**0.014**	**0.879**
2A1	**Cement Production**	**CO_2**	**786**	**500**	**0.006**	**0.012**	**0.891**
3C2	**Liming**	**CO_2**	**618**	**277**	**0.006**	**0.012**	**0.903**
1A1	**Energy Industries: Liquid**	**CO_2**	**2 607**	**3 110**	**0.006**	**0.012**	**0.914**
2F1	**Refrigeration and Air Conditioning**	**HFCs, PFCs**	**0**	**578**	**0.006**	**0.011**	**0.925**
3C5	**Indirect N_2O Emissions from managed soils**	**N_2O**	**735**	**592**	**0.005**	**0.009**	**0.934**
3A2	**Manure Management**	**N_2O**	**623**	**461**	**0.004**	**0.008**	**0.942**
1A3b	**Road Transportation**	**N_2O**	**160**	**516**	**0.003**	**0.006**	**0.948**
1A3e	**Other Transportation**	**CO_2**	**644**	**651**	**0.003**	**0.005**	**0.953**
3B4ai	Peatlands Remaining Peatlands	CO_2	503	547	0.002	0.003	0.956
3C1	Biomass Burning	CO_2	180	91	0.002	0.003	0.959
1A3a	Civil Aviation	CO_2	320	316	0.001	0.003	0.962
1A3c	Railways	CO_2	191	134	0.001	0.003	0.965
1B2aii	Flaring[b]	CO_2	123	63	0.001	0.002	0.967
2G	Other Product Manufacture and Use	SF_6	87	22	0.001	0.002	0.969

TABLE 4.6
EXAMPLE OF APPROACH 1 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (with key categories in bold)

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend Assessment** $E_{x,t}$	**% Contribution to Trend**	**Cumulative Total of Column G**
1A4	Other Sectors: Biomass	CH_4	282	307	0.001	0.002	0.971
4D	Wastewater Treatment and Discharge	CH_4	153	128	0.001	0.002	0.973
4D	Wastewater Treatment and Discharge	N_2O	133	102	0.001	0.002	0.974
1A4	Other Sectors: Gas	CO_2	98	225	0.001	0.002	0.976
3A2	Manure Management	CH_4	215	222	0.001	0.002	0.977
2D	Non-Energy Products from Fuels and Solvent Use	CO_2	640	830	0.001	0.002	0.979
1A3b	Road Transportation	CH_4	90	47	0.001	0.002	0.981
1A2	Manufacturing Industries and Construction: Biomass	N_2O	111	81	0.001	0.002	0.982
2	Miscellaneous	CO_2, HFCs, PFCs, SF_6	68	168	0.001	0.001	0.983
1A1	Energy Industries: Biomass	N_2O	10	80	0.001	0.001	0.985
1A2	Manufacturing Industries and Construction: Solid	N_2O	108	90	0.001	0.001	0.986
2F4	Aerosols	HFCs	0	63	0.001	0.001	0.987
1A2	Manufacturing Industries and Construction: Peat	N_2O	56	29	0.001	0.001	0.988
2G	Other Product Manufacture and Use	N_2O	62	40	0.000	0.001	0.989
1A5	Non-Specified: Gas	CO_2	222	363	0.000	0.001	0.990
1B2b	Fugitive Emissions from Fuels - Natural Gas	CH_4	4	52	0.000	0.001	0.991
1A4	Other Sectors: Peat	CO_2	123	131	0.000	0.001	0.992
1A1	Energy Industries: Solid	N_2O	85	162	0.000	0.001	0.993
1A5	Non-Specified: Liquid	CO_2	734	1083	0.000	0.001	0.993
2A2	Lime Production	CO_2	383	513	0.000	0.001	0.994
1A4	Other Sectors: Liquid	N_2O	56	47	0.000	0.001	0.995
1A1	Energy Industries: Biomass	CH_4	2	31	0.000	0.001	0.995
1A1	Energy Industries: Gas	N_2O	18	51	0.000	0.000	0.996
2F2	Foam Blowing Agents	HFCs	0	25	0.000	0.000	0.996
1A1	Energy Industries: Peat	N_2O	141	226	0.000	0.000	0.997
1A4	Other Sectors: Solid	CO_2	33	25	0.000	0.000	0.997
1A4	Other Sectors: Biomass	N_2O	56	61	0.000	0.000	0.997
3C1	Biomass Burning	CH_4	16	8	0.000	0.000	0.998
1A2	Manufacturing Industries and Construction: Liquid	N_2O	39	41	0.000	0.000	0.998
1A4	Other Sectors: Liquid	CH_4	19	15	0.000	0.000	0.998

TABLE 4.6
EXAMPLE OF APPROACH 1 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (with key categories in bold)

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend Assessment** $E_{x,t}$	**% Contribu-tion to Trend**	**Cumulative Total of Column G**
1A2	Manufacturing Industries and Construction: Biomass	CH_4	20	19	0.000	0.000	0.998
4	Miscellaneous	N_2O	8	3	0.000	0.000	0.998
2A3 and 2A4	Limestone and Dolomite Usea	CO_2	99	148	0.000	0.000	0.999
1A1	Energy Industries: Liquid	N_2O	26	30	0.000	0.000	0.999
1A3d	Water-borne Navigation	CH_4	8	5	0.000	0.000	0.999
2A3 and 2A4	Soda Ash Usea	CO_2	18	20	0.000	0.000	0.999
1A3d	Water-borne Navigation	CO_2	361	519	0.000	0.000	0.999
1A2	Manufacturing Industries and Construction: Liquid	CH_4	9	7	0.000	0.000	0.999
1A2	Manufacturing Industries and Construction: Gas	N_2O	17	19	0.000	0.000	0.999
1A1	Energy Industries: Solid	CH_4	9	16	0.000	0.000	0.999
1A2	Manufacturing Industries and Construction: Solid	CH_4	4	2	0.000	0.000	0.999
1A1	Energy Industries: Gas	CH_4	4	9	0.000	0.000	1.000
1A4	Other Sectors: Solid	CH_4	2	1	0.000	0.000	1.000
1A2	Manufacturing Industries and Construction: Peat	CH_4	4	3	0.000	0.000	1.000
1A3e	Other Transportation	N_2O	5	5	0.000	0.000	1.000
2C1	Iron and Steel Production	CH_4	5	9	0.000	0.000	1.000
3	Miscellaneous	CH_4	5	6	0.000	0.000	1.000
1A3a	Civil Aviation	N_2O	4	4	0.000	0.000	1.000
3C1	Biomass Burning	N_2O	2	1	0.000	0.000	1.000
1A3e	Other Transportation	CH_4	5	6	0.000	0.000	1.000
1A1	Energy Industries: Liquid	CH_4	6	7	0.000	0.000	1.000
1B2a	Fugitive Emissions from Fuels - Oil	CH_4	8	10	0.000	0.000	1.000
1A3c	Railways	N_2O	2	1	0.000	0.000	1.000
1A4	Other Sectors: Peat	CH_4	1	1	0.000	0.000	1.000
1A4	Other Sectors: Gas	N_2O	1	1	0.000	0.000	1.000
1A4	Other Sectors: Peat	N_2O	1	2	0.000	0.000	1.000
2B8	Petrochemical and Carbon Black Production	CH_4	4	5	0.000	0.000	1.000
1A2	Manufacturing Industries and Construction: Gas	CH_4	5	6	0.000	0.000	1.000
1A4	Other Sectors: Solid	N_2O	0.5	0.3	0.000	0.000	1.000

TABLE 4.6
EXAMPLE OF APPROACH 1 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 (with key categories in bold)

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend Assessment** $E_{x,t}$	**% Contribu-tion to Trend**	**Cumulative Total of Column G**
1A1	Energy Industries: Peat	CH_4	5	7	0.000	0.000	1.000
1A5	Non-Specified: Gas	N_2O	1	2	0.000	0.000	1.000
1A3a	Civil Aviation	CH_4	0.4	0.3	0.000	0.000	1.000
1A3c	Railways	CH_4	0.2	0.2	0.000	0.000	1.000
1A5	Non-Specified: Liquid	N_2O	6	9	0.000	0.000	1.000
1A4	Other Sectors: Gas	CH_4	0.1	0.3	0.000	0.000	1.000
1A3d	Water-borne Navigation	N_2O	3	4	0.000	0.000	1.000
1A5	Non-Specified: Gas	CH_4	0.3	0.4	0.000	0.000	1.000
1A5	Non-Specified: Liquid	CH_4	2	2	0.000	0.000	1.000
Total			47 604	67 729	0.531	1	

[a] Example was based on 2003 inventory of Finland, and therefore glass production could not be separated as recommended in these *Guidelines*. This does not affect categories identified as *key*.

[b] Example was based on 2003 inventory of Finland, and therefore flaring was separated from other fugitive emissions from oil (1B2a). According to these *Guidelines*, all emissions under 1B2a should be treated together in key category analysis. This would not affect categories identified as key in this example.

TABLE 4.7
EXAMPLE OF APPROACH 1 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 USING A SUBSET
(CO_2 from category 3B was excluded from the analysis). Only *key categories* are presented.

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**Greenhouse Gas**	$E_{x,t}$ **(Gg CO_2-eq)**	$\lvert E_{x,t} \rvert$ **(Gg CO_2 eq)**	$L_{x,t}$	**Cumulative Total of Column F**
1A1	Energy Industries: Solid	CO_2	17 311	17 311	0.203	0.203
1A3b	Road Transportation	CO_2	11 447	11 447	0.134	0.337
1A1	Energy Industries: Peat	CO_2	9 047	9 047	0.106	0.443
1A1	Energy Industries: Gas	CO_2	6 580	6 580	0.077	0.520
1A4	Other Sectors: Liquid	CO_2	5 651	5 651	0.066	0.586
1A2	Manufacturing Industries and Construction: Solid	CO_2	5 416	5 416	0.063	0.650
1A2	Manufacturing Industries and Construction: Liquid	CO_2	4 736	4 736	0.055	0.705
1A1	Energy Industries: Liquid	CO_2	3 110	3 110	0.036	0.742
3C4	Direct N_2O Emissions from managed soils	N_2O	2 619	2 619	0.031	0.772
4A	Solid Waste Disposal	CH_4	2 497	2 497	0.029	0.802
1A2	Manufacturing Industries and Construction: Gas	CO_2	2 174	2 174	0.025	0.827
3A1	Enteric Fermentation	CH_4	1 537	1 537	0.018	0.845
1A2	Manufacturing Industries and Construction: Peat	CO_2	1 498	1 498	0.018	0.863
2B2	Nitric Acid Production	N_2O	1 396	1 396	0.016	0.879
1A5	Non-Specified: Liquid	CO_2	1 083	1 083	0.013	0.892
2D	Non-Energy Products from Fuels and Solvent Use	CO_2	830	830	0.010	0.901
1A3e	Other Transportation	CO_2	651	651	0.008	0.909
3C5	Indirect N_2O Emissions from Managed Soils	N_2O	592	592	0.007	0.916
2F1	Refrigeration and Air Conditioning	HFCs, PFCs	578	578	0.007	0.923
1A3d	Water-borne Navigation	CO_2	519	519	0.006	0.929
1A3b	Road Transportation	N_2O	516	516	0.006	0.935
2A2	Lime Production	CO_2	513	513	0.006	0.941
2A1	Cement Production	CO_2	500	500	0.006	0.947
3A2	Manure Management	N_2O	461	461	0.005	0.952
....						
Total			85 352	85 352	1	

TABLE 4.8
EXAMPLE OF APPROACH 1 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003 USING A SUBSET (CO_2 from category 3B was excluded from the analysis). Only *key categories* are presented.

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend assessment** $T_{x,t}$	**% Contribu-tion to Trend**	**Cumulative Total of Column G**
1A1	Energy Industries: Solid	CO_2	9 279	17 311	0.086	0.194	0.194
1A1	Energy Industries: Peat	CO_2	3 972	9 047	0.060	0.135	0.329
1A1	Energy Industries: Gas	CO_2	2 659	6 580	0.048	0.107	0.436
1A4	Other Sectors: Liquid	CO_2	6 714	5 651	0.035	0.078	0.514
1A2	Manufacturing Industries and Construction: Solid	CO_2	6 410	5 416	0.033	0.074	0.588
4A	Solid Waste Disposal	CH_4	3 678	2 497	0.028	0.062	0.650
3C4	Direct N2O Emissions from Managed Soils	N_2O	3 513	2 619	0.023	0.052	0.702
1A3b	Road Transportation	CO_2	10 800	11 447	0.023	0.051	0.752
1A2	Manufacturing Industries and Construction: Liquid	CO_2	4 861	4 736	0.016	0.036	0.788
3A1	Enteric Fermentation	CH_4	1 868	1 537	0.010	0.023	0.811
2F1	Refrigeration and Air Conditioning	HFCs, PFCs	0	578	0.008	0.018	0.830
2B2	Nitric Acid Production	N_2O	1 595	1 396	0.008	0.017	0.846
3C2	Liming	CO_2	618	277	0.007	0.015	0.861
2A1	Cement Production	CO_2	786	500	0.006	0.014	0.876
1A2	Manufacturing Industries and Construction: Peat	CO_2	1 561	1 498	0.005	0.012	0.888
1A2	Manufacturing Industries and Construction: Gas	CO_2	2 094	2 174	0.005	0.011	0.899
1A3b	Road Transportation	N_2O	160	516	0.005	0.010	0.909
3C5	Indirect N_2O Emissions from Managed Soils	N_2O	735	592	0.004	0.009	0.919
3A2	Manure Management	N_2O	623	461	0.004	0.009	0.928
1A5	Non-Specified: Liquid	CO_2	734	1 083	0.003	0.006	0.934
3C1	Biomass Burning	CO_2	180	91	0.002	0.004	0.938
1A3e	Other Transportation	CO_2	644	651	0.002	0.004	0.942
1A4	Other Sectors: Gas	CO_2	98	225	0.001	0.003	0.946
1A3c	Railways	CO_2	191	134	0.001	0.003	0.949
1A5	Non-Specified: Gas	CO_2	222	363	0.001	0.003	0.952
....	....						
Total			70 692	85 352	0.445	1	

TABLE 4.9
EXAMPLE OF APPROACH 2 LEVEL ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003
The aggregation level used is country-specific, and does not represent recommended aggregation level. Only *key categories* are presented.

A	B	C	D	E	F	G
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,t}$ **(Gg CO_2-eq)**	$\lvert E_{x,t} \rvert$ **(Gg CO_2 eq)**	$LU_{x,t}$	**Cumulative Total of Column F**
3B1a	Forest Land Remaining Forest Land: carbon stock change in biomass	CO_2	-21 354	21 354	0.23	0.23
3C4	Direct N_2O Emissions from Managed Soils: Agricultural Soils	N_2O	2 608	2 608	0.18	0.41
3B3a	Grassland Remaining Grassland: net carbon stock change in mineral soils	CO_2	2 907	2 907	0.09	0.50
3C5	Indirect N_2O Emissions from Managed Soils	N_2O	592	592	0.06	0.56
1A3b	Road Transportation: Cars with Catalytic Converters	N_2O	410	410	0.05	0.61
2B2	Nitric Acid Production	N_2O	1 396	1 396	0.04	0.66
3B2a	Cropland Remaining Cropland: net carbon stock change in organic soils	CO_2	1 324	1 324	0.04	0.70
3B4ai	Peatlands Remaining Peatlands	CO_2	547	547	0.04	0.73
3B2a	Cropland Remaining Cropland: net carbon stock change in mineral soils	CO_2	-1 113	1 113	0.03	0.77
4A	Solid Waste Disposal	CH_4	2 497	2 497	0.03	0.80
1A	Fuel Combustion Activities: Liquid	CO_2	27 640	27 640	0.02	0.82
1A	Fuel Combustion Activities: Solid	CO_2	22 753	22 753	0.02	0.85
1A	Fuel Combustion Activities: Peat	CO_2	10 676	10 676	0.02	0.87
3A1	Enteric Fermentation	CH_4	1 537	1 537	0.01	0.88
1A4	Other Sectors: Biomass	CH_4	307	307	0.01	0.90
2D	Non-Energy Products from Fuels and Solvent Use	CO_2	830	830	0.01	0.91

TABLE 4.10
EXAMPLE OF APPROACH 2 TREND ASSESSMENT FOR THE FINNISH GHG INVENTORY FOR 2003
The aggregation level used is country-specific, and does not represent recommended aggregation level. Only *key categories* are presented.

A	B	C	D	E	F	G	H
IPCC Category Code	**IPCC Category**	**GHG**	$E_{x,0}$ **(Gg CO_2-eq)**	$E_{x,t}$ **(Gg CO_2-eq)**	**Trend Assessment with Uncertainty** $TU_{x,t}$	**% Contri-bution to Trend**	**Cumulative Total of Column G**
3C4	Direct N_2O Emissions from Managed Soils: Agricultural Soils	N_2O	3 486	2 608	5.42	0.24	0.24
3B3a	Grassland Remaining Grassland: net carbon stock change in mineral soils	CO_2	-1 181	2 907	3.62	0.16	0.40
3B1a	Forest Land Remaining Forest Land: carbon stock change in biomass	CO_2	-23 798	-21 354	2.71	0.12	0.52
3C5	Indirect N_2O Emissions from Managed Soils	N_2O	735	592	1.54	0.07	0.58
1A3b	Road Transportation: Cars with Catalytic Converters	N_2O	32	410	1.45	0.06	0.65
3B2a	Cropland Remaining Cropland: net carbon stock change in organic soils	CO_2	1 813	1 324	1.21	0.05	0.70
4A	Solid Waste Disposal	CH_4	3 678	2 497	1.20	0.05	0.75
2B2	Nitric Acid Production	N_2O	1 595	1 396	0.89	0.04	0.79
3B2a	Cropland Remaining Cropland: net carbon stock change in mineral soils	CO_2	-535	-1 113	0.82	0.04	0.83
3B4ai	Peatlands Remaining Peatlands	CO_2	503	547	0.36	0.02	0.85
3A2	Manure Management	N_2O	623	461	0.36	0.02	0.86
3A1	Enteric Fermentation	CH_4	1 868	1 537	0.35	0.02	0.88
1A	Fuel Combustion Activities: Liquid	CO_2	27 232	27 640	0.32	0.01	0.89
4D1	Domestic Wastewater Treatment and Discharge: densely populated areas	N_2O	84	66	0.20	0.01	0.90

TABLE 4.11
SUMMARY OF KEY CATEGORY ANALYSIS FOR FINLAND
Quantitative method used: Approach 1 and Approach 2

A	B	C	D	E
IPCC Category Code	**IPCC Category**	**Greenhouse gas**	**Identification criteria**	**Comments[a]**
1A	Fuel Combustion Activities: Liquid	CO_2	L2, T2	Aggr
1A	Fuel Combustion Activities: Solid	CO_2	L2	Aggr
1A	Fuel Combustion Activities: Peat	CO_2	L2	Aggr
1A1	Energy Industries: Solid	CO_2	L1, T1	
1A1	Energy Industries: Peat	CO_2	L1, T1	
1A1	Energy Industries: Gas	CO_2	L1, T1	
1A1	Energy Industries: Liquid	CO_2	L1, T1	
1A2	Manufacturing Industries and Construction: Solid	CO_2	L1, T1	
1A2	Manufacturing Industries and Construction: Liquid	CO_2	L1, T1	
1A2	Manufacturing Industries and Construction: Gas	CO_2	L1, T1	
1A2	Manufacturing Industries and Construction: Peat	CO_2	L1, T1	
1A3b	Road Transportation	CO_2	L1, T1	
1A3b	Road Transportation	N_2O	L1, T1	
1A3b	Road Transportation: Cars with Catalytic Converters	N_2O	L2, T2	Aggr
1A3c	Railways	CO_2		Tsub
1A3d	Water-borne Navigation	CO_2	L1	
1A3e	Other transportation	CO_2	L1, T1	
1A4	Other Sectors: Liquid	CO_2	L1, T1	
1A4	Other Sectors: Gas	CO_2		Tsub
1A4	Other Sectors: Biomass	CH_4	L2	
1A5	Non-Specified: Liquid	CO_2	L1	
1A5	Non-Specified: Gas	CO_2		Tsub
2A1	Cement Production	CO_2	T1	
2A2	Lime Production	CO_2	L1	
2B2	Nitric Acid Production	N_2O	L1, L2, T1, T2	
2D	Non-Energy Products from Fuels and Solvent Use	CO_2	L1, L2	
2F1	Refrigeration and Air Conditioning	HFCs, PFCs	L1, T1	
3A1	Enteric Fermentation	CH_4	L1, L2, T1, T2	
3A2	Manure Management	N_2O	T1, T2	
3B1a	Forest Land Remaining Forest Land	CO_2	L1, L2, T1, T2	
3B2a	Cropland Remaining Cropland	CO_2	L2, T1, T2	
3B3a	Grassland Remaining Grassland	CO_2	L1, T1	
3B3a	Grassland Remaining Grassland: net carbon stock change in mineral soils	CO_2	L2, T2	Aggr

TABLE 4.11
SUMMARY OF KEY CATEGORY ANALYSIS FOR FINLAND
Quantitative method used: Approach 1 and Approach 2

A	B	C	D	E
IPCC Category Code	**IPCC Category**	**Greenhouse gas**	**Identification criteria**	**Comments[a]**
3B4ai	Peatlands Remaining Peatlands	CO_2	L1, L2, T2	
3C2	Liming	CO_2	T1	
3C4	Direct N_2O Emissions from Managed Soils	N_2O	L1, T1	
3C4	Direct N_2O Emissions from Managed Soils: Agricultural Soils	N_2O	L2, T2	Aggr
3C5	Indirect N_2O Emissions from Managed Soils	N_2O	L1, L2, T1, T2	
3C1	Biomass Burning	CO_2		Tsub
4A	Solid Waste Disposal	CH_4	L1, L2, T1, T2	
4D1	Domestic Waste Waster Treatment and Discharge: densely populated areas	N_2O	T2	Aggr

[a] Tsub denotes a category that was only identified by trend assessment for a subset without category 3B. Level assessment of the subset did not identify additional categories when compared with Approach 1 analysis of the total inventory. Aggr denotes a category identified by Approach 2, where aggregation level has been different than in Approach 1.

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