Hands-on training Workshop on National GHG Inventory Preparation and Reporting under the ETF: Agriculture, IPPU and Waste Sector

Methodological Choice and Identification of Key Categories

Uncertainty Analysis

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Belize

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Methods: Tier 1, 2, 3

- **Tiers: A tier represents a level of methodological complexity.**

- **Usually three tiers are provided:**
  - Tier 1 - is the basic method,
  - Tier 2 - intermediate and
  - Tier 3 - most demanding in terms of complexity and data requirements

- **Tiers 2 and 3 are sometimes referred to as *higher tier methods* and are generally considered to be more accurate**

Methodological Choice

- **Methodological choice for individual source and sink categories is important in managing overall inventory uncertainty** (it is lower when emissions and removals are estimated using the most rigorous methods)

- **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** (therefore it is *good practice* to identify those categories that have the greatest contribution to overall inventory)

- **By identifying these *key categories* in a systematic and objective manner, inventory compilers can prioritise their efforts and improve their overall estimates** (it is *good practice* to use results of key category analysis as a basis for methodological choice to improve inventory quality and to increase confidence in the GHG estimates)

Key Category

A ***key category*** is one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of:

- *the absolute level*,
- *the trend*, or
- *the uncertainty* in emissions and removals.

Key categories **should be the priority for countries during inventory resource allocation for data collection, compilation, quality assurance/quality control and reporting.**

In general, more detailed ***higher tier methods*** **should be selected for** ***key categories.***

How to Define Key Categories

- **Disaggregate categories to the lowest possible level:**
  - to sub-category (e.g., to a fuel type – liquid, gaseous, solid)
  - to individual gas (use GWP).

- **Apply two Approaches:**
  - Approach 1 – Level and Trend Assessment
  - Approach 2 – Level/Trend + Uncertainty Assessment

- **Approach 1 – Level and Trend Assessment:**

  Key categories - 95% cumulative effect

- **Approach 2 – Level/Trend + Uncertainty Assessment:**

  Key categories - 90% cumulative effect

- ***Removals:*** **expressed as positive numbers (inclusion/exclusion)**

Identifying Key Categories via KCA

A key category analysis helps to focus your efforts and determine the appropriate methodological choice to estimate emission per category or subcategory

There are three approaches for a Key Category Analysis

- **Approach 1**: Predetermined cumulative emissions threshold (e.g., 95%)
- **Approach 2**: Contribution to uncertainty
- **Approach 3:** Qualitative criteria

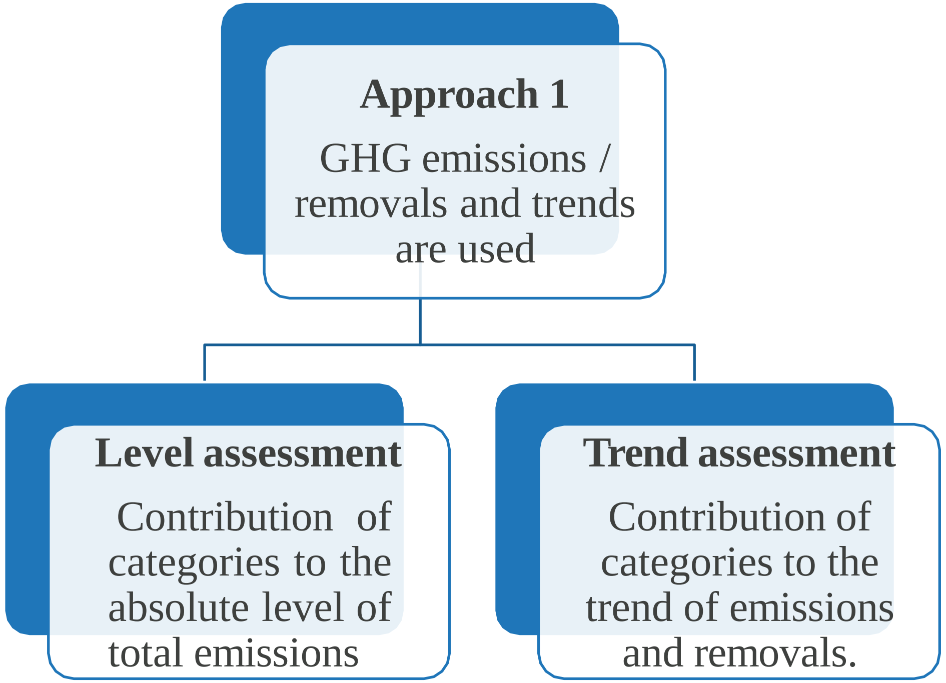
Approaches 1 and 2 are applied in two ways:

1. **Level assessment** by calculating the influence of a category on total emissions.
2. **Trend assessment** by calculating the influence of a category on the overall inventory emissions time series trend

If data is available you should apply all 3 approaches.

You should always apply Qualitative criteria with either Approach 1, Approach 2 or both.

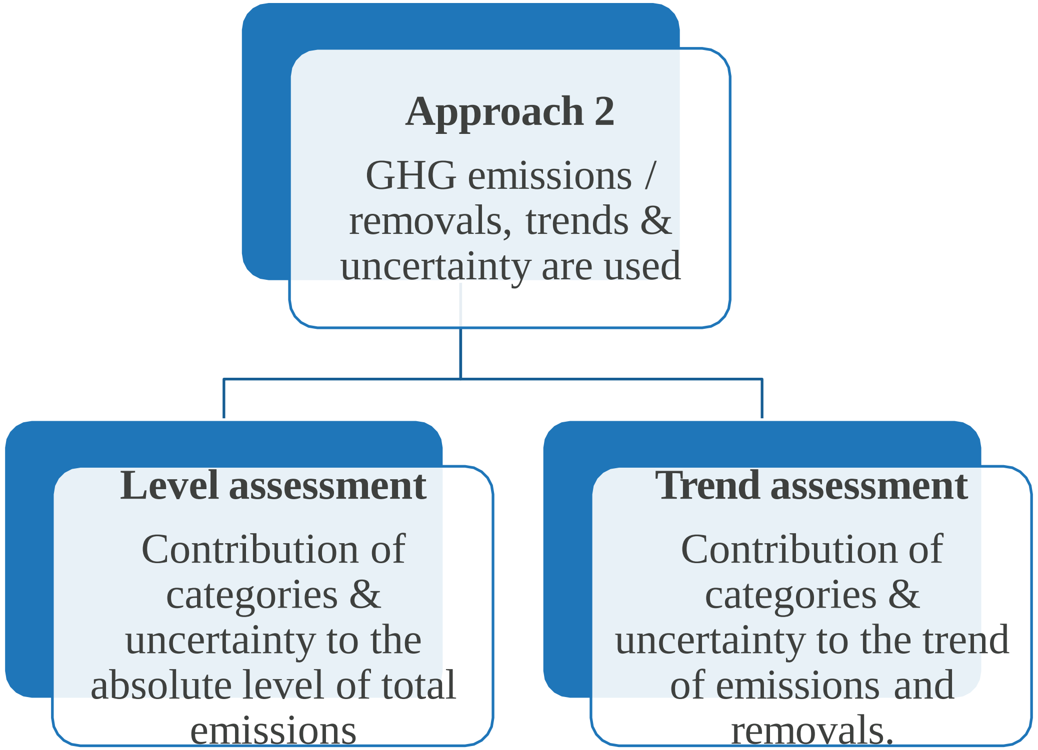
How to combine approaches and assessments over time



- Most countries start out with the level assessment under approach 1
- Then add the trend assessment, once they have a time series
- This is what the majority of developing countries do
- Moving to the level + trend assessment under approach 2 can happen when the national GHG inventory is more advanced

How to combine approaches and assessments over time

Belize's next progressive step is to commence conducting uncertainty assessments on the AD, EF and other parameters to execute an Approach 2 to identifying addition key categories that have not been identified using Approach 1



REMEMBER: If data is available you should apply all 3 approaches.
You should always apply Qualitative criteria with either Approach 1, Approach 2 or both.

KCA - Approach 1 – Level Assessment – Step by Step

1. **Estimate emissions** and **removals** from all known activities using tier 1 methods
2. **Convert removals** into ‘emissions’ (use absolute values)
3. **Calculate total** emissions
4. Calculate **% contribution** of each category to total ‘emissions’
5. **Arrange** all categories in descending order (based on % contribution)
6. **Add up the % contribution** of categories until you reach **95%** of total emissions
7. For categories between 95-97%, it is good practice to consider whether significant via a **qualitative analysis.**

Approach 1: Level Assessment

The level Assessment uses the contribution of a category to the inventory total

The 2006 IPCC Guidelines provide the following formula:

The category as a fraction of the total

EQUATION 4.1
LEVEL ASSESSMENT (APPROACH 1)

Key category level assessment = | source or sink category estimate | / total contribution

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

Removals (i.e. sinks) should be considered as an absolute value

Where:

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

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

$\sum_{y}|E_{y,t}|$ = 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[5], the total contribution/level can be larger than a country's total emissions less removals.[6]

KCA - Approach 1 – Trend Assessment – Step by Step

1. Calculate **the change of category emissions** between the two years
2. Calculate **the change in total emissions** between the two years
3. Calculate **trend assessment**
4. Calculate **contribution** to the trend
5. **Repeat Steps 1-4 for all source and sink categories** and estimate the individual contributions to the trend.
    - Once you have all individual contributions , then the remaining steps are similar to the Level assessment, where
6. **Rank** sources according to **their contribution to the trend**
7. Calculate cumulative contributions
8. **Identify sources contributing to 95% of the trend**. These sources are Key categories according to the Trend Assessment.

Example of Level Assessment

			Emission/ Removal	Absolute
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10000	10000
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1300	1300
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5502	5502
3A2	Manure Management	CH_4	543	543
3B1a	Forest Land Remaining Forest Land	CO_2	-2345	2345
3B1b	Land Converted to Forest Land	CO_2	879	879
				20892

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gef UN environment programme

Example of Level Assessment

			Emission/ Removal	Absolute	Level
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10000	10000	47.9%
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200	1.0%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1300	1300	6.2%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123	0.6%
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5502	5502	26.3%
3A2	Manure Management	CH_4	543	543	2.6%
3B1a	Forest Land Remaining Forest Land	CO_2	-2345	2345	11.2%
3B1b	Land Converted to Forest Land	CO_2	879	879	4.2%
				20892	

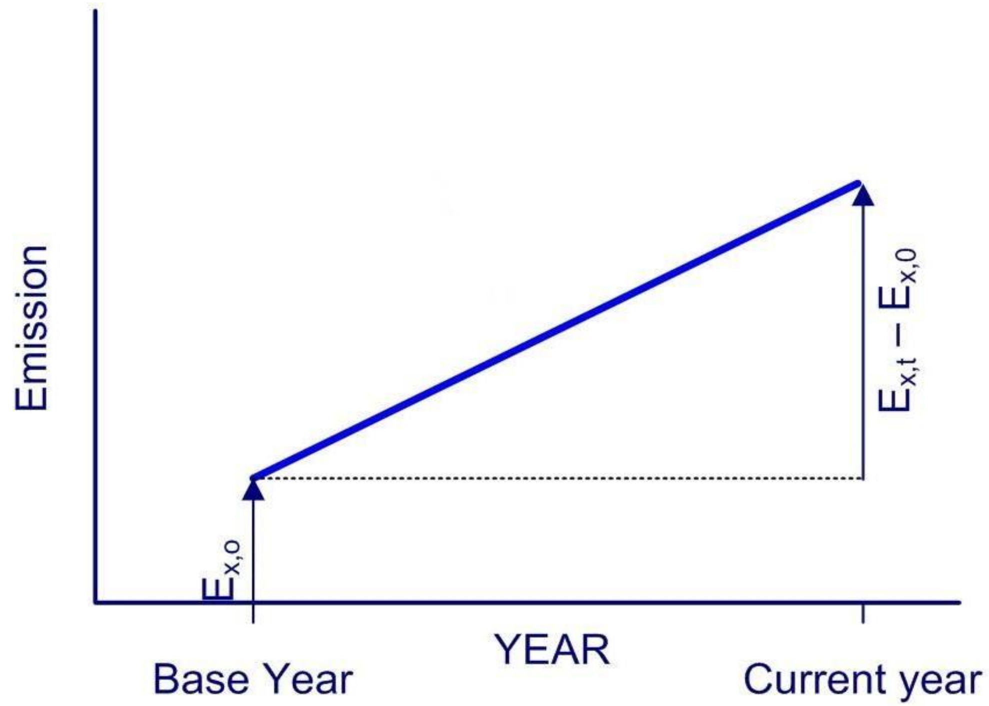
Example of Level Assessment

			Emission/ Removal	Absolute	Level	Cumulative
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10000	10000	47.9%	47.9%
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5502	5502	26.3%	74.2%
3B1a	Forest Land Remaining Forest Land	CO_2	-2345	2345	11.2%	85.4%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1300	1300	6.2%	91.6%
3B1b	Land Converted to Forest Land	CO_2	879	879	4.2%	95.8%
3A2	Manure Management	CH_4	543	543	2.6%	98.4%
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200	1.0%	99.4%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123	0.6%	100.0%
				20892		

Approach 1 : 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.



Approach 1: Trend Assessment

Approach 1: Trend Assessment is used to identify smaller key categories that may not be large enough to be identified by the level assessment, but whose trend has a significant influence on the trend of the overall inventory. **The 2006 IPCC Guidelines provide the following formula:**

EQUATION 4.2
TREND ASSESSMENT (APPROACH 1)

$$T_{x,t} = \frac{|E_{x,0}|}{\sum_y |E_{y,0}|} \bullet \left| \left[\frac{(E_{x,t} - E_{x,0})}{|E_{x,0}|} \right] - \frac{\left(\sum_y E_{y,t} - \sum_y E_{y,0} \right)}{\left| \sum_y E_{y,0} \right|} \right|$$

$T_{x,t}$ = trend assessment of source or sink category *x* in year *t* as compared to the base year (year 0)

$|E_{x,0}|$ = absolute value of emission or removal estimate of source or sink category *x* in year 0

$E_{x,t}$ and $E_{x,0}$ = real values of estimates of source or sink category *x* in years *t* and 0, respectively

$\sum_y E_{y,t}$ and $\sum_y E_{y,0}$ = total inventory estimates in years *t* and 0, respectively

KCA - Approach 1 – Trend Assessment – Step by Step

1. Calculate **the change of category emissions** between the two years
2. Calculate **the change in total emissions** between the two years
3. Calculate **trend assessment**
4. Calculate **contribution** to the trend
5. **Repeat Steps 1-4 for all source and sink categories** and estimate the individual contributions to the trend.
    - Once you have all individual contributions , then the remaining steps are similar to the Level assessment, where
6. **Rank** sources according to **their contribution to the trend**
7. Calculate cumulative contributions
8. **Identify sources contributing to 95% of the trend**. These sources are Key categories according to the Trend Assessment.

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Example of Trend Assessment

ICAT

IPCC Category Code	IPCC Category	Greenhouse Gas	$E_{x,0}$ (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 N_2O 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	

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Qualitative Criteria Analysis

Criterion	Explanation
Mitigation techniques and technologies	• If category may be subject to mitigation activities (e.g. NDC)
Expected growth	• A category may become key soon (e.g. for many years, F gases fell into this category for annex I countries.)
No quantitative assessment of uncertainties performed	• Categories may have significant uncertainty, even when approach 2 not performed.
Completeness	• The quantitative KCA may not accurately reflect circumstances if not all categories are estimated. Could look at other similar countries to determine possible key categories.

Conclusion

- ***Key categories* are extremely important:**
  - Mistakes will lead to significant under-/over- estimates
  - Improvements will significantly improve overall inventory quality

- **Higher tiers** *(Tier 2 and Tier 3)* **should be used for estimating *key categories***

- **Resources of national inventory compilers are** *(in many cases)* **limited → focus on *key categories***

Reporting requirements for uncertainty analysis in national GHG inventories under the ETF

Parties shall…

- submit 1st BTR at the latest 31 December 2024 (18/CMA.1) – Least developed country Parties and small island developing States may submit at their discretion.
- use the 2006 IPCC Guidelines – uncertainty estimates are an essential element of a complete inventory of GHG emissions and removals. They should be derived for both the national level and the trend estimate, as well as for the component parts such as emission factors, activity data and other estimation parameters for each category.
- quantitatively estimate uncertainty and qualitatively discuss uncertainty for emission, removal estimates for all categories, including inventory totals for at least the starting year and latest year of the inventory time series.
- also estimate the trend uncertainty – use at least approach 1.
- Flexibility – for developing countries Parties that need it in the light of their capacity, provide, at a minimum, a qualitative discussion of uncertainty for key categories where quantitative input data are unavailable to quantitatively estimate uncertainties and encourage to provide quantitative estimate of uncertainty.

Reporting requirements for uncertainty analysis in national GHG inventories under the ETF

Parties shall…

- Time series
  - report consistent time series from 1990 (with flexibility)
  - report latest reporting year T-2 (T-3 with flexibility)
- report recalculations for starting year and all subsequent years of time series together with justification and impact of recalculations
- identify key category for the starting year and the latest reporting year including and excluding LULUCF categories, using approach 1, for both level and trend assessment (with flexibility)
- report on institutional arrangements (e.g., planning, preparation and management) – uncertainty data collection, academia, statistics office
- develop a QA/QC plan (with flexibility)
- report basket of 7 gases – CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF3 (with flexibility), using AR5 GWP values (*IPCC WGI AR5 Chapter08, Table 8.A.1*)

KCA Exercise

Which of the following statements are True or False?

1. According to the 2006 IPCC Guidelines, key category is prioritised within an inventory because its emissions or removals have a significant influence on the total GHG inventory, in terms of absolute level, the total trend, or uncertainty in emissions and removals.
2. According to the 2006 IPCC Guidelines, qualitative assessment should only be performed based on expert judgement.
3. The sole purpose of a key category analysis is to determine whether the IPCC default emissions factors can be used to estimate emissions from specific categories
4. When you perform a key category analysis, for each activity that emits more than one GHG there is no need to specify a separate category for each gas.

Select which of the following can be used as qualitative criteria for Approach 3.

a) Technological advancements leading to reductions in GHG emissions from specific categories
b) Expected large decreases in the uncertainty of a category based on the findings of a peer-viewed article
c) Results of the key categories analysis from the GHG inventory of a neighbouring country with similar circumstances

KCA Exercise

Arrange the following steps, from 1 to 6, to correspond to the Approach 1 – Level Assessment.

- Add up the % contribution of categories until you reach 95% of total emissions ☐
- Estimate emissions and removals from all known activities using tier 1 methods ☐
- Arrange all categories in descending order (based on % contribution) ☐
- Convert removals into 'emissions' ☐
- Calculate % contribution of each category to totals 'emissions' ☐
- Calculate total emissions ☐

KCA Exercise Answers

Which of the following statements are True or False?

1. According to the 2006 IPCC Guidelines, key category is prioritised within an inventory because its emissions or removals have a significant influence on the total GHG inventory, in terms of absolute level, the total trend, or uncertainty in emissions and removals. True
2. According to the 2006 IPCC Guidelines, qualitative assessment should only be performed based on expert judgement. False
3. The sole purpose of a key category analysis is to determine whether the IPCC default emissions factors can be used to estimate emissions from specific categories. False
4. When you perform a key category analysis, for each activity that emits more than one GHG there is no need to specify a separate category for each gas. False

Select which of the following can be used as qualitative criteria for Approach 3.

a) Technological advancements leading to reductions in GHG emissions from specific categories
b) Expected large decreases in the uncertainty of a category based on the findings of a peer-viewed article
c) Results of the key categories analysis from the GHG inventory of a neighbouring country with similar circumstances

All three can be used.

KCA Exercise Answer

Arrange the following steps, from 1 to 6, to correspond to the Approach 1 – Level Assessment.

- Add up the % contribution of categories until you reach 95% of total emissions 6
- Estimate emissions and removals from all known activities using tier 1 methods 1
- Arrange all categories in descending order (based on % contribution) 5
- Convert removals into 'emissions' 2
- Calculate % contribution of each category to totals 'emissions' 4
- Calculate total emissions 3

Uncertainty Overview

2006 IPCC Guidelines for
National Greenhouse Gas Inventories

Guidelines | Energy | IPPU | AFOLU | Waste

Vol. 1 - Ch. 3: uncertainty

Vol. 1 - Ch. 4: KCA based on uncertainty

Vol. 1 - Ch. 5: Splicing techniques

Good Practice Guidance and Uncertainty Management
in National Greenhouse Gas Inventories

Chapter 1 Introduction
Chapter 2 Energy
Chapter 3 Industrial Processes
Chapter 4 Agriculture
Chapter 5 Waste
Chapter 6 Quantifying Uncertainties in Practice
Chapter 7 Methodological Choice and Recalculation
Chapter 8 Quality Assurance and Quality Control

Uncertainty Overview

General approach

Uncertainty

Lack of knowledge of the true value of a variable that can be described as a probability density function (PDF). Uncertainty depends on the analyst's state of knowledge, which in turn depends on the quality and quantity of applicable data as well as knowledge of underlying processes and inference methods.

Uncertainty analysis

An uncertainty analysis should be seen, first and foremost, as a means to help prioritise national efforts to reduce the uncertainty of inventories in the future, and guide decisions on methodological choice.
Quantitative uncertainty analysis is performed by estimating the 95 percent confidence interval of the emissions and removals estimates for individual categories and for the total inventory

Uncertainty assessment

The term "ASSESSMENT" is intended to convey an exercise that includes the investigation of quantitative and qualitative aspects. In the glossary to the Guidelines, "uncertainty analysis" is defined as only a quantitative exercise.

Uncertainty Overview

Key concepts

Confidence interval: range that encloses the true, but unknown value, with a determined confidence (probability). Typically, a 95 percent confidence interval is used in greenhouse gas inventories.
Alternative interpretation: Range that may safely be declared to be consistent with observed data or information

Probability Density Function (PDF): describes the range and relative likelihood of possible values.
For emission inventory, it is used to describe uncertainty in the estimate of a quantity that is a fixed constant whose value is not exactly known.

Sensitivity analysis: method to determine which of the input uncertainties to an inventory contributes most substantially to the overall uncertainty.

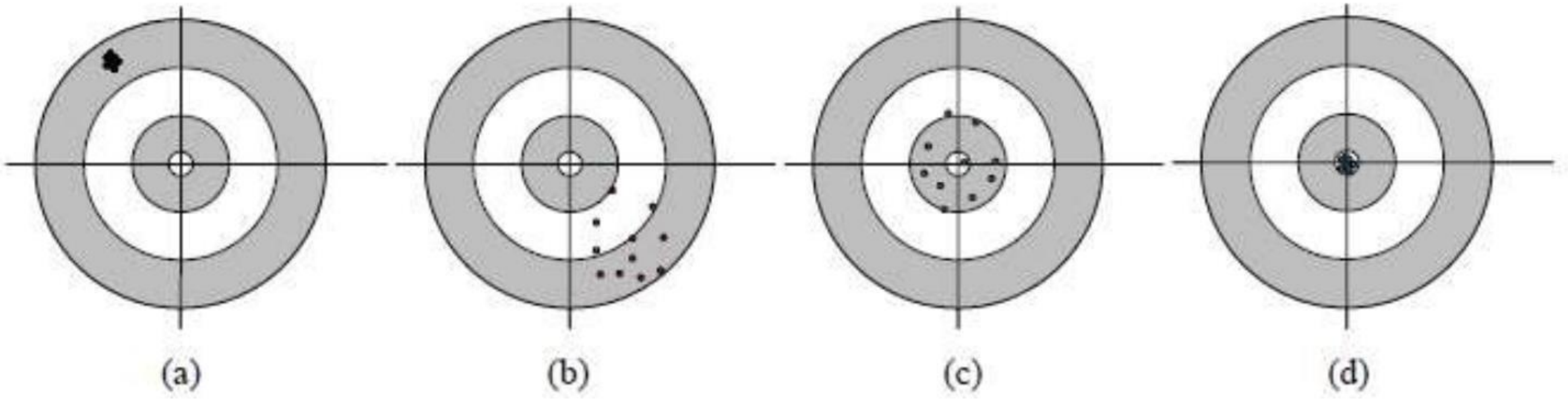
Uncertainty Overview

Lack of knowledge of the true value

How far is the true value from the value used?

Accuracy (systematic errors or bias) vs. Precision (random errors)

(a) inaccurate but precise; (b) inaccurate and imprecise; (c) accurate but imprecise; and (d) precise and accurate



Uncertainty Overview

Linear Error Propagation (LEP)

Enter Emissions Data

Data Calculated using simple equations

TABLE 3.2
APPROACH 1 UNCERTAINTY CALCULATION

A	B	C	D	E	F	G	H	I	J	K	L	M
IPCC category	Gas	Base year emissions or removals	Year *t* emissions or removals	Activity data uncertainty	Emission factor / estimation parameter uncertainty	Combined uncertainty	Contribution to Variance by Category in Year *t*	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor / estimation parameter uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data Note A	Input data Note A	$\sqrt{E^2+F^2}$	$\frac{(G \bullet D)^2}{(\sum D)^2}$	Note B	$\left\lvert\frac{D}{\sum C}\right\rvert$	$I \bullet F$ Note C	$J \bullet E \bullet \sqrt{2}$ Note D	K^2+L^2
		Gg CO_2 equivalent	Gg CO_2 equivalent	%	%	%		%	%	%	%	%
E.g., 1.A.1. Energy Industries Fuel 1	CO_2											
E.g., 1.A.1. Energy Industries Fuel 2	CO_2											
Etc...	…											
Total		$\sum C$	$\sum D$				$\sum H$					$\sum M$
					Percentage uncertainty in total inventory:		$\sqrt{\sum H}$				Trend uncertainty:	$\sqrt{\sum M}$

Enter Uncertainties

Uncertainty Overview

AD uncertainties based on source of data

EF uncertainties based on data used

List of source/sinks

Approach 1 uncertainty calculation												
A	B	C	D	E	F	G	H	I	J	K	L	M
IPCC category	Gas	Base year emissions or removals	Year *t* emissions or removals	Activity data uncertainty	Emission factor / estimation parameter uncertainty	Combined uncertainty	Contribution to Variance by Category in	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national	Uncertainty in trend in national	Uncertainty introduced into the trend in total national emissions
		Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{(G \bullet D)^2}{(\Sigma D)^2}$	Note B	$\left\lvert \frac{D}{\Sigma C} \right\rvert$	$I \bullet F$	$J \bullet E \bullet \sqrt{2}$	K^2+L^2
		Gg CO_2 equivalent	Gg CO_2 equivalent	%	%	%		%	%	%	%	%
1.A.1. Energy Industries	CH4	35.5346662	32.9951217	5	25	25.50	0.0	3.20506E-05	0.00010495	0.000801264	0.000742109	1.19275E-06
1.A.2. Manufacturing Industries and Constructior	CH4	57.0302899	51.8776096	5	25	25.50	0.0	4.80131E-05	0.000165011	0.001200328	0.001166804	2.80222E-06
1.A.3. Transport	CH4	81.7067834	37.1466612	5	25	25.50	0.0	-4.94664E-05	0.000118155	-0.00123666	0.000835483	2.22736E-06
1.A.4. Other Sectors	CH4	1041.24025	428.554682	5	25	25.50	0.0	-0.000772946	0.001363136	-0.019323647	0.009638828	0.00046631
1.A.5. Other	CH4	330.338228	97.5658895	5	25	25.50	0.0	-0.000367351	0.000310335	-0.009183772	0.002194401	8.91571E-05
1.B.1. Solid Fuels	CH4	24867.6834	12364.38	10	25	26.93	2.7	-0.011678579	0.039328314	-0.291964463	0.556186352	0.394586505
1.B.2. Oil and Natural Gas	CH4	12570.348	4022.34735	10	25	26.93	0.3	-0.012988732	0.012794183	-0.324718297	0.180937071	0.138180196
2.B. Chemical Industry .	CH4	40.53	37.5018	10	25	26.93	0.0	3.61373E-05	0.000119285	0.000903433	0.001686942	3.66196E-06
4.A. Enteric Fermentation.	CH4	14054.9863	7346.85	15	30	33.54	1.5	-0.005462727	0.023368679	-0.163881819	0.495724537	0.272600067
4.B. Manure Management.	CH4	1903.28061	1199.63088	15	30	33.54	0.0	-8.88245E-05	0.003815756	-0.002664735	0.080944413	0.006559099
4.C. Rice Cultivation.	CH4	522.9	338.94	10	30	31.62	0.0	5.3609E-06	0.001078092	0.000160827	0.015246523	0.000232482
4.F. Field Burning of Agricultural Residues.	CH4	64.3314	[illegible]	[illegible]	[illegible]	[illegible]	0.0	-1.24107E-05	0.000119565	-0.000372321	0.003381819	1.15753E-05
6.A. Solid Waste Disposal on Land.	CH4	1959.72	[illegible]	[illegible]	[illegible]	[illegible]	0.4	0.00787088	0.011891742	0.236126385	0.252261939	0.119391756
6.B. Wastewater Handling.	CH4	787.08	[illegible]	[illegible]	[illegible]	[illegible]	0.0	0.000761896	0.002376612	0.022856865	0.050415547	0.003064164
1.A.1. Energy Industries	CO2	102607.31	[illegible]	[illegible]	[illegible]	[illegible]	11.2	0.094441853	0.305249301	0.472209267	2.158438506	4.881838378
1.A.2. Manufacturing Industries and Constructior	CO2	33991.06	[illegible]	[illegible]	5	7.07	1.1	0.02618491	0.095945987	0.130924551	0.678440577	0.477422855
1.A.3. Transport	CO2	23987.07	[illegible]	5	5	7.07	0.1	-0.022453294	0.026739124	-0.11226647	0.189074157	0.048352797
1.A.4. Other Sectors	CO2	[illegible]	11784.04	5	5	7.07	0.2	-0.053800014	0.037482383	-0.269000072	0.265040472	0.14260749
1.A.5. Other	CO2	8370.16	4124.19	5	5	7.07	0.0	-0.004052209	0.013118122	-0.020261045	0.092759127	0.009014766
1.B.2. Oil and Natural Gas	CO2	3408.21	5171.49583	10	15	18.03	0.2	0.009456387	0.016449366	0.141845811	0.232629165	0.074236563
2.A. Mineral Products.	CO2	5744.63	2507.20146	10	15	18.03	0.0	-0.003809586	0.007974844	-0.057143788	0.112781331	0.015985041
2.B. Chemical Industry .	CO2	1355.56	171.93456	10	15	18.03	0.0	-0.002233954	0.000546885	-0.033509311	0.007734125	0.001182691
2.C. Metal Production.	CO2	12932.6799	10507.4715	10	15	18.03	0.9	0.006887639	0.033421905	0.103314586	0.47265712	0.234078657
5.A. Changes in Forest and Other Woody Bioma	CO2	97.19		50	80	94.34	0.0	-0.000199385	0	-0.015950798	0	0.000254428
5.A. Changes in Forest and Other Woody Bioma	CO2	-7810.79	-7721.7341	50	80	94.34	12.9	-0.008539362	0.024561101	-0.683148991	1.736732102	3.482930938
5.B. Forest and Grassland Conversion.	CO2	6.26	280.43888	25	75	79.06	0.0	0.00087917	0.000892013	0.065937785	0.031537424	0.005342401
1.A.1. Energy Industries	N2O	388.516902	328.741673	5	50	50.25	0.0	0.000248607	0.001045653	0.012430334	0.007393886	0.000209183
1.A.2. Manufacturing Industries and Constructior	N2O	112.709781	114.844426	5	50	50.25	0.0	0.000134069	0.000365294	0.006703468	0.002583021	5.16085E-05
1.A.3. Transport	N2O	57.3319301	21.6195922	5	50	50.25	0.0	-4.88495E-05	6.87671E-05	-0.002442474	0.000486257	6.20212E-06
1.A.4. Other Sectors	N2O	194.497577	46.1816455	5	50	50.25	0.0	-0.000252117	0.000146893	-0.01260587	0.001038693	0.000159987
1.A.5. Other	N2O	27.4386549	13.5195061	5	50	50.25	0.0	-1.3288E-05	4.30025E-05	-0.000664398	0.000304074	5.33886E-07
4.B. Manure Management.	N2O	375.1	198.4	15	30	33.54	0.0	-0.000138451	0.000631066	-0.004153541	0.013386927	0.000196462
4.D. Agricultural Soils(2).	N2O	25217.694	9798.17	20	30	36.06	3.0	-0.020551916	0.031165777	-0.616557485	0.881501284	1.157187646
4.F. Field Burning of Agricultural Residues.	N2O	24.304	21.297	20	30	36.06	0.0	1.78812E-05	6.7741E-05	0.000536437	0.001916004	3.95884E-06
6.B. Wastewater Handling.	N2O	452.6	384.4	15	30	33.54	0.0	0.000294175	0.00122269	0.008825264	0.025937172	0.000750622
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Total		314388.7626	202771.1719			ΣH	34.6				ΣM	11.4670044
					Percentage uncertainty in total inventory:		5.880740472				Trend uncertainty:	3.386296561

Uncertainty Overview

Uncertainty assessment

- It is a means to help prioritise national efforts to reduce the uncertainty of inventories in the future
- It guides decisions on methodological choice
- It helps understand the quality of the information use
- It is a requirement of GHG Inventories

Assessment of uncertainty in the input parameters should be part of the data collection !

Any Questions?