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ClimaEast

Support to Climate Change Mitigation and Adaptation in Russia and ENP East countries

Introducing national greenhouse gas inventories

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Ricardo MRV / GHG Team

28 March 2017, Tbilisi

What we will cover this morning

- What is a GHG inventory?
- IPCC Guidelines
- ‘TCCCA‘ and why we need principles
- Annual Inventory Cycle

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What is a national GHG inventory?

- A **greenhouse gas inventory** is an accounting of **greenhouse gases** (GHGs) emitted to or removed from the atmosphere.
- An inventory will list, by source, the amount of pollutants emitted to the atmosphere during a given time period (annual emission estimates from a base year to the latest year).
- Policy makers use **inventories** to establish a baseline for tracking emission trends, developing mitigation strategies and policies, and assessing progress.
- Internationally, the reporting of national inventories is part of the UNFCCC management of GHG emissions. Inventories are used to **monitor progress towards reduction targets** and to enable countries to **access climate finance mechanisms**.

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Scope of a national GHG inventory

- GHG Inventories report annual emissions of all anthropogenic GHG emissions.
- Sectors: energy, industrial process and product use (IPPU), agriculture land use change and forestry, waste
- **Gases**: *Carbon dioxide, methane, nitrous oxide, HFCs, PFCs, SF_6 and NF_3*
  - Carbon dioxide: mainly from combustion of fuels in different economic sectors, industrial processes, LULUCF sources and sinks
  - Methane: waste, agriculture
  - Nitrous oxide: industrial processes, agriculture
  - F-gases: IPPU
- **Excluded**:
  - Short-cycle biocarbon in the GHGI (e.g. CO_2 from plant biomass)
  - International shipping and aviation – reported as “memo items”.

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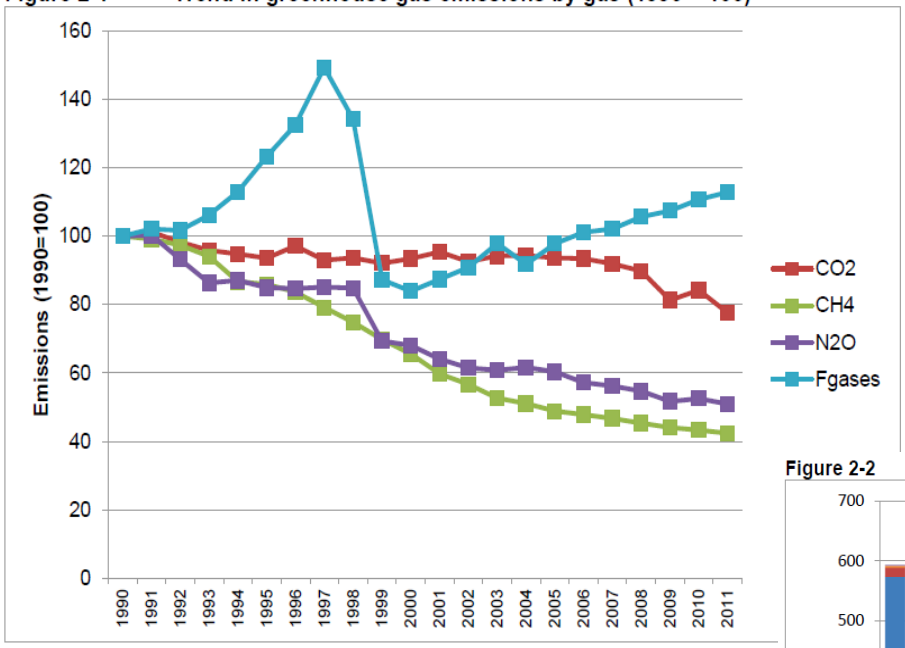
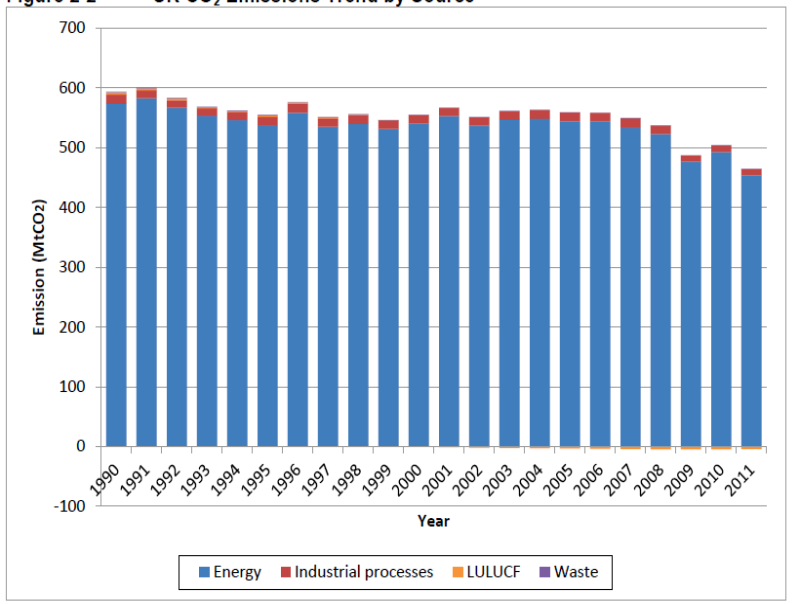
Purpose of National GHG Inventories

Figure 2-1 Trend in greenhouse gas emissions by gas (1990 = 100)



- Show development of GHG emissions at national level over time
- Allow prioritising of sectors, sources or gases for mitigation action
- But there is more.....

Figure 2-2 UK CO_2 Emissions Trend by Source



Further uses of GHG Inventories

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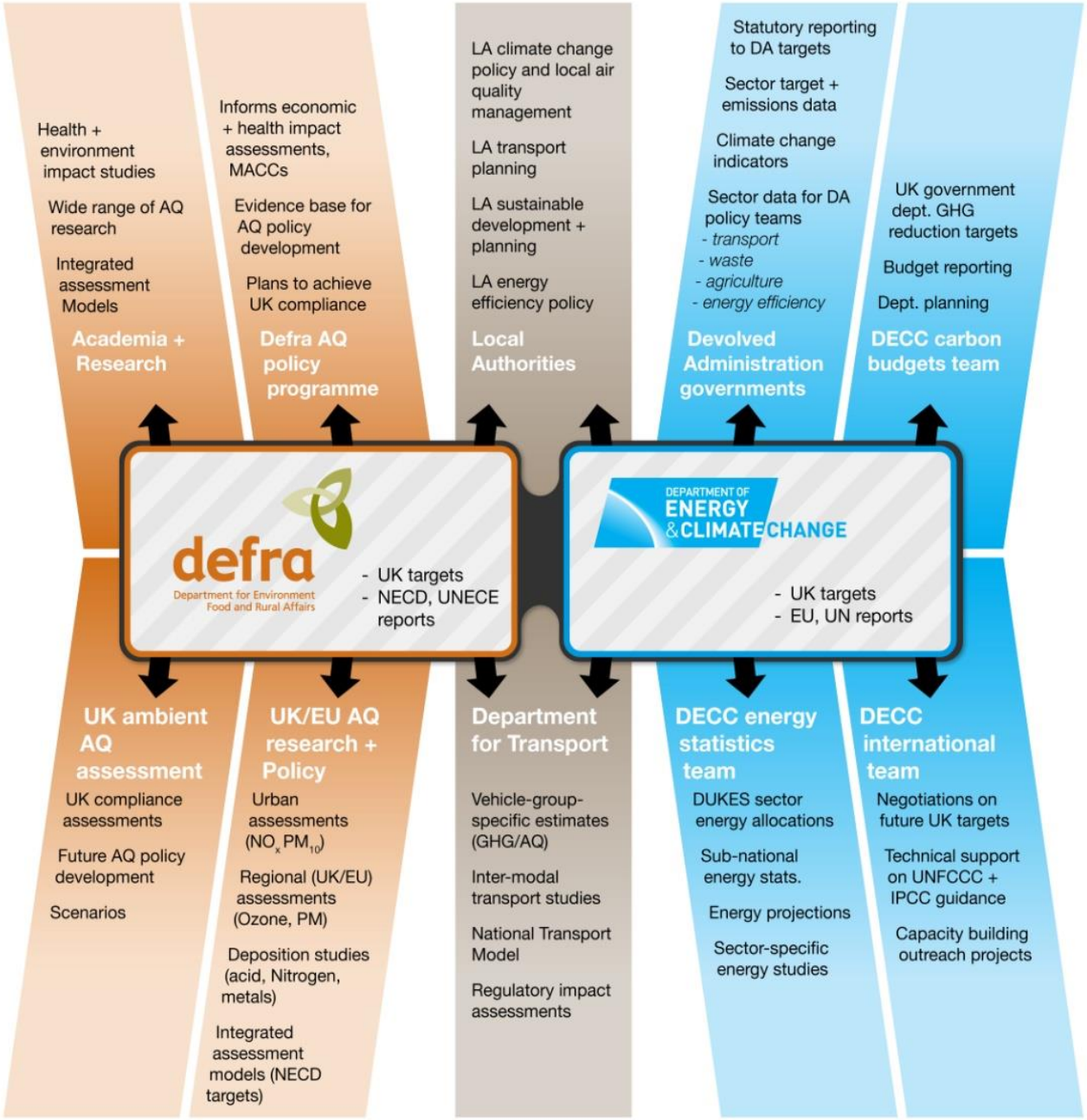

Use of inventory data and inventory experience in the UK

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How do you compile a national GHG Inventory?

- There is a lot of guidance on how to compile GHG inventories, and there are a lot of workbooks / software / literature resources to help.
- There are varying levels/'tiers' of complexity and detail that can be applied in preparing emission estimates, but **it does not have to be complicated!**
- In general, high-emitting sources need to be looked at in more detail, whilst lesser sources can be dealt with simply.
- The aim is to: make a start, set up a system that enables a rolling programme of improvement, identify skills and resource gaps (and seek support to address those), document what is done to retain knowledge.
- It makes sense to phase improvements according to national priority sectors, e.g. biggest sources, biggest opportunities for mitigation.

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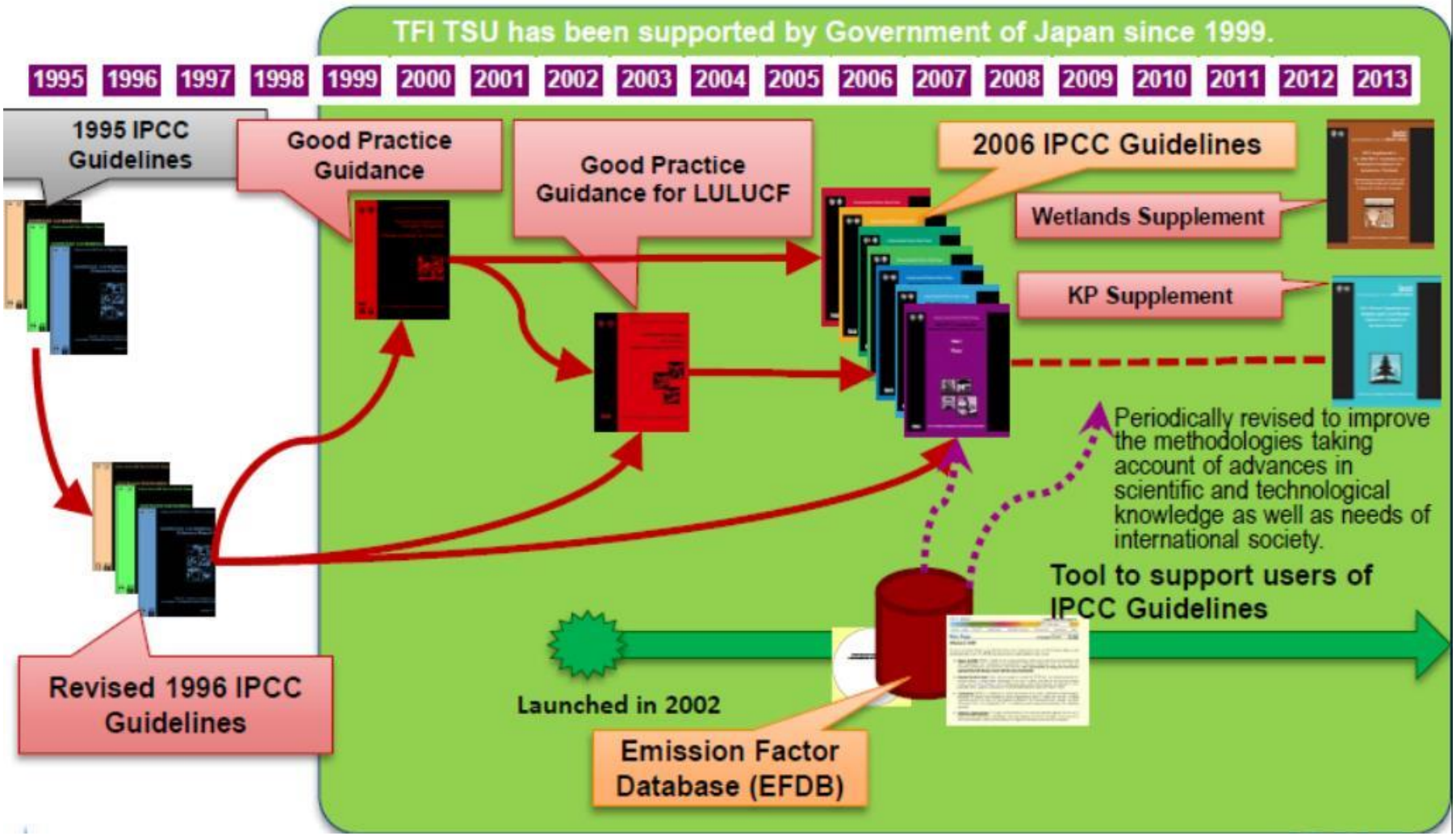
Evolution of IPCC Guidelines & other tools



Source: IPCC

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Evolution of IPCC Guidelines

- Guidelines have evolved from 1996 to 2006
  - Have developed and improved as knowledge and experience increases
- Development of Good Practice Guidance (GPG) a major step forward
  - Complete, consistent, comparable, transparent, and accurate inventories taking account of available resources
  - Major change was from 1996 LUCF to GPG LULUCF
    - 1996 Guidelines focus main processes, LULUCF & AFOLU focus on all land-uses.
    - This increase in completeness and accuracy also increases data & resource needs.
    - In contrast, changes from LULUCF to 2006 Guidelines (AFOLU) are small
- 2006 Guidelines [2.5 years work, 250 authors]
  - Have 4 sectors to reduce double counting or omissions and improve transparency and completeness
  - Have improved methods and default data
  - Cover more greenhouse gases and give methods for more sectors
  - Have integrated good practice guidance for clarity and ease of use
  - Require similar resources to implement as the 1996 Guidelines plus the two volumes of GPG
  - Does not pre-empt accounting choices - all the information needed is retained
  - The best globally applicable methods

Source: IPCC

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Methodological approaches unchanged

- ✓ **Continued from 1996 Guidelines, through GPG 2000 & LULUCF to 2006 Guidelines:**

Emission = [Emission Factor] x [Activity Data]

- In General:
  - Energy emissions
    - Based on carbon content of fuel
  - Industrial Processes
    - Based on chemistry of process
    - Some use mass balance of product used
  - Land Use
    - Stock changes ⇒ Emissions/Removals
    1. Inputs (e.g. growth) - outputs (e.g. decay, harvest)
    2. Total Stock at end minus Total stock at beginning
  - Waste
    - Tracks carbon (fossil & biogenic) in waste

Source: IPCC

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General Estimation Methodologies

- More than one estimation methodology is presented.
- Methodologies ("tiers") are classified according to the accuracy of available data

National statistics and IPCC default emission factors	**Tier 1**
National statistics and country-specific emission factors, partly plant-level data	Tier 2
Plant-level input data	**Tier 3**

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A ‘Quality’ Inventory

- National GHG inventories must produce **high quality** data of anthropogenic emissions and removals of greenhouse gases, that is **credible & traceable.**
- National GHG inventories must be prepared in accordance with the UNFCCC **data quality principles (TACCC)**:
  - **Transparency**
  - **Accuracy**
  - **Completeness**
  - **Comparability**
  - **Consistency**

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Transparency:

- Assumptions and methodologies are clearly explained and documented to facilitate replication and assessment
- If you do not provide documentation, there is no way to demonstrate that any of the other principles have been met

Accuracy:

- Relative measure of the exactness of emission/removal estimates
- Estimates must be: "systematically neither over nor under true emissions/removals, as far as can be judged according to the available data and information"
- Uncertainties must be reduced as far as practicable
- Appropriate methodologies must be used, in accordance with IPCC guidelines

Consistency:

- An Inventory must be internally consistent in all its elements with inventories from previous years
- Use the same methodologies for the base year and all subsequent years
- Consistent data sets to estimate emissions and removals from sources/sinks

Comparability:

- Estimates must be comparable among Parties
- Methodologies and formats as agreed by the Conference of the Parties
- Allocation of source/sink categories

Completeness:

- Report all sources/sinks and gases included in the IPCC Guidelines
- Other existing specific source/sink categories
- Full geographic coverage of sources/sinks of a Party

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Key Category Analysis

IPCC defines a Key Category as:

"a category that is prioritized 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

Example: Georgia's key categories from the 3rd National Communication

No	Source-category	Gas	2011 Emissions (Gg)	Level assessment, (%)	Trend assessment, (%)	Reason to select as Key- category
1	1B2. Fugitive emissions from gas transportation and distribution processes	CH4	2357	15%	13%	Level, Trend
2	1A3. Road transport (gasoline)	CO2	1236	8%	1%	Level, Trend
3	4A. Enteric fermentation	CH4	1189	7%	9%	Level, Trend
4	1A1. Electricity and heat production (gas)	CO2	1179	7%	2%	Level, Trend
5	1A3. Road transport (diesel)	CO2	1000	6%	7%	Level, Trend
6	2A1. Cement production	CO2	983	6%	7%	Level, Trend
7	1A4b. Residential gas	CO2	926	6%	4%	Level, Trend
8	6A. Solid waste	CH4	904	6%	3%	Level, Trend
9	2F. Halocarbons use	HFC	804	5%	8%	Level, Trend
10	2B2. Nitric Acid production	N2O	721	4%	0%	Level
11	1A2. Manufacturing industries and construction (gas consumption)	CO2	553	3%	3%	Level, Trend
12	1A2. Manufacturing industries and construction (solid fuel consumption)	CO2	438	3%	5%	Level, Trend
13	2C2. Ferroalloys production	CO2	413	3%	4%	Level, Trend
14	4D3. Indirect emissions from soils	N2O	390	2%	3%	Level, Trend

Task Force on
National Greenhouse Gas Inventories

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

IPCC web sites

- Home IPCC
- IPCC-TFI Home
- Organization
- Publications
- Inventory Software
- Meetings
- FAQs
- Links
- Emission Factor Database (EFDB)
- Electronic DIscussion Group (EDG)

IPCC honoured with the 2007 Nobel Peace Prize

Inventory Software

IPCC Inventory Software

The IPCC Inventory Software implements the simplest Tier 1 methods in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and as such is useful to users of all versions of the IPCC Guidelines. The TFI is currently working on making it compatible with the Tier 2 methods in the 2006 IPCC Guidelines.

This software has a number of improvements over earlier software for the Revised 1996 Guidelines, including:

- Standalone software that does not require any additional software or internet access
- Covers all inventory categories but can also be used for management of specific sectors
- Allows different parts of the inventory to be developed simultaneously
- Data entry in worksheets following 2006 IPCC Guidelines for ease-of-use
- Provides default data from 2006 IPCC Guidelines but gives users the flexibility to use their own country-specific information

The IPCC TFI will continue to develop this software including:

- Complete Tier 2 capabilities

Download

- Inventory Software Ver 2.18 (released on 6 March 2017) >> Please read note carefully before using the software.
- User Manual (Ver 2.18) PDF

http://www.ipcc-nggip.iges.or.jp/software/

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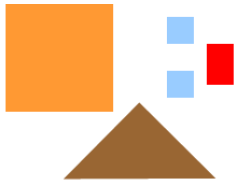
Inventory development: from simple to complex…

Year 0



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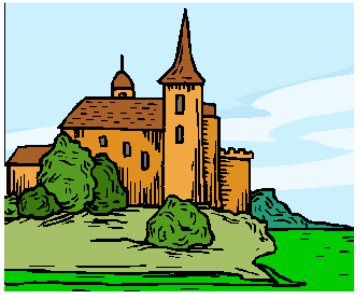

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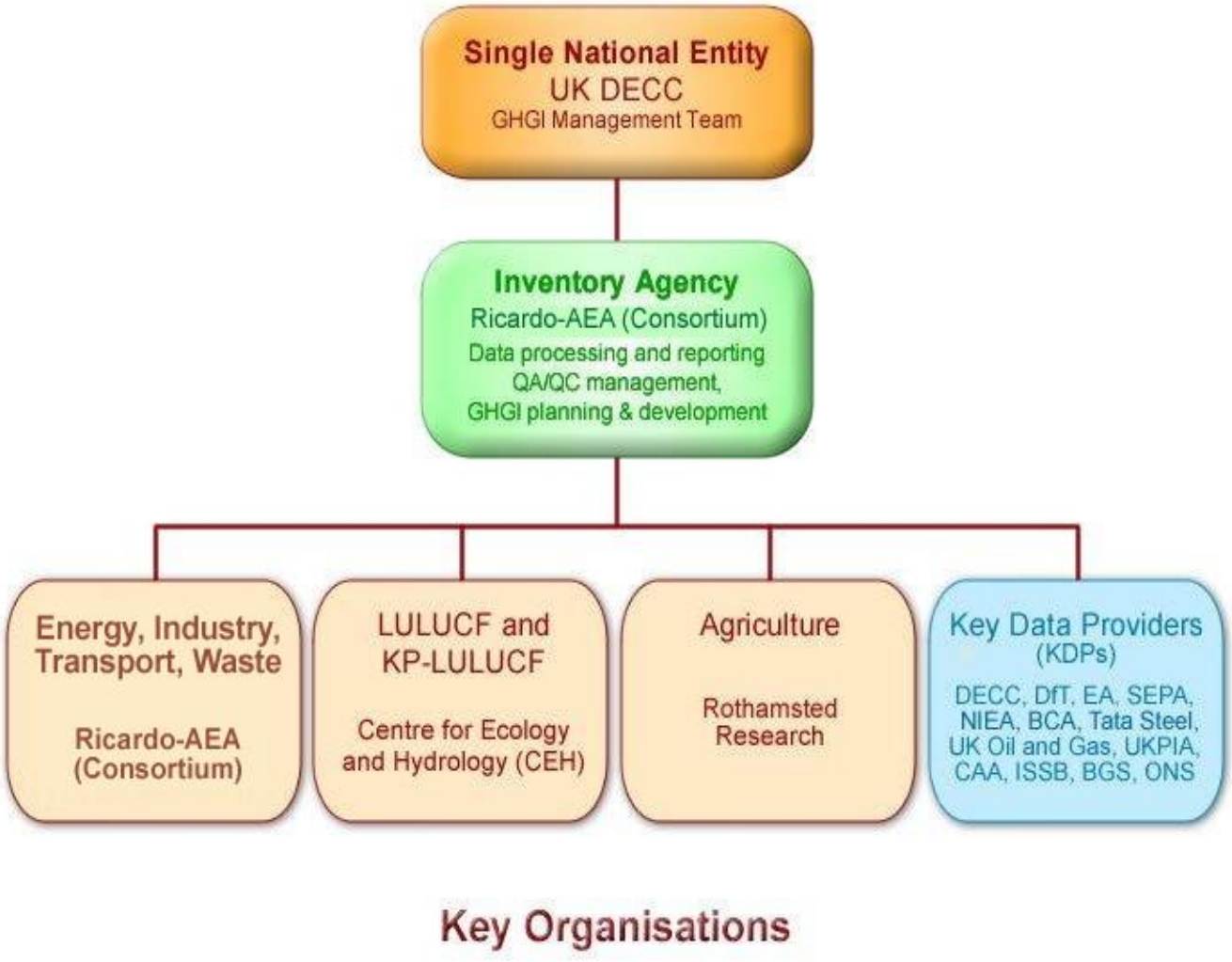
Key organisational structure of UK NIS



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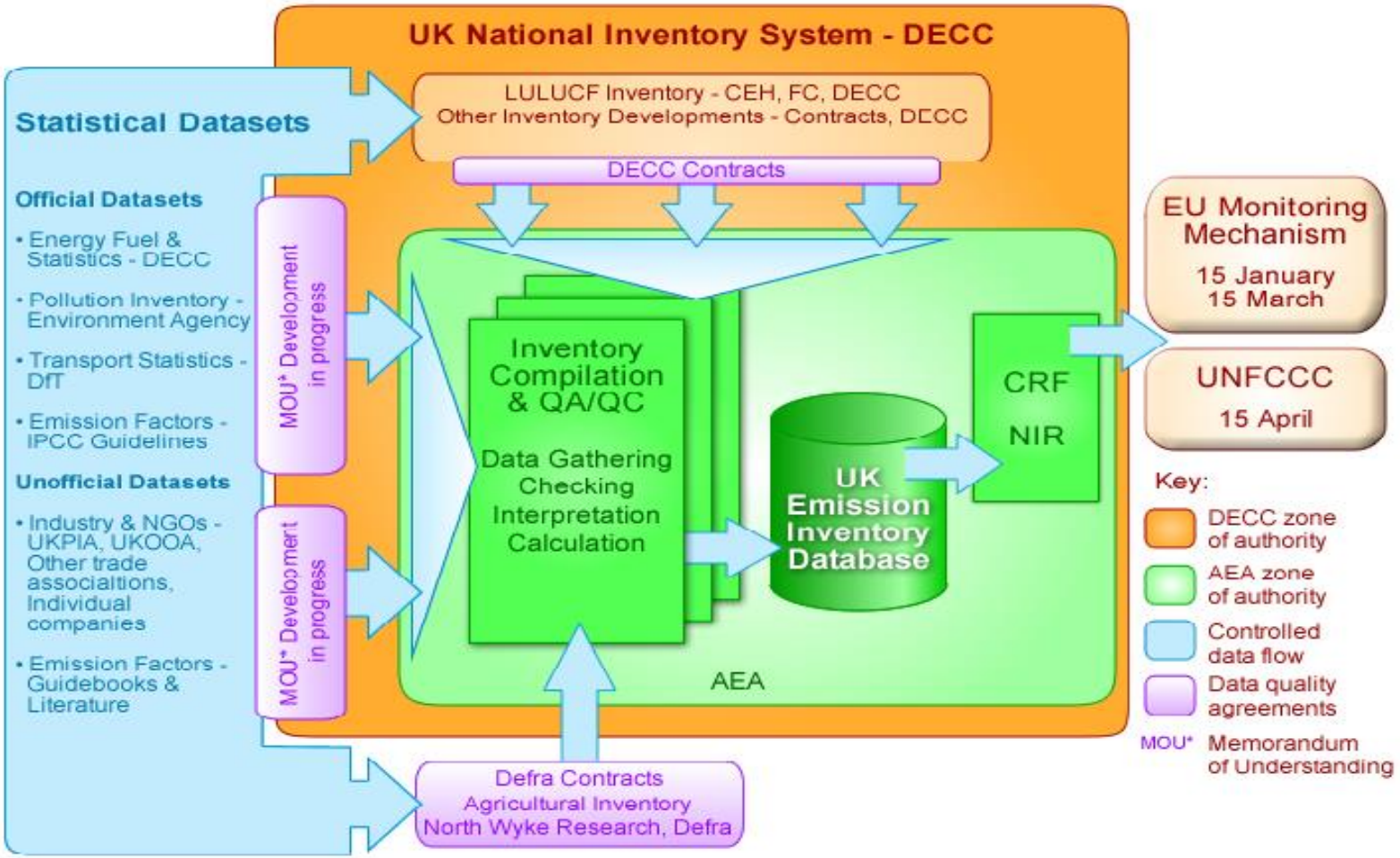
Example: UK National System for the GHGI



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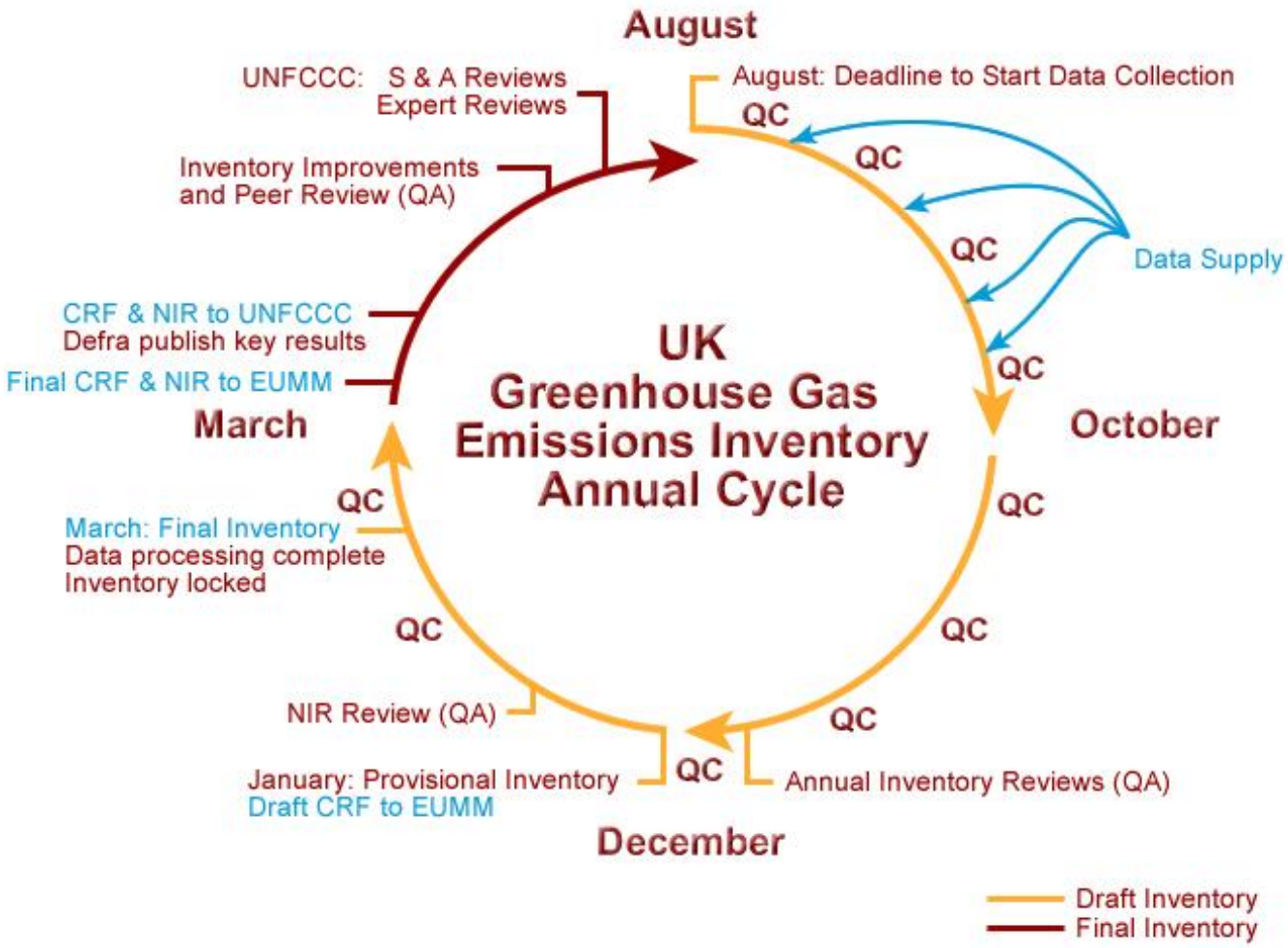
Example: UK Annual inventory compilation cycle



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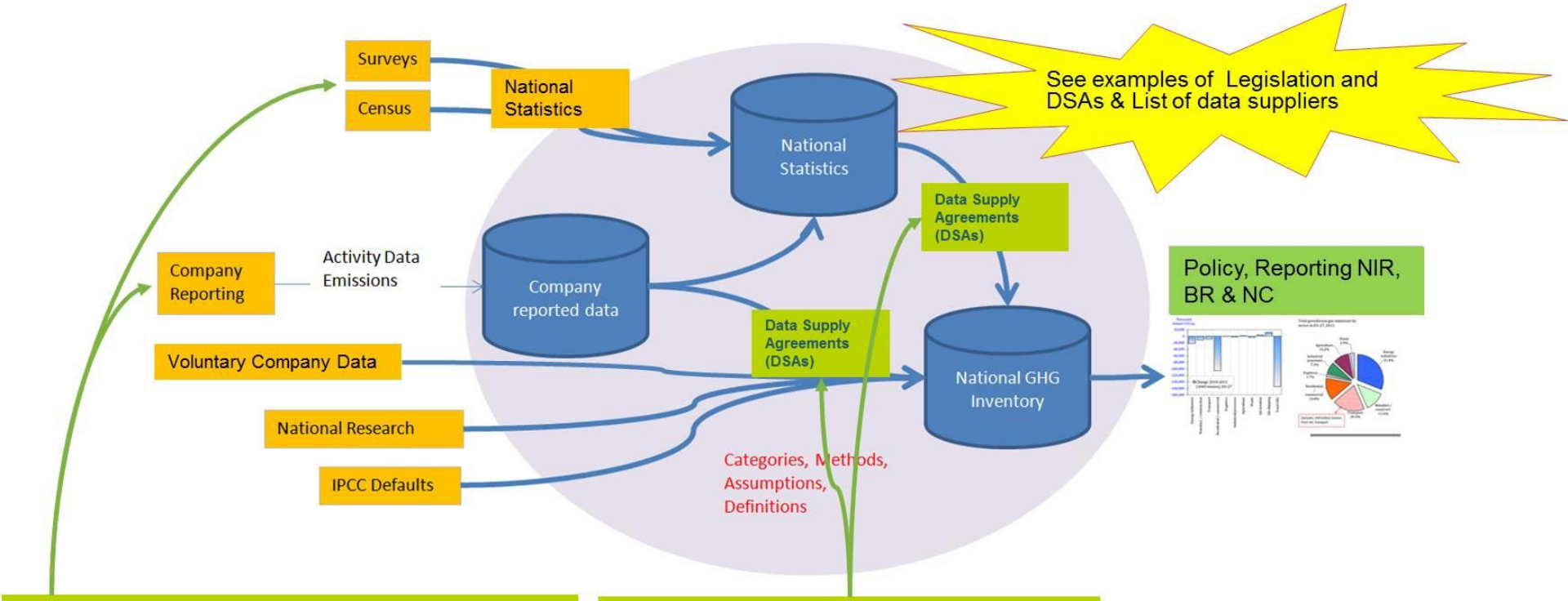
Data gathering process



Legislation

non GHGI specific
- Industrial Pollution (IPPC)
- Statistics of Trade Act (UK energy statistics from DECC)

GHGI specific
- Greenhouse Gas Emissions Trading System
- National Emissions Inventory Regulations 2005

Data Supply Agreements (DSAs)

- Quality, format, security and timeframe for preparation of the inventory.
- Government Agencies & Departments, Industry, Trade associations.

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Summary

- Inventories form the basis for mitigation policies, projections, scenario setting.
- A GHG inventory is more than just a part of a national communication; it should be viewed as a broader analytical programme.
- Having a GHGI that meets some/all of the UNFCCC GLs, GPG and underpinning MRV requirements provides credibility, relevant for donors. A well constructed inventory should therefore include enough documentation to allow readers to understand the underlying assumptions and calculations.
- The GHGI inventory agency will develop into a resource of technical expertise that can be drawn upon across a wide range of technical and policy areas. Not just useful for generating a technical report every year!
- Inventory systems are live systems that operate year-round, geared to addressing specific outcomes and national priorities.
- Developing data at national, regional, local level is achievable through a mixture of top-down and bottom-up data management, and it is useful to foster better engagement across different stakeholders.

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How to contact ClimaEast

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Support to Climate Change Mitigation and Adaptation in Russia and ENP East countries

National GHG Inventories – the IPPU Sector – Industrial Process Categories

Sina Wartmann
Ricardo MRV / GHG Team

28 March 2017, Tbilisi

Overview

- Industrial processes
- Background
- General calculation methodologies
- Typical data issues and solutions
- Approaches taken by Georgia

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Volume 3
Industrial Processes and Product Use

Chapter	Chapter Name
-	Cover Page of Volume 3 PDF
1	Introduction PDF
	Table 1-3 (MS-Excel)
	Table 1-5 (MS-Excel)
2	Mineral Industry Emissions PDF
3	Chemical Industry Emissions PDF *2
4	Metal Industry Emissions PDF *1
5	Non-Energy Products from Fuels and Solvent Use PDF
6	Electronics Industry Emissions PDF
7	Emissions of Fluorinated Substitutes for Ozone Depleting Substances PDF *2
8	Other Product Manufacture and Use PDF

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Industrial Processes

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Background

- Greenhouse gas emissions are produced from a wide variety of industrial activities.
- The main emission sources are releases from industrial processes that chemically or physically transform materials, e.g.
- Iron and steel industry
- Cement, glass, lime production
- Ammonia, nitric acid, adipic acid production
- All GHGs might be emitted: CO2, CH4, N20, PFCs, HFCs, SF6, NF3

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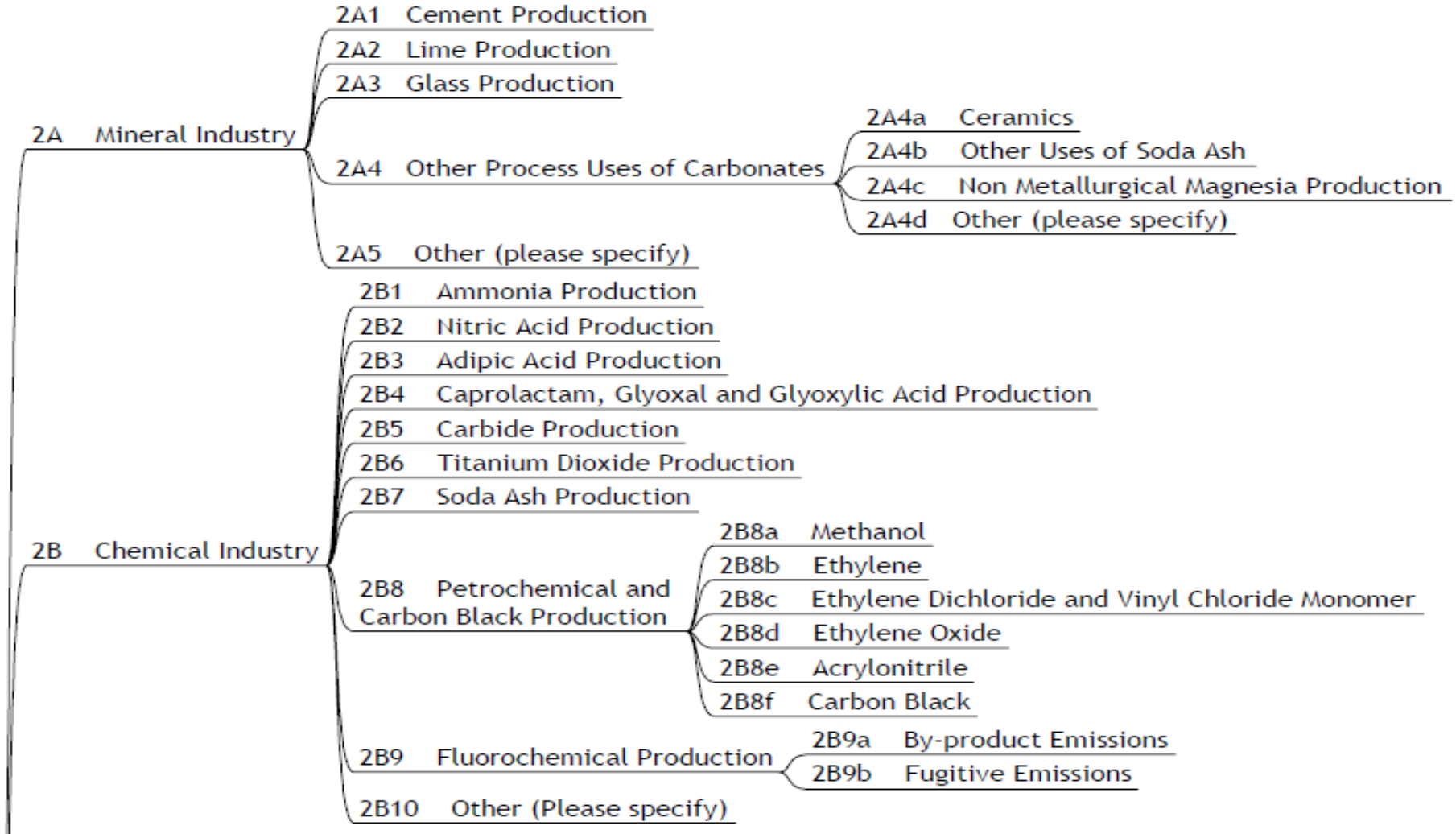
IP Source Categories in the IPCC 2006 Guidelines



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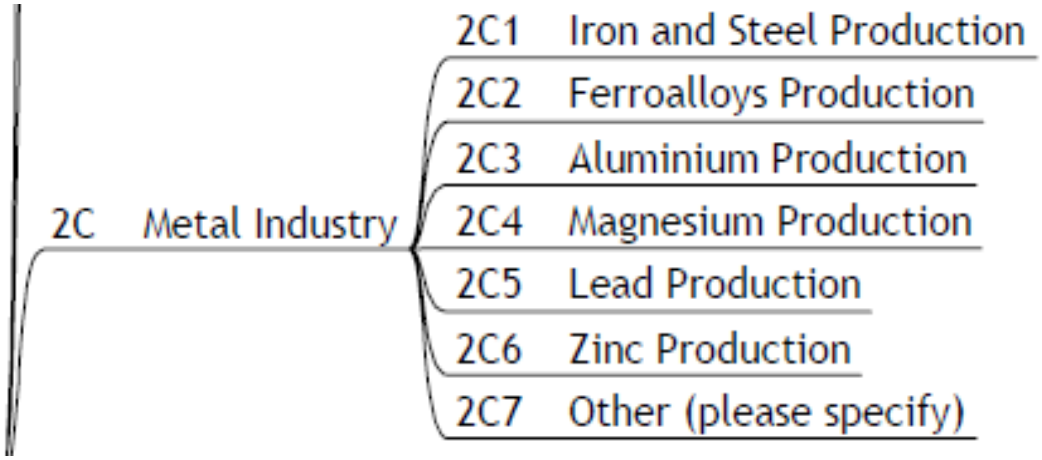
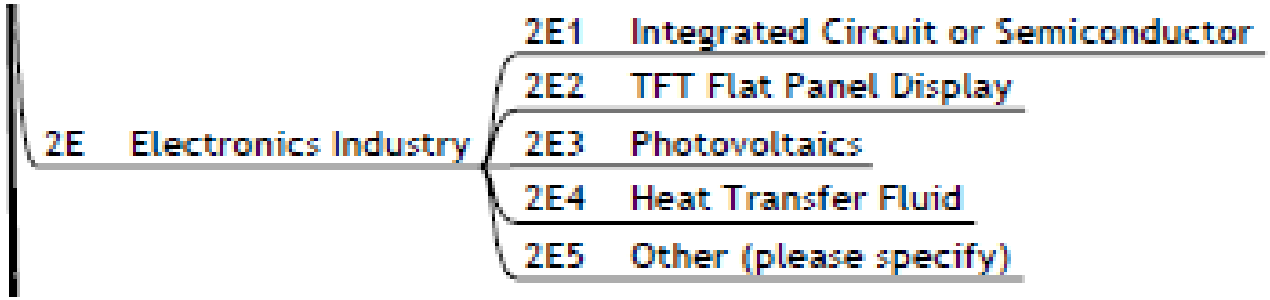
Further IP Source Categories





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General Calculation Methodologies

General equation:

$$\mathbf{TOTAL_{ij} = AD_j \times EF_{ij}}$$

where:

$TOTAL_{ij}$ = Process emission (tonnes) of gas i, from industrial sector j

AD_j = Amount of activity or production of process material (activity data) in industrial sector j (tonnes/yr)

EF_{ij} = Emission factor (EF) associated with gas i, per unit of activity in industrial sector j (tonne/tonne)

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General Estimation Methodologies

- More than one estimation methodology is presented.
- Methodologies ("tiers") are classified according to the accuracy of available data

National statistics and IPCC default emission factors	**Tier 1**
National statistics and country-specific emission factors, partly plant-level data	Tier 2
Plant-level input data	**Tier 3**

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Typical IP Data Issues and Solutions

- Possible double counting of CO_2 due to reporting of industrial process emissions from non-energy use (NEU) of feedstock produced in combination with fuel combustion under energy sector due to the difficulty in differentiation.
  - Impact on inventory: Underestimation of the contribution of IP sector to national emissions.
  - Recommended approach: Stoichiometric estimation of the NEU and subtraction from the energy statistics to avoid double counting.

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Typical IP Data Issues and Solutions

- Few facilities and concerns about disclosing sensitive business information
- National institutions and industry associations collect and present data in formats not appropriate for GHG estimation.
- Mandatory industry reports (e.g. annual environmental reports) provide only emissions estimates without AD and/or EF.
- There is a lack of mainstreaming of climate change data collection by national statistical services and industry associations.
- There is an absence of QA/QC and uncertainty analysis by data collection institutions.

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Mineral industry - Approaches

- The main emissions sources in the mineral industry are:
  - ✓ Cement Production
  - ✓ Lime Production
  - ✓ Glass Production

- The primary process resulting in the release of CO2 in the mineral industry is the calcination of carbonate compounds:

$$CaCO3 + heat \rightarrow CaO + CO2$$

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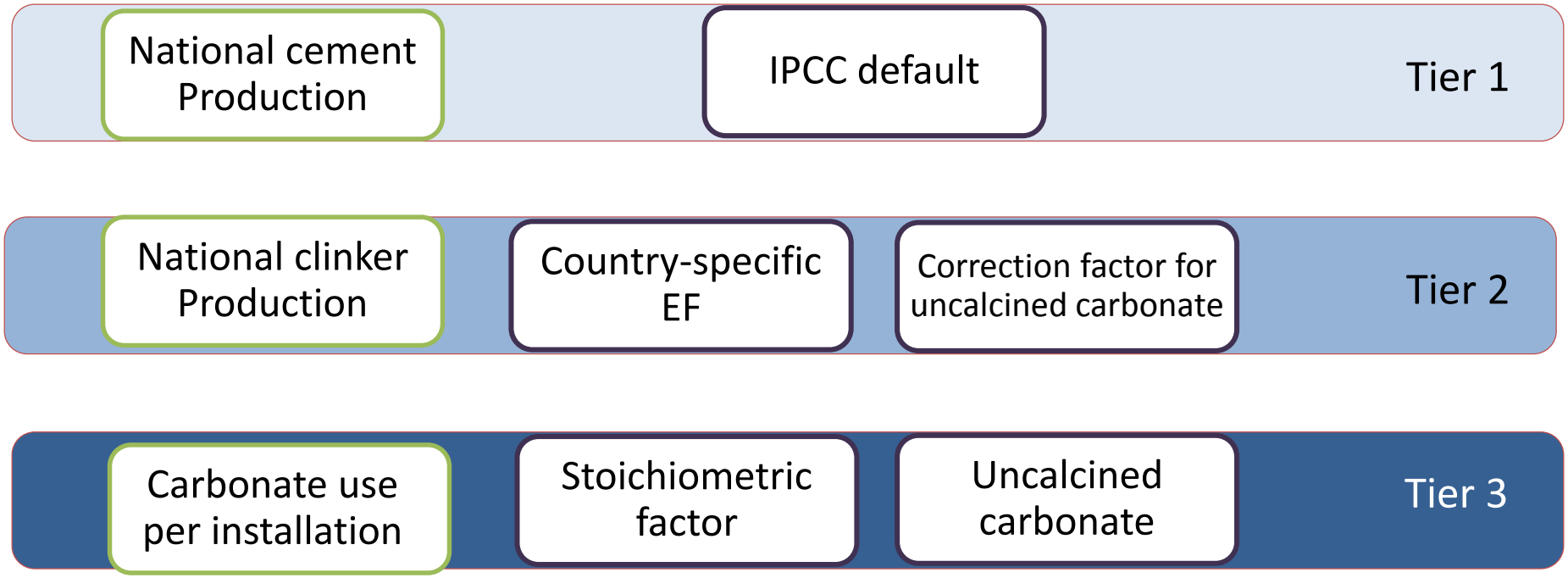
Example: Tiers for cement production



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Cement - Approach used in Georgia

- CO2 from cement production is estimated using the following data:
  - Where available, clinker production is multiplied with a default emission factor
  - Otherwise, cement production is multiplied with a default emission factor
  - Emission factors and activity data are in line with the Revised 1996 IPCC Guidelines

Improvement potential:

- As cement production is a key category, the 2000 GPG recommend using a Tier 2 approach, i.e. a country-specific emission factor multiplied by clinker production
- The above approach is still applicable under the IPCC 2006 GL
- A country-specific emission factor could be derived as follows:
  - Deriving amounts of limestone and other carbonate use in the cement sector through (revised or new) statistics or from the cement associations
  - With a view to Georgia setting up an Emission Trading System based on the Association Agreement with the EU, this information will have to be made available on the long-term in any case

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Chemical Industry: Emissions from ammonia production

How much fuel was used?

How much carbon is in this fuel?

How much carbon was converted?

How much of the formed CO2 was captured?

- Ammonia production uses natural gas or other hydrocarbons as feedstock and represents a significant non-energy industrial source of CO2 emissions
- Attention: Danger of double counting with energy use of natural gas

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Ammonia Production – Approach used in Georgia

- CO2 estimations from ammonia production are presented in the form of three time series:
  - Using an input based approach (in line with the Rev 1997 GL)
  - Using an output based approach (in line with the Rev 1997 GL)
  - an average of the input and output based approach (not in line with the Rev 1997 GL)
- The input based approach is used in the national GHG inventory, the other two approaches are presented to enhance understanding

Improvement Potential:

- Present transparently which data is used for the national GHG inventory
- Do not present the average-approach data or explain in detail why it is presented
- The input-based approach continues to be applicable under the IPCC 2006 GL
- **CO2 captured for downstream use to be deducted from calculated GHG emission under IPCC 2006 GL**

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Chemical Industry: Emissions from nitric acid production

Tier 1	Nitric Acid Production	IPCC default EF		
Tier 2	Nitric Acid Production	Technology-specific EF	Factor expressing abatement technology used	Operation time of abatement technology
Tier 3	Direct measurement			

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Technology-specific default EFs

TABLE 3.3 DEFAULT FACTORS FOR NITRIC ACID PRODUCTION	
Production Process	**N_2O Emission Factor (relating to 100 percent pure acid)**
Plants with NSCR[a] (all processes)	2 kg N_2O/tonne nitric acid ±10%
Plants with process-integrated or tailgas N_2O destruction	2.5 kg N_2O/tonne nitric acid ±10%
Atmospheric pressure plants (low pressure)	5 kg N_2O/tonne nitric acid ±10%
Medium pressure combustion plants	7 kg N_2O/tonne nitric acid ±20%
High pressure plants	9 kg N_2O/tonne nitric acid ±40%
[a]Non-Selective Catalytic Reduction (NSCR). Source: van Balken (2005).	

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Nitric Acid Production – Approach used in Georgia

- N20 emissions are estimated by multiplying nitric acid production with an emission factor in line with the Rev 1996 GL.

Improvement potential:

- As nitric acid production is a key category, Georgia should move to a tier 2 approach over time
- The general approach used remains valid unter the IPCC 2006 GL

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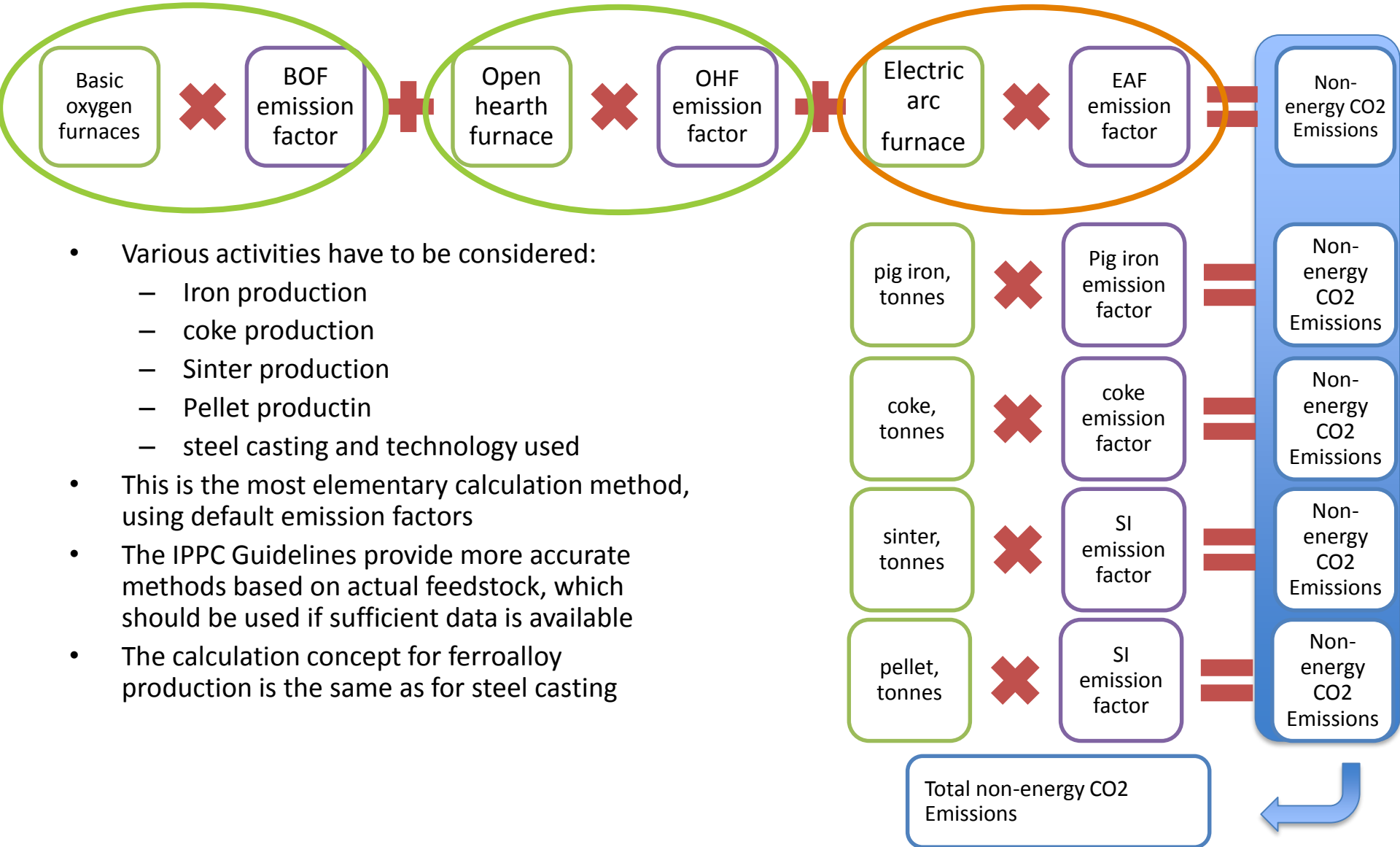
Metal Industry: CO2 emissions from iron and steel production



- Various activities have to be considered:
  - Iron production
  - coke production
  - Sinter production
  - Pellet productin
  - steel casting and technology used
- This is the most elementary calculation method, using default emission factors
- The IPPC Guidelines provide more accurate methods based on actual feedstock, which should be used if sufficient data is available
- The calculation concept for ferroalloy production is the same as for steel casting

Iron and Steel production – Approach used in Georgia

- At present only secondary steel production takes place, leading to emissions from the consumption of carbon electrodes
- CO2 emissions are estimated by multiplying steel production by an output-based emission factor in line with the Rev 1996 GL

Improvement potential

- As iron and steel production is a key category, in line with the 2000 GPG a tier 2 approach should be used, i.e. at least a country-specific emission factor should be used
- The general calculation approach will not change under the IPCC 2006 GL
- A country specific emission factor could be developed using the known consumption of 10kg carbon electrodes per ton of steel produced as well as the carbon content of the electrodes

Ferroalloys production – Approach used in Georgia

- Only silicon manganese was produced in Georgia between 2006-2011, leading to CO2 emissions through the consumption of carbon electrodes (30-40kg electrodes/1t silicon manganese)
- CO2 emissions are estimated by multiplying the silicon manganese production by an emission factor in line with the Rev 1996 GL

Improvement potential

- The general calculation approach will not change under the IPCC 2006 GL
- As ferroalloy production is a key category, in line with the 2000 GPG a tier 2 approach should be used, i.e. at least a country-specific emission factor should be used
- A country specific emission factor could be developed using the known consumption of 30-40 kg carbon electrodes per ton of silicon manganese produced as well as the carbon content of the electrodes

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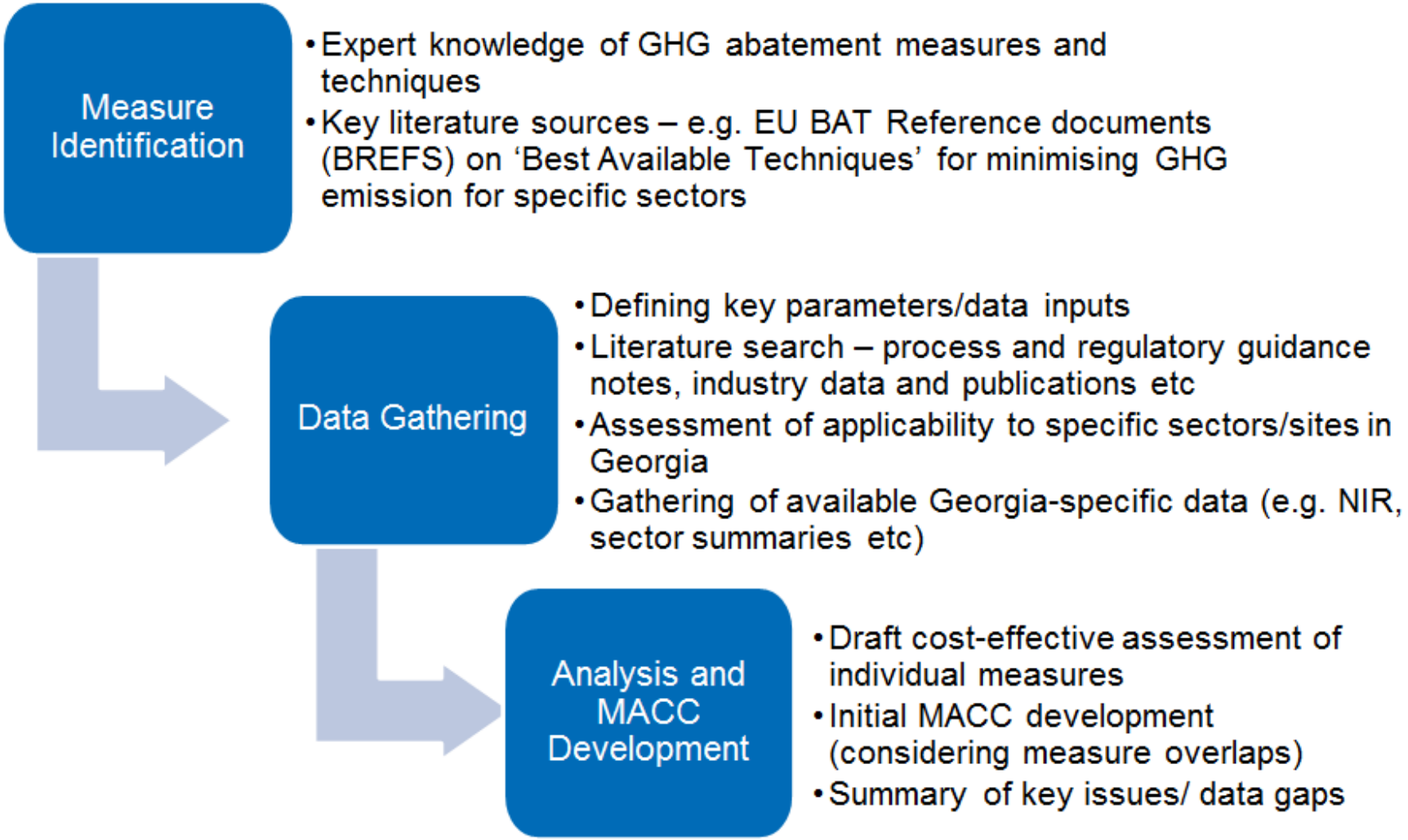
Support to Climate Change Mitigation and Adaptation in Russia and ENP East countries

Assessment of IPPU mitigation reduction potentials

Sina Wartmann
Ricardo MRV / GHG Team

28 March 2017, Tbilisi

Approach



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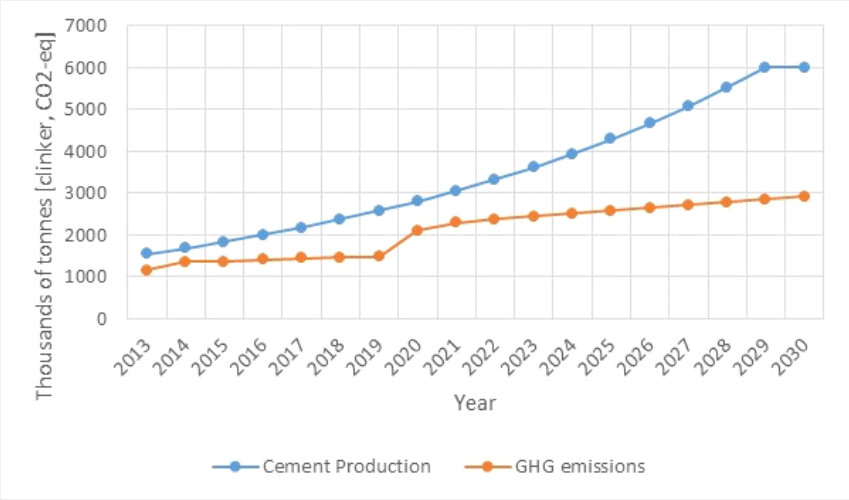
Sectoral Assessments



- Business as usual projections of production and of GHG emissions
- Collection of data from sectoral stakeholders to understand feasibility of measures

Measure Name	Measure considered for further assessment?
Raw material substitution - fly ash/steel slag	No further substitution possible as a high level of substitution is already achieved. Measure is not assessed further.
Raw material substitution - calcerous oil shale	No further substitution possible as a high level of substitution is already achieved. Measure is not assessed further.
Blended Cements - cementitious materials	No further substitution possible as a high level of substitution is already achieved. Measure is not assessed further.
Blended Cements - Pozzolans	No further substitution possible as a high level of substitution of clinker through fly ash is already achieved. Measure is not assessed further.
Limestone portland cement	No further substitution possible as a high level of substitution of clinker is already achieved (see above). Measure is not assessed further.
Alternative cements	The substitution of clinker already takes place, furthermore it is uncertain how acceptable alternative cements are to local markets. Measure is not assessed further.
Reduce lime saturation factor	Measure is assessed further.
Carbon Capture	Measure is assessed further.

Measures selected for further assessment

- Due to small “installation population” and ongoing implementation of good practice in Georgia, only a limited list of measures is feasible:
  - Ammonia Production - Carbon capture
  - Ammonia Production - Hydrogen by electrolysis
  - Cement Production - Reduced lime saturation factor
  - Cement Production - Carbon capture
  - Ferroalloy Production - Substituting coal/coke reductant with biomass carbon (charcoal)

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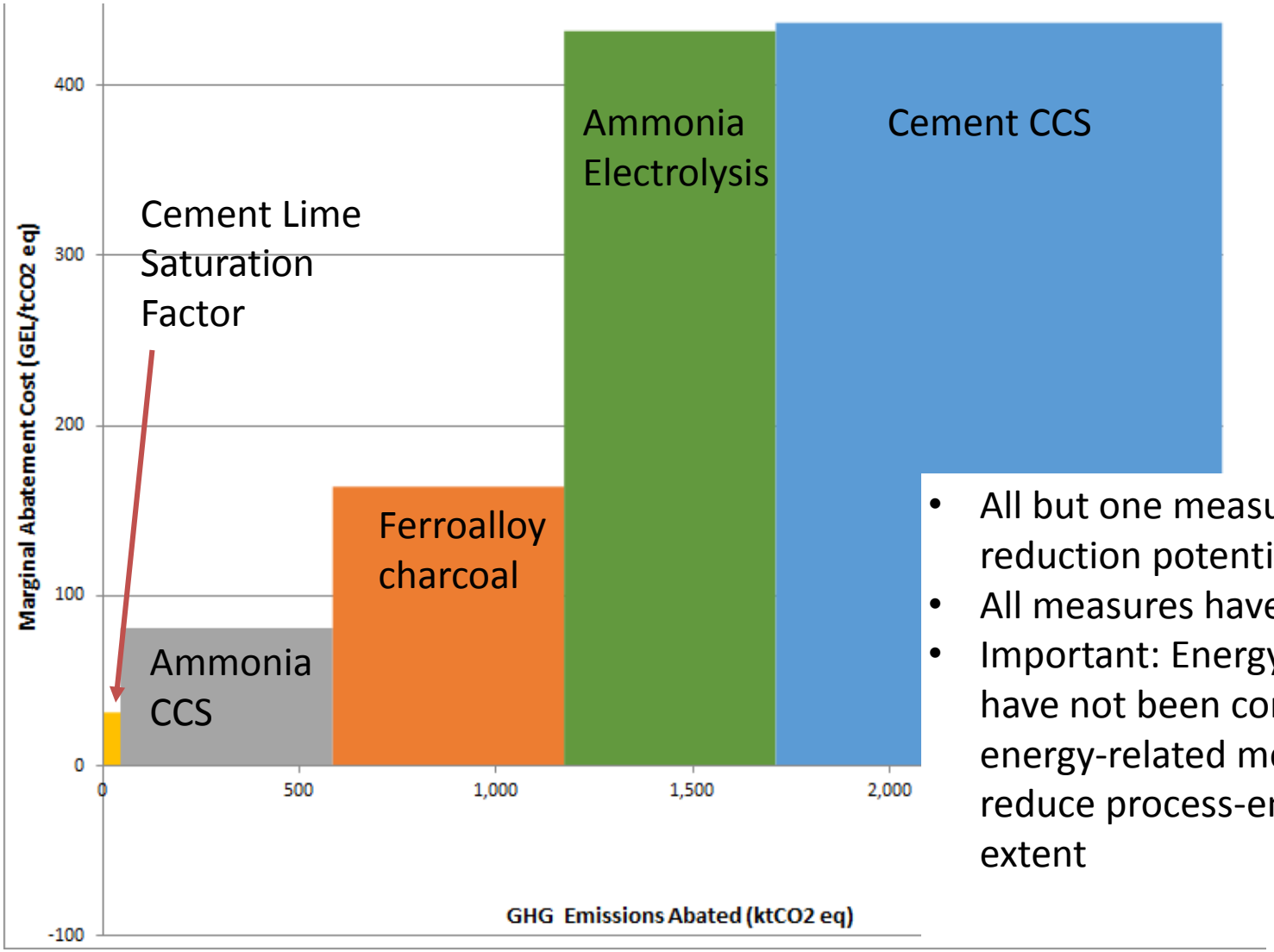
MACC for selected measures



- All but one measures have large reduction potentials
- All measures have positive costs
- Important: Energy-related measures have not been considered. Some energy-related measures will also reduce process-emissions to some extent

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ClimaEast

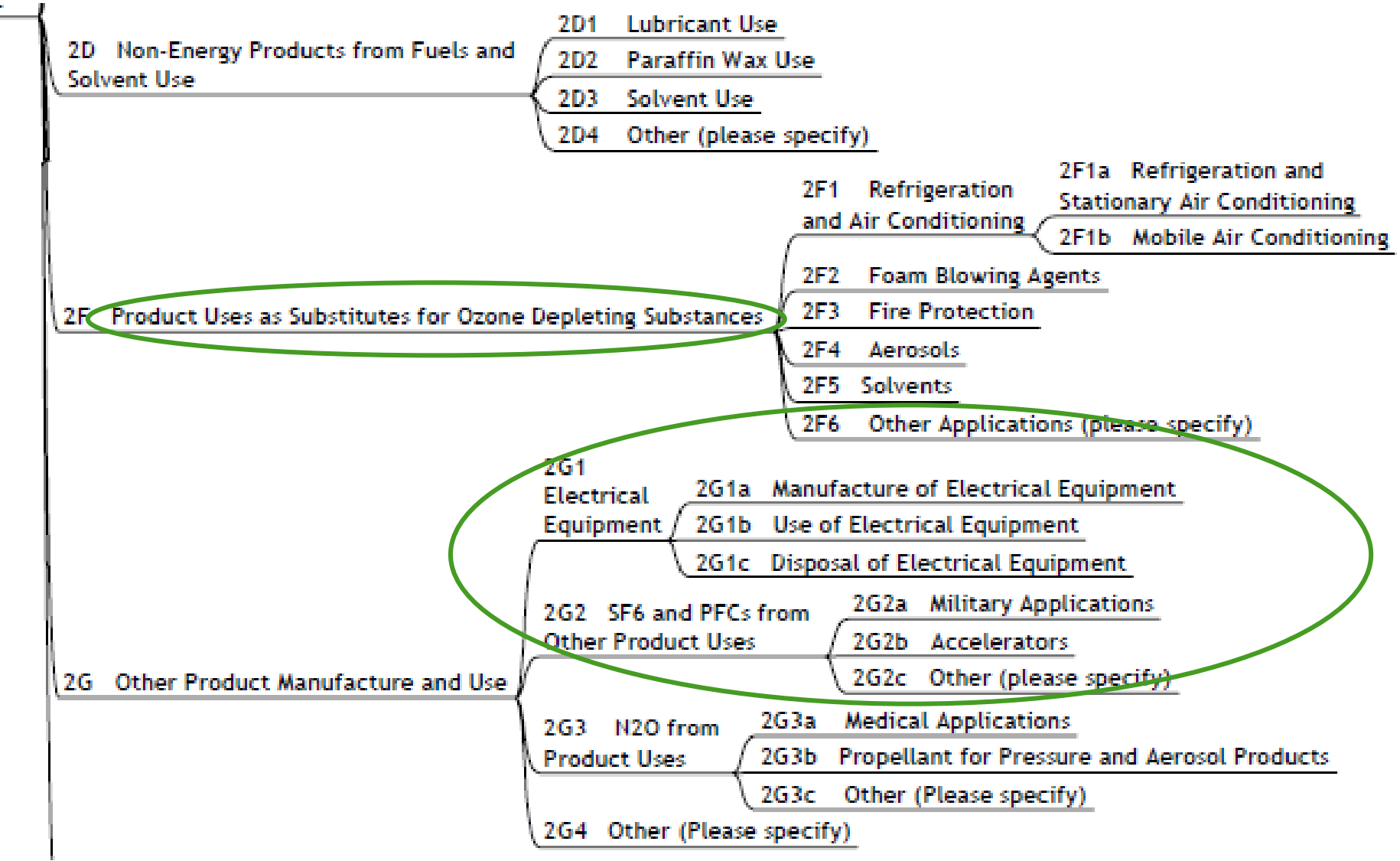
Support to Climate Change Mitigation and Adaptation in Russia and ENP East countries

National GHG Inventories – the IPPU Sector – Product Use Categories

Sina Wartmann
Ricardo MRV / GHG Team

28 March 2017, Tbilisi

PU Source Categories in the IPCC 2006 Guidelines



PU Gases and Methodologies I

2 Industrial Processes and Product Use (Note 1, 2)	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halo-genated Gases (Note 3)
2D Non-Energy Products from Fuels and Solvent Use (Note 7)							
2D1: Lubricant Use	X						
2D2: Paraffin Wax Use	X	*	*				
2D3: Solvent Use (Note 8)							
2D4: Other (Note 9)	*	*	*				

1) 'X' denotes gases for which methodological guidance is provided in this volume.
2) '*' denotes gases for which emissions may occur but for which no methodological guidance is provided in this volume.
3) For precursors (NOx, CO, NMVOC, SO_2 and NH_3) see Table 7.1 in Chapter 7 of Volume 1.

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PU Gases and Methodologies II

2 Industrial Processes and Product Use (Note 1, 2)	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halo-genated Gases (Note3)
2F Product Uses as Substitutes for Ozone Depleting Substances							
2F1: Refrigeration and Air Conditioning							
2F1a: Refrigeration and Stationary Air Conditioning	*			X	X		*
2F1b: Mobile Air Conditioning	*			X	X		*
2F2: Foam Blowing Agents	*			X	*		*
2F3: Fire Protection	*			X	X		*
2F4: Aerosols				X	X		*
2F5: Solvents (Note 12)				X	X		*
2F6: Other Applications	*	*	*	X	X		*
2G Other Product Manufacture and Use							
2G1: Electrical Equipment							
2G1a: Manufacture of Electrical Equipment (Note 13)					X	X	*
2G1b: Use of Electrical Equipment (Note 13)					X	X	*
2G1c: Disposal of Electrical Equipment (Note 13)					X	X	*
2G2: SF_6 and PFCs from Other Product Uses							
2G2a: Military Applications					*	X	*
2G2b: Accelerators (Note 14)					*	X	*
2G2c: Other					X	X	*
2G3: N_2O from Product Uses							
2G3a: Medical Applications			X				
2G3b: Propellant for Pressure and Aerosol Products			X				
2G3c: Other			X				
2G4: Other	*	*		*			*
2H Other							
2H1: Pulp and Paper Industry (Note 15)	*	*					
2H2: Food and Beverages Industry (Note 15)	*	*					
2H3: Other	*	*	*				

1) 'X' denotes gases for which methodological guidance is provided in this volume.
2) '*' denotes gases for which emissions may occur but for which no methodological guidance is provided in this volume.

Characteristics of PU Source Categories

- Mostly small and diffuse sources
- In some cases product function depends on GHG being contained (e.g. fridges, air conditioning)
- Emissions might occurr
  - during manufacture
  - and/or use
  - and/or decomissioning

depending on source category

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General Calculation approach

For most sources, the following formula applies:

GHG emissions = AD x EF

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Mass Balance Approach

- A mass balance approach can alternatively be used, e.g. For cooling/air conditioning, certain foams, fire protection, electrical equipment
- The mass balance approach
  - tracks the amount of new chemical introduced each year
  - accounting for gas that is used to fill new equipment capacity or to replayce destroyed gas
  - Consumption which cannot be accounted for is assumed to be emitted/replace emitted gas

EQUATION 7.3
GENERAL MASS BALANCE EQUATION FOR TIER 1b

$$Emissions = Annual\ Sales\ of\ New\ Chemical - (Total\ Charge\ of\ New\ Equipment - Original\ Total\ Charge\ of\ Retiring\ Equipment)$$

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Modelling Emissions

- The source categories suitable for the mass balance approach tend to have a long lifetime during which they emit small amounts continuously.
- Modelling allows understanding how the banked amounts of a GHG (e.g. R-134a as coolant) develop over time as new equipment is bought and old equipment is discarded.
- Start simple – e.g. using MS Excel - and improve over time,
- Adjust the model regularly based on studies/statistics.

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Data Collection

- Statistics often not available
- Hospitals, research facilities might use N_2O/SF_6
- Importers, manufacturers and/or industry associations typically relevant data sources
- Industry will often not have data at hand or understand data needs
- Confidentiality issues with industry data
- Explore benefits for industry in generating/sharing the data

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Approaches used in Georgia

ODS substitutes

- HFC emissions from cooling equipment are calculated by multiplying the HFC amounts stored in equipment by default factors for the equipment types in line with the rev 1996 GL.
- The IPCC 2006 GL provides updated emission factors

Electrical equipment:

- The capacity (amount of SF6 contained) in electrical equipment is multiplied by default emission factors from the IPCC 2006 GL
- This basic approach remains the same in the IPCC 2006 GL.

Approaches taken in Georgia

- Non-energy product from fuels and solvent use:
  - NMVOC emissions from paint applicaction, degreasing and dry cleaning, poligraphical industry, glue and lacquer consumption, solvents consumption
  - N_2O emissions from anesthesia use in healthcare

- NMVOCs estimated based on population data and per capita defaults from CORINAIR
- N_2O use based on data reported by hospitals
- No changes to approach under IPCC 2006 GL

Potential for improvement:

- The IPCC 2006 GL considers CO_2 emissions from the use of lubricants and paraffin waxes
- Consider the inclusion of lubricants and paraffin waxes in the next GHG inventory submission

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Thank you for your attention !

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