The 9th Workshop on GHG Inventories in Asia (WGIA9)

- Capacity building for measurability, reportability and verifiability -

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Session I: Report of the latest NCs (Inventories) Recently Submitted

Indonesia's Second National Communication

Indonesia

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Outline

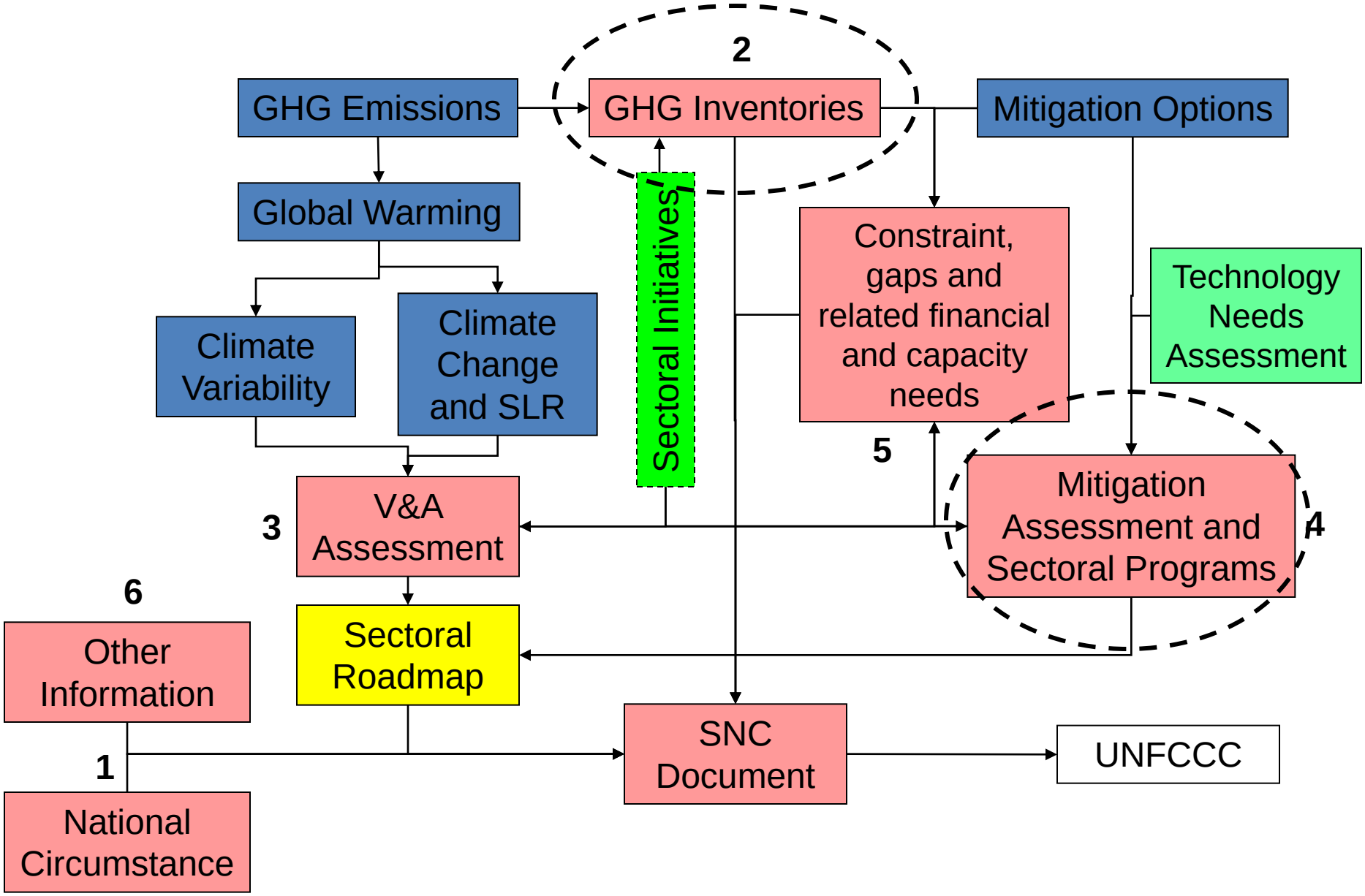
- Background
- Indonesia's Second National Communication
  - National GHG Inventory 2000 – 2005
  - GHG Projection and Mitigation
- Lesson Learned from the SNC Development
  - Institutional Arrangements and Development Stages
  - Tools for NGHG Inventory, Projection and Mitigation
  - Success Factors
- Improvement After The SNC
- Proposed Future Improvement

Background

- 1992: Indonesia signed the UNFCCC
- 1994: Ratification of UNFCCC Act No. 6/1994
- Although Indonesia is not Annex-1 country, as a Party to the convention, Indonesia has to submit report regarding GHG inventory and other activities related to climate change
- Indonesia has developed and submitted two Natcom documents:
  - INC (first Natcom in 1999)
  - SNC (second Natcom in 2010).
- National Policies for Climate Change

- National Mid-term Development Plans 2010-2014 → PRIORITY 9 – Environment & Disaster Management: "Conservation & environmental utilization supports economy growth & sustainable welfare in accordance with the risk mastering & management in the context of climate change.
- National Emission Reduction Action Plan below BAU by 2020
- Development of National GHG Inventory System

Indonesia's Second National Communication



Indonesian SNC

- **Key contents:**
  - GHGs inventory (2000 to 2005) and projections (2010-2025),
  - Set of mitigation options and their effect to future GHG emissions level, and adaptation actions, and
  - Several steps planned by GOI in supporting/implementing climate change programs
- **Indonesian GHG Inventory:**
  - Key sources category: Energy (energy industry/supply and consumption of manufacturing, transportation, households, commercial, and ACM); Industrial Process (IP), Agriculture; LUCF; Peat Fires ; Waste
  - Type of GHG considered: Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydro-fluorocarbons (HFC), Per-fluorocarbons (PFC), Sulfur Hexafluoride (SF_6).
  - Notes: precursor gases (carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), nitrogen oxides (NOx), ammonia (NH3) and sulfur dioxide (SO2) are excluded.

Legal Basis of the GHG Inventory in Indonesia

1. Law Number 6/1994 Concerning Ratification of the United Nations Framework Convention on Climate Change → Indonesia is obligated to Periodically Developed Its National Communication, financed by developed country parties to the Convention;

   → GHG Inventory as part of National Communication

2. Law Number 31/2009 Concerning Meteorology, Climatology and Geophysics: need to develop GHG inventory for climate change policy development.

3. Law Number 32/2009 Concerning Environmental Protection and Management: Government at national, province and city level develop GHG inventory.

4. Presidential Decree Concerning National GHG Inventory (On Going Process)

a. As a legal basis for all relevan ministries/sectors to do GHGI inventories
b. It also regulates:
   - the role of each line ministry and local government
   - GHG inventory relating to NAMAs mplementation in a MRV manner.
   - the use of national GHG inventory reports.

National GHG Emissions Inventory (NGHGI)

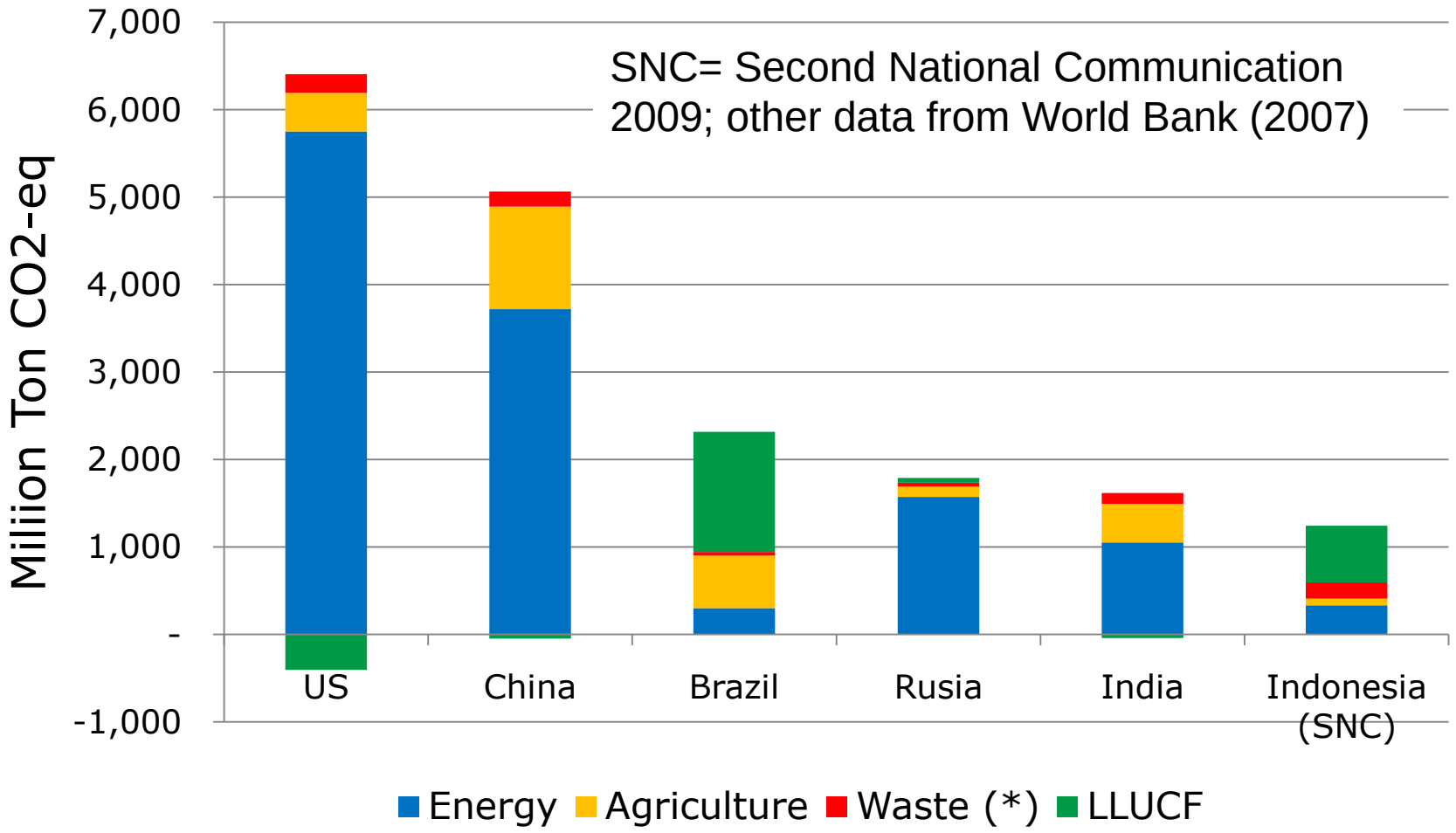
- NGHGI resulted in the status of Indonesia's emission with base year of 2000, i.e. GHGs level (including LULUCF) is 1.38 GTon CO2eq in 2000 and increased to 1.99 GTon CO2-eq in 2005.

1000-Tons CO2eq

Sector	2000	2001	2002	2003	2004	2005	Annual Growth
Energy	280,938	306,774	327,911	333,950	372,123	369,800	5.7 %
Industry	42,814	49,810	43,716	46,118	47,971	48,733	2.6 %
Agriculture	75,420	77,501	77,030	79,829	77,863	80,179	1.1 %
Waste	157,328	160,818	162,800	164,074	165,799	166,831	1.2 %
LUCF	649,254	560,546	1,287,495	345,489	617,423	674,828	Fluctuated
Peat Fire	172,000	194,000	678,000	246,000	440,000	451,000	Fluctuated
Total with LUCF	1,377,753	1,349,449	2,576,952	1,215,460	1,721,179	1,991,371	Fluctuated
Total w/o LUCF	556,499	594,903	611,457	623,971	663,756	665,544	3.2 %

- At this GHG level, Indonesia is among the world's 10 largest emitters of GHGs. The major sources of the emissions are LUCF and peat fire (56-60%), energy (18-20%), waste (8-11%), agriculture (4-5.5%), and industrial processes (2-3%).

Up-dated Major World GHG Emiters (Mton CO2e)



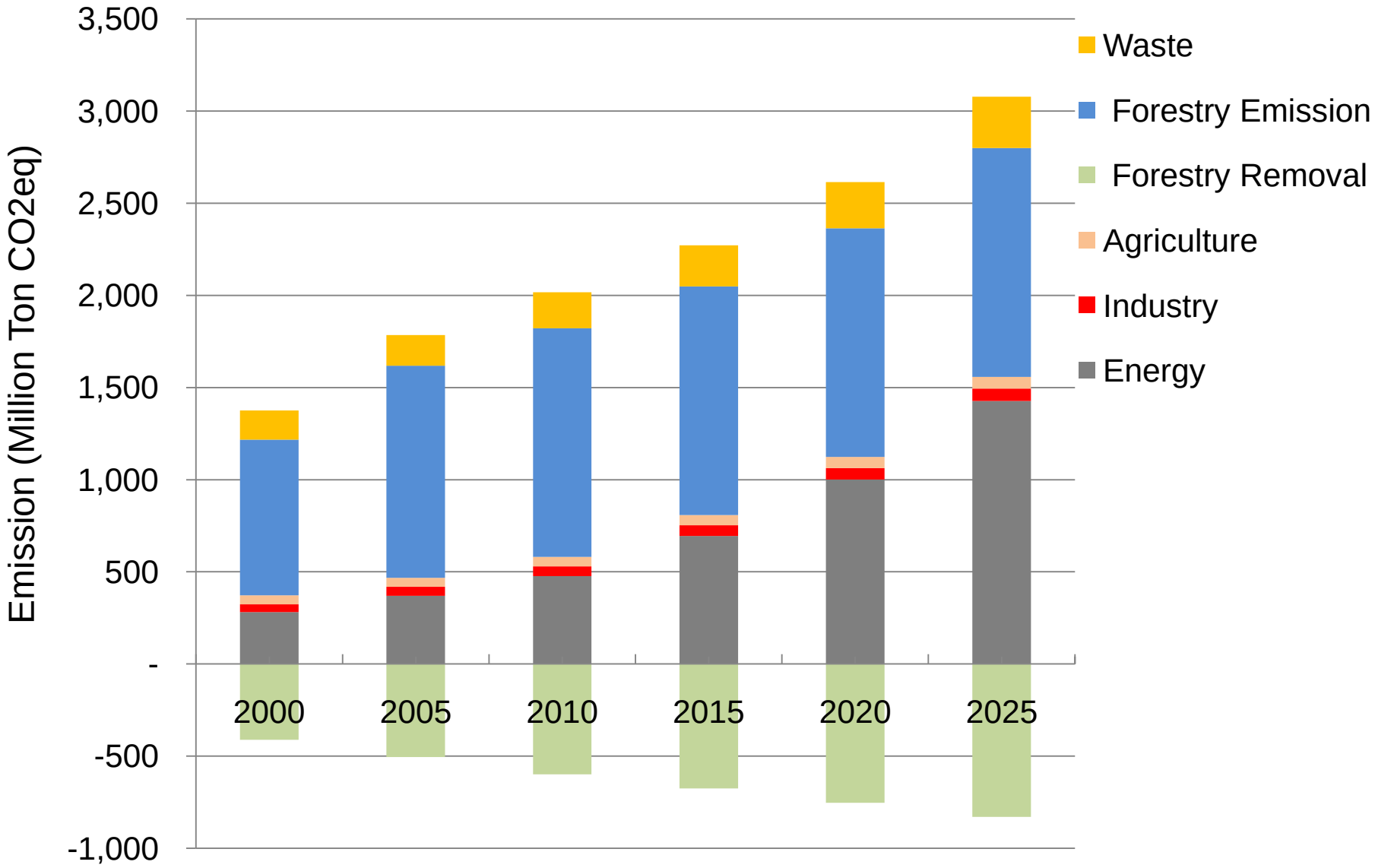
Notes: * including industrial and domestic waste; If GHG emission from peat fires is not covered by LULUCF, Indonesia generate 1.078 Giga Ton CO2eq

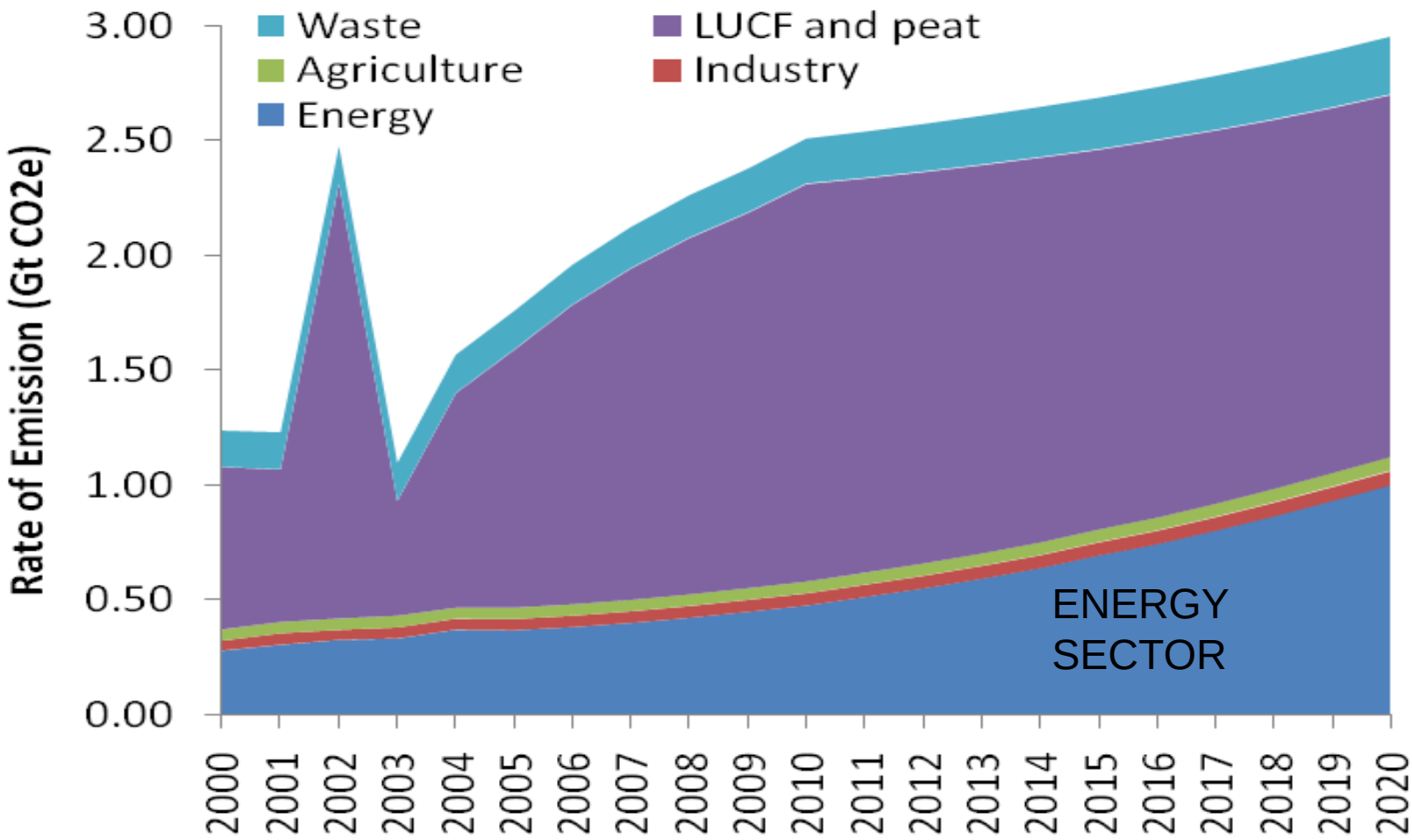
Indonesian GHG Emission by Type (2000)

1000-Tons CO2eq

2000	CO2 emission	CO2 removal	CH4	N2O	PFC	CO2e
Energy	247,522		1,437	10		280,938
Industry	40,342		104	0.43	0.02	42,814
Agriculture	2,178		2,419	72		75,420
LUCF	1,060,766	411,593	3	0.08		649,254
Peat Fire	172,000					172,000
Waste	1,662		7,294	8		157,328
TOTAL	1,524,472	411,593	236,388	28,341		1,377,754

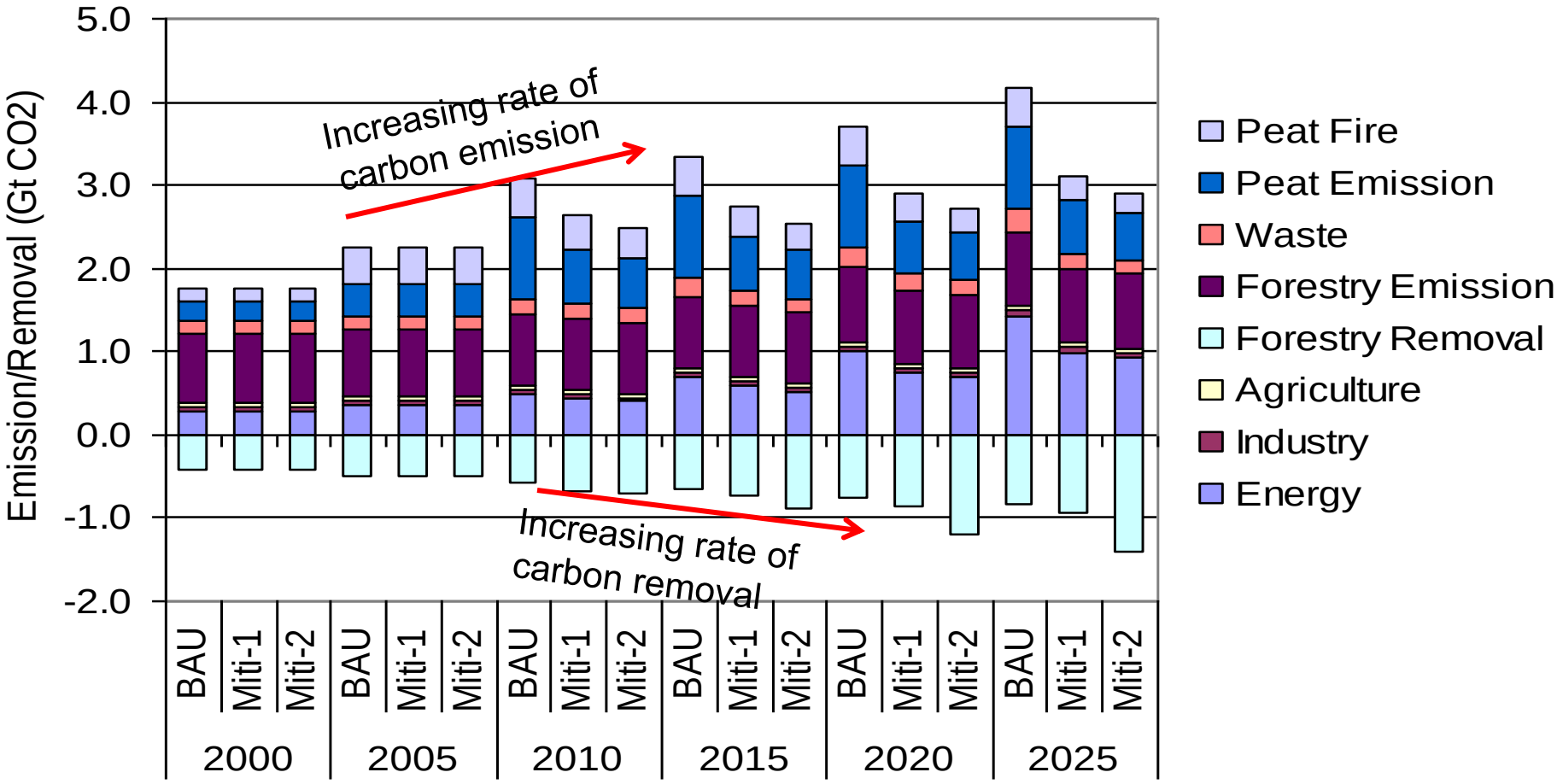
GHG Emission and Removal Projection





Historical and future projection of emission from all sectors in Indonesia

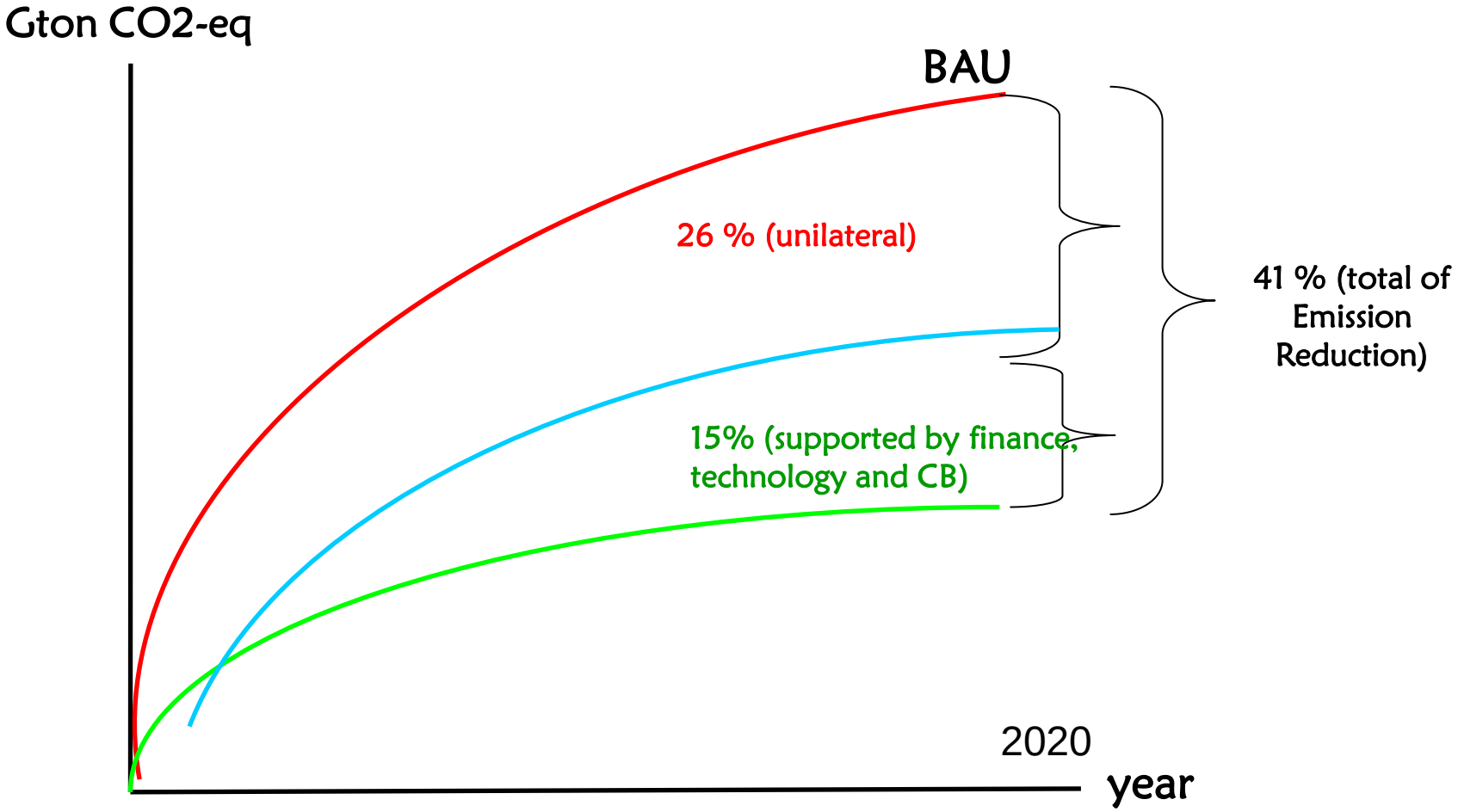
GHG Emission and Removal Projection (BaU & Mitigation Scenarios)



- GHG emissions will reach 2.6 GTCO2eq in 2020 and 3.08 GT COeq in 2025.
- GHG removal potential 0.75 GTCO2 eq in 2020 and 0.83 GTCO2eq in 2025.
- Net GHG 1.86 GTCO2eq in 2020 and 2.25 GTCO2eq in 2025.

Indonesia Emission Reduction Target

Government of the RI Commitment on G20 meeting in Pittsburgh, Indonesia voluntarily will reduce its emission in 2020



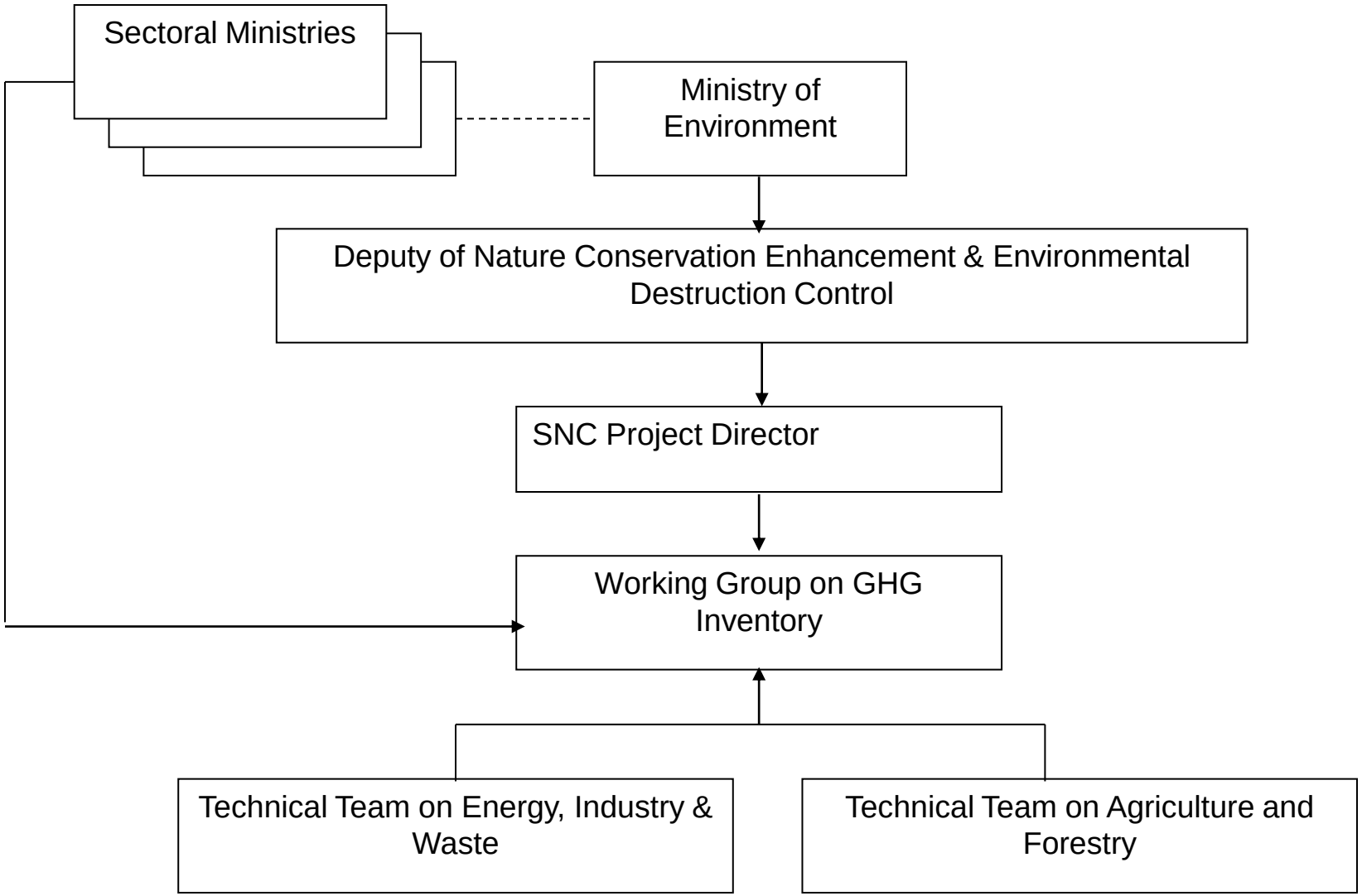
Emission Reduction Action Plan

Sector	Emission Reduction (Giga ton CO2e)		Total	Action Plan	Implementing Institution(s)
	26%	15% (Total 41%)			
Forestry and Peatland	0.672	0.367	1.039	Pengendalian Kebakaran hutan dan Lahan, pengelolaan sistem jaringan dan tata air, Rehabilitasi hutan dan lahan, HTI, HR. Pemberantasan illegal logging, Pencegahan deforestasi, Pemberdayaan masyarakat.	Kemnehut, KLH, Kepmen.PU. Kementan
Waste	0.048	0.030	0.078	Pengelolaan sampah dengan 3R dan Pengelolaan limbah terpadu di perkotaan	Kemen.PU, KLH
Agriculture	0.008	0.003	0.011	Intro varitas padi rendah emisi, efisiensi air irigasi, peggunaan pupuk organik	Kementan, KLH
Industry	0.001	0.004	0.005	Efisiensi ennergi, penggunaan renewable energi, dll	Kemenprin
Energy and Transportation	0.038	0.018	0.056	Penggunaan biofuel, mesin dengan standar efisiensi BBM tinggi, memperbaiki TDM, kualitas transportasi umum dan jalan, Demand Side Management, efisiensi Energi, Pengembangan renewable energi	Kepmenhub, Kemen.ESDM, Kemen.PU
Total	**0.767**	**0.422**	**1.189**		

Lesson Learned from the SNC Development

Institutional Arrangement

- The SNC was developed by a National Working Group (WG) on project base (supported by UNDP). The WG was under coordination of the Deputy of Nature Conservation Enhancement and Environmental Destruction Control of MoE
- WG members are representative of relevant Ministries/Gov. Agency:
  - Ministry of Environment (MoE),
  - Ministry of Energy and Mineral Resources (MEMR),
  - Ministry of Transportation,
  - Ministry of Forestry,
  - Ministry of Agriculture,
  - Ministry of Public Works,
  - Ministry of Industry,
  - Ministry of Finance, and
  - Ministry of Agriculture and Forestry,
  - BAPPENAS (National Development Planning Agency),
  - BPPT (Technology Assessment and Application Agency), and
  - DNPI (National Climate Change Council).
- The WG are assisted by experts and technical teams from:
  - Universities: Institut Teknologi Bandung & Bogor Institute of Agriculture),
  - Research agencies: Agencies for Forest and Agriculture R&D



Structure of the institutional arrangements for data collection, QA/QC, Archiving

Stages in Developing the NGHGI

- **Kickoff** : WG and inventory experts discussed methodologies and good practices for NGHGI, activity data, emission factors.
- **Developing NGHGI**: Data analysis, GHG estimations, and stake holder consultation for activity data, emission factor, and estimations results.
- **Sectoral Consultation**: completed NGHGI was discussed under the WG for the improvement of activity data consistency, emissions/removal factors, GHGs estimation. The external experts from different sectors are also included in determing the level of uncertainty activity data and emission factors.
- **Reporting and External Reviwing**: International experts through the UNDP Country Office are selected to review the draft final report and all spreadsheets calculations. Inputs and comments from the external reviewers are included in the improvement of the report.
- **Revision and Publication**: The revised final report is reported to the relevant ministries for final improvement and approval.

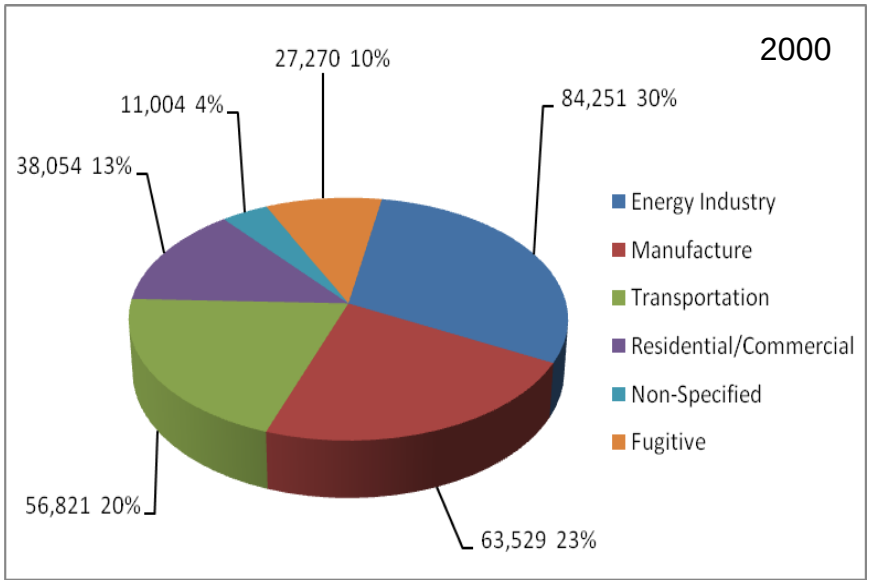
Methodology in Developing NGHGI

- Methodology used in SNC is 2006 IPCC GL in National GHG Inventory.
- The adoption of this methodology was not in line with GL for Natcom of non-Annex I Parties of the UNFCCC, adopted in decision 17/CP.8 where the UNFCCC GL states that non-Annex 1 countries have to use revised 1996 IPCC GL for developing their inventory.
- At earlier stage, WG members and experts decided to adopt 2006 IPCC GL using Tier 1 and, to some extent, some sectors adopted Tier 2 (use local emissions/ removal factors).
- The main reason of using the 2006 IPCC GL is Prodoc of the SNC TOR from UNDP (main sponsor of the Indonesian SNC development). The TOR stated that revised 1996 IPCC Inventory GL will be adopted in developing GHG inventory for the SNC. However, if IPCC 2006 GL is available, the National GHG Inventory Team were encouraged to assess the use of 2006 IPCC GL.
- Based on consensus among sectors or line ministries through a series of roundtable discussions, the 2006 IPCC GL was adopted for most sectors as it covers some sources which are not included in the revised 1996 IPCC GL.

Lessons Learned of Methodology in Energy

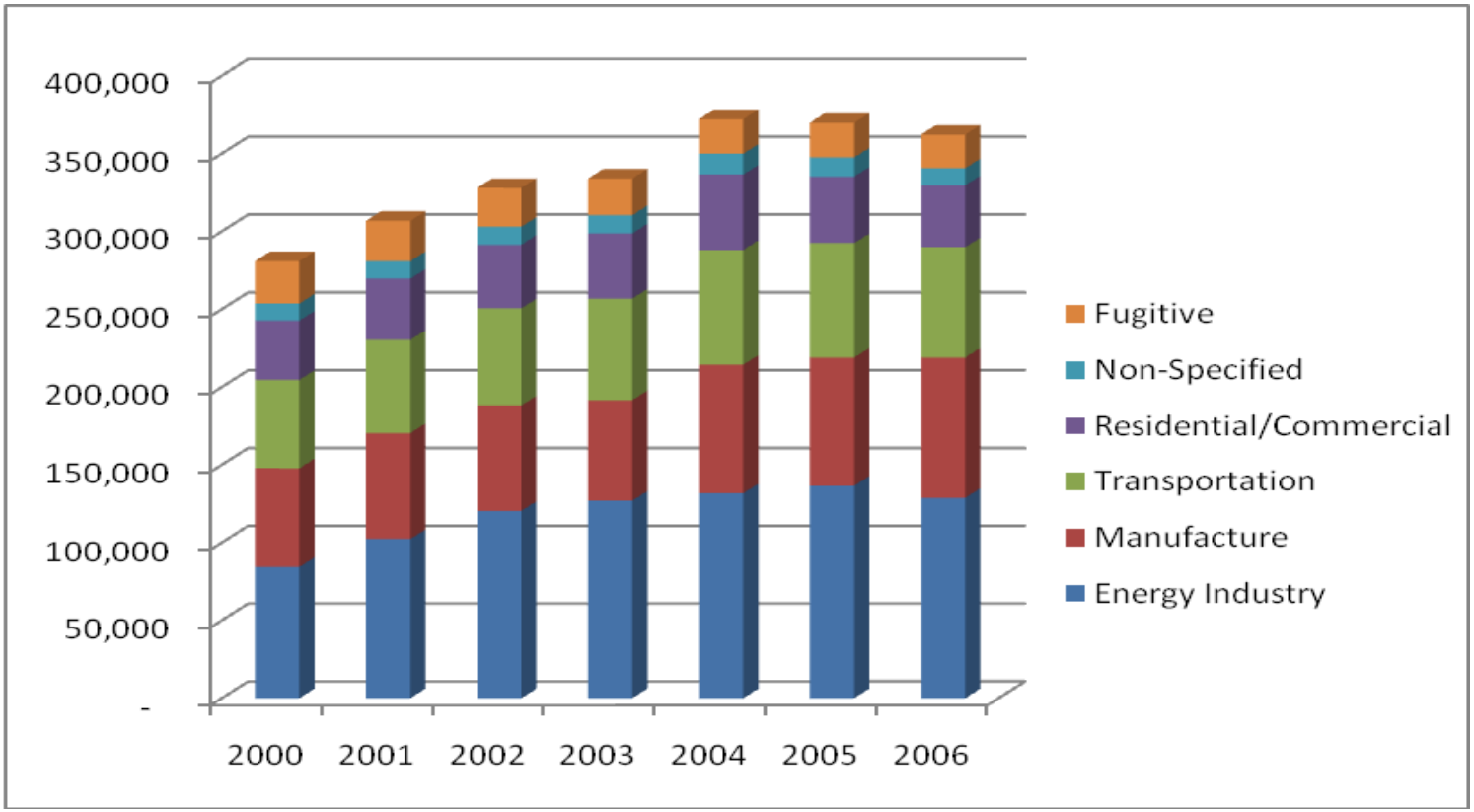
Type of GHGs and Methodology to Estimates the GHGs

- CO_2, CH_4, and N_2O components; the MEMR of Indonesia considers these gases as the most significant GHGs in Indonesia's energy sector
- Methodology used to estimate the GHG emissions are
  - top-down or reference approach
  - bottom-up or sectoral approach (more detail).
- In reference approach, fuel combustion activity in energy sector is grouped into different type of fuels: oil, natural gas, and coal.
- In sectoral approach, fuel combustion activity is grouped into different source category: energy production activity (electricity, oil, and coal) industry, manufacturing, transport and residential and commercial
- The SNC applies both, sectoral and reference approaches for energy sector. The calculation results are compared to each other



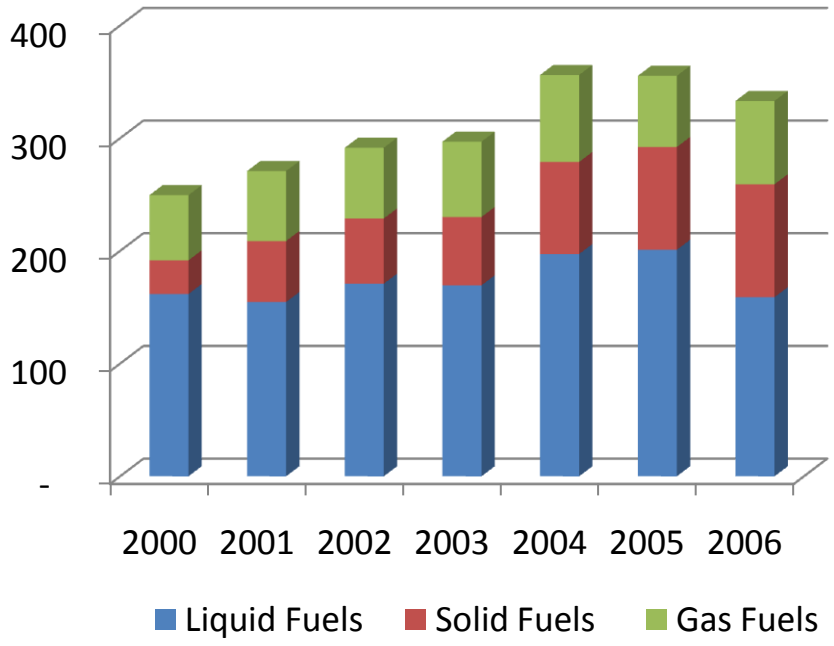
GHG emission of each key source of energy sector, Ggram (000 Ton) $CO_{2\text{-eq}}$

$$CO_{2\text{-eq}} = CO_2 + 21*CH_4 + 310*N_2O$$

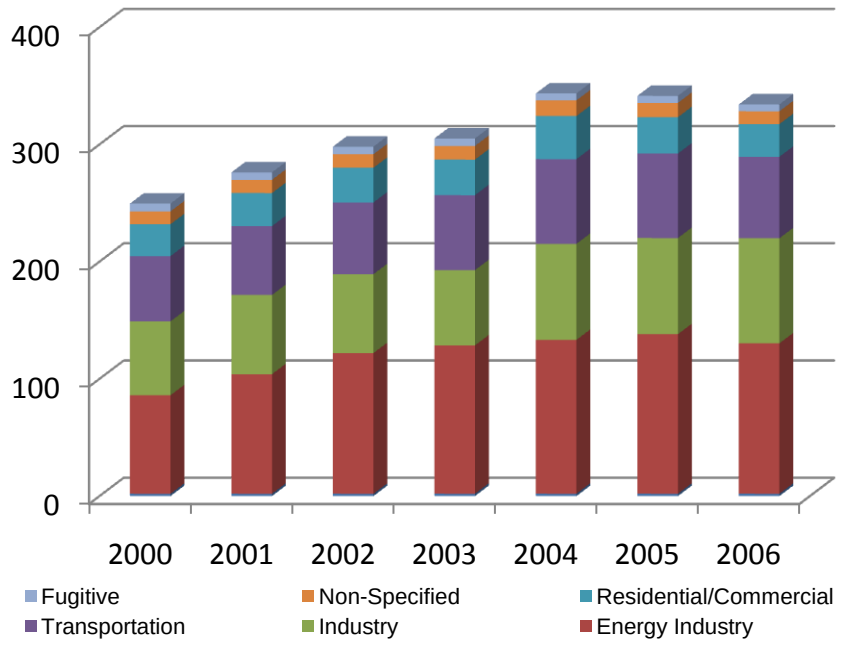


CO2 Emission Inventory, Million Ton

Reference Approach



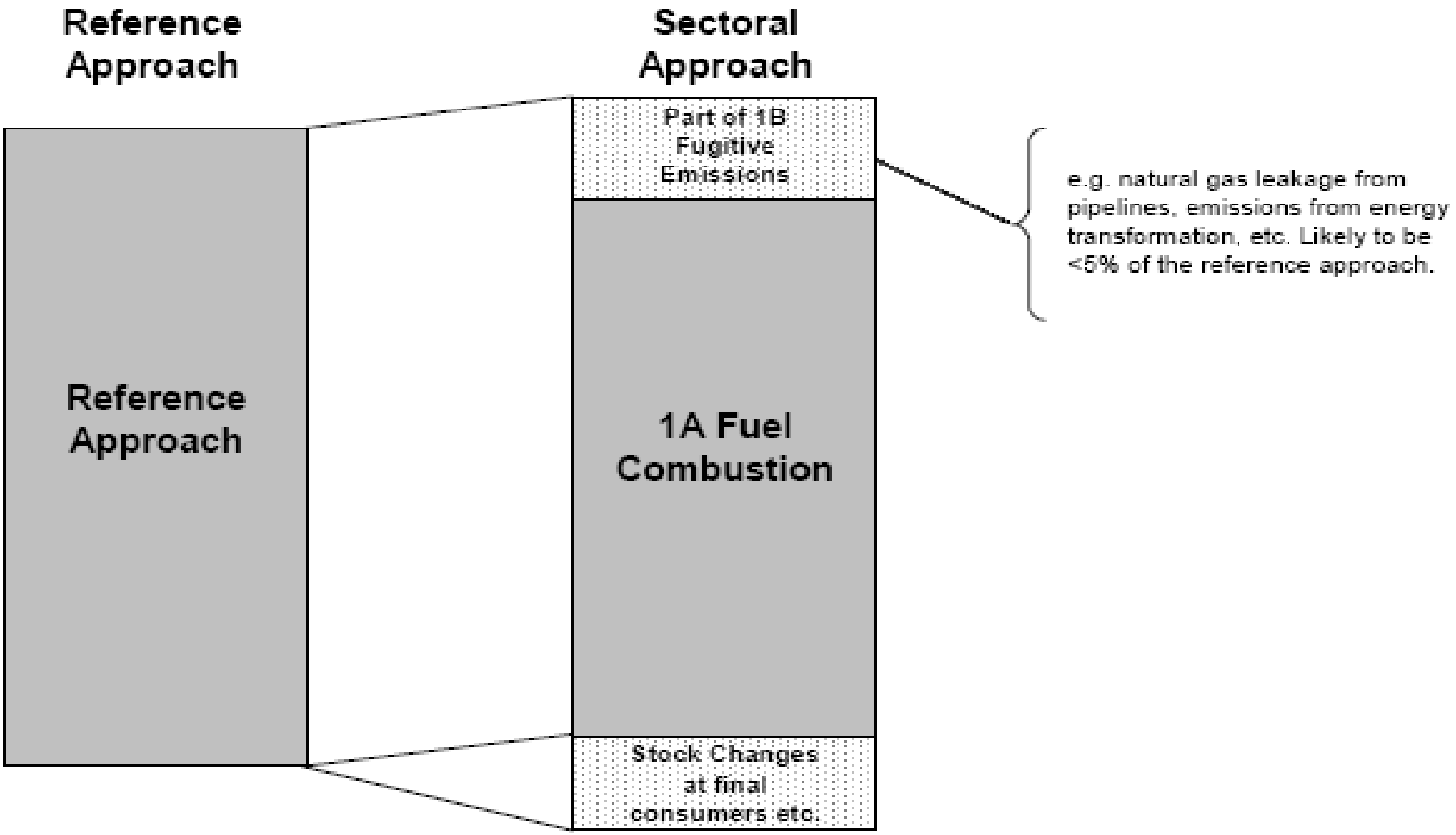
Sectoral Approach



% (w.r.t refference)	2000	2001	2002	2003	2004	2005	2006
Reference vs Sectoral	0.77%	2.94%	2.39%	1.85%	7.85%	7.91%	3.58%

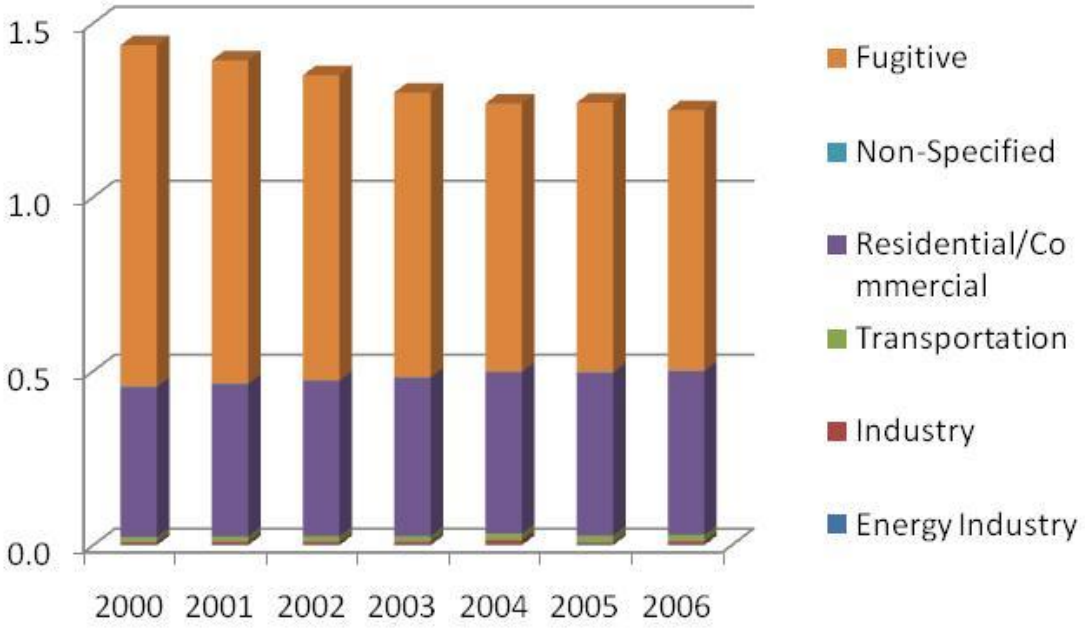
Notes: % of difference between reference and sectoral approach in 2005 and 2005 is due to
- lack of data in non-energy consumption for referrence approach in 2004
- lack of data in coal stock change in 2005, and
- fuel consumption data in power and refinery in 2004 = 2005

2006 IPCC Guideline

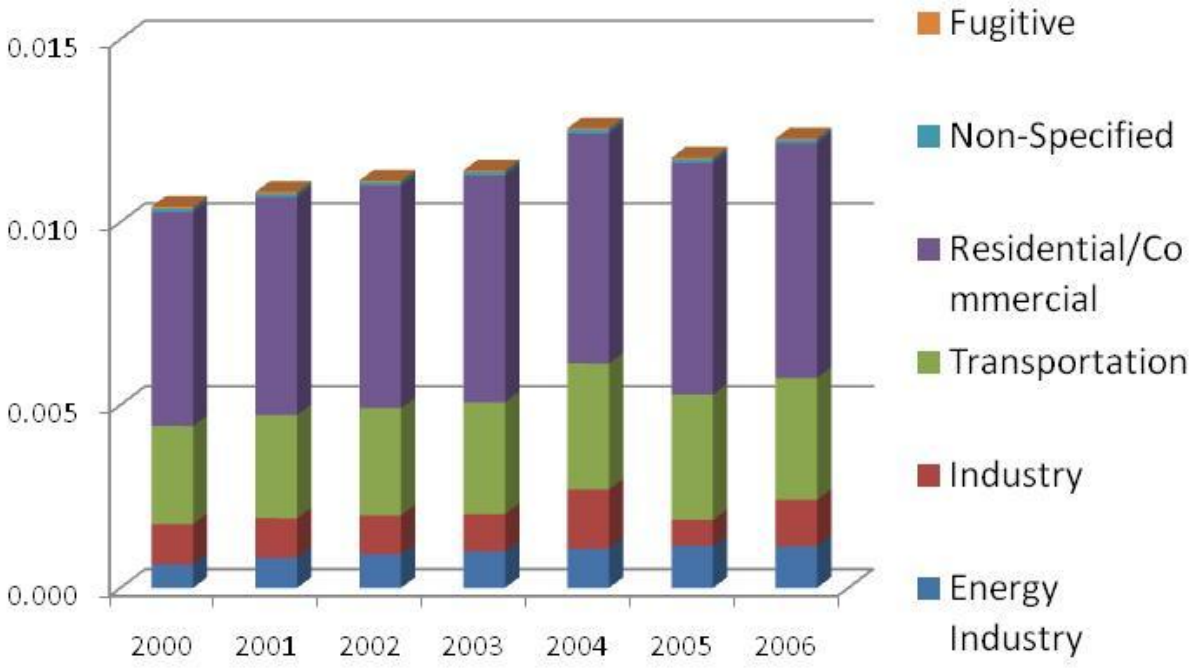


Sectoral Approach

CH4



N2O



GHGs Estimates under IPCC revised 1996 vs IPCC 2006

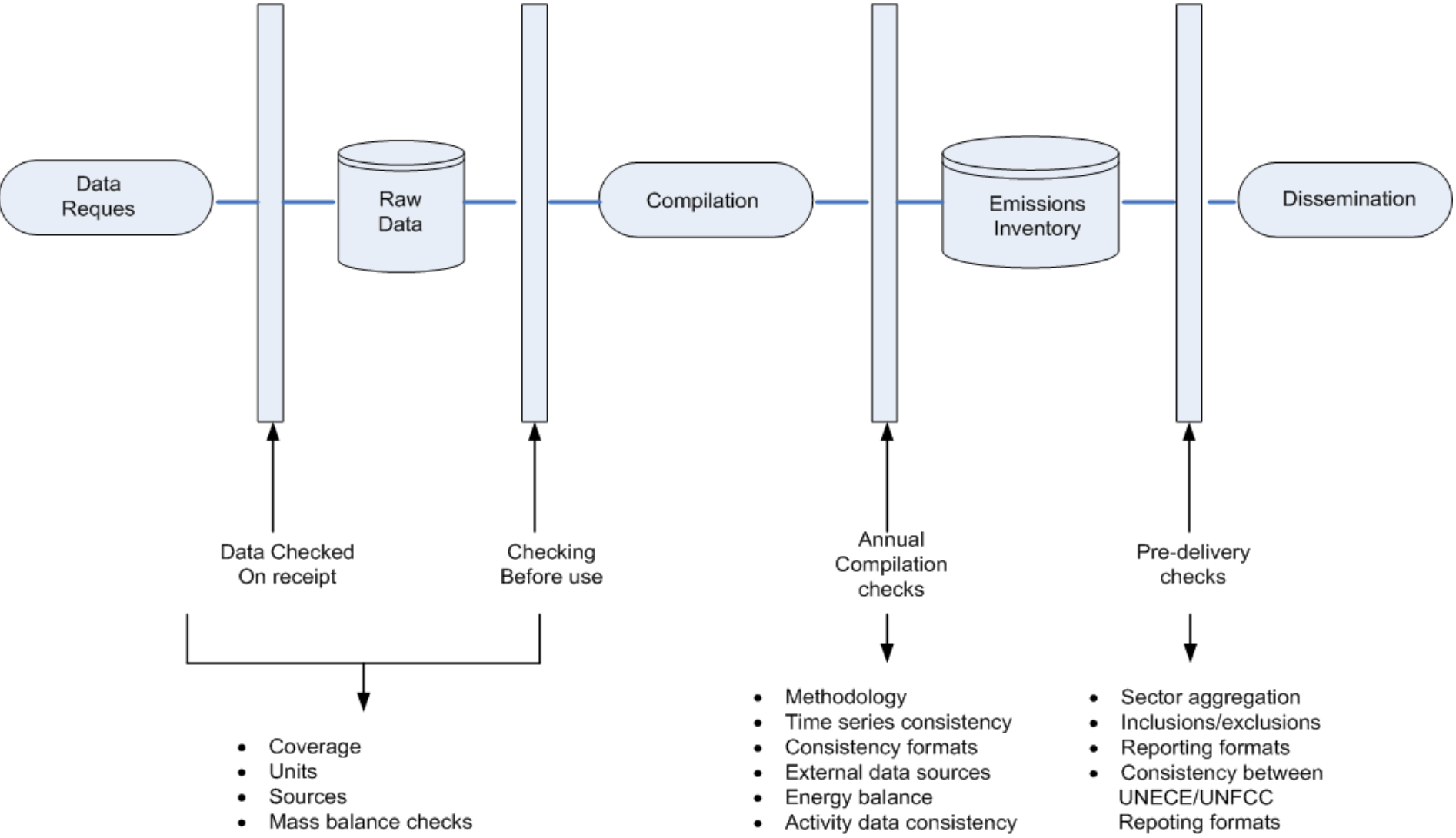
Year	CO_2		CH_4		N_2O		CO2-eq	
	IPCC 1996	IPCC 2006	IPCC 1996	IPCC 2006	IPCC 1996	IPCC 2006	IPCC 1996	IPCC 2006
2000	250,151	256,862	3,052	1,437.3	14	10.60	318,614	290,333
2001	279,661	274,789	3,016	1,392.4	15	10.96	347,499	307,426
2002	301,845	296,788	3,204	1,349.7	15	11.27	373,744	328,627
2003	298,663	305,062	3,303	1,299.6	15	11.57	372,736	335,941
2004	333,459	327,794	3,298	1,275.5	16	12.07	407,539	358,319
2005	336,387	330,517	3,281	1,270.5	16	12.35	410,190	361,026

GHGs estimates under IPCC 2006 are lower compared to GHGs estimates under IPCC revised 1996

Activity Data and Emission Factors

- Most activity and other relevant data are published (official) data from
  - Energy Balance Table from Data and Information Center (PUSDATIN) - MEMR
  - Population Data and Growth from Central Bureau of Statistics (BPS)
  - Socio Economic Data from the Ministry of Finance Publication
  - Data and information related to industrial processes from BPS
  - Notes: all data are updated annually by relevant institutions. Specifically in energy, update is annually carried by PUSDATIN using data from relevant institutions: Pertamina (National Oil and Gas Company), PLN (State Electricity Enterprises), PGN (National Gas Company), etc.
- **Emission Factor (EF)**
  - EF used in GHG calculation are a mix of local EF and default EF (2006 IPCC GL)
  - Specifically in the energy, the EFs were derived from local heating value of each fuels used in the country and default value of carbon content per energy unit.

Activity Data Collection and Compilation



Key Category Analysis - 1

- The key category analysis (Tier 1) without and with LUCF indicated that there are 20 and 5 key categories respectively.
- Without LUCF, the first three main categories that contributed to more than 50% of the total emissions were:
  - (i) energy production (electricity, heat, oil & gas refining),
  - (ii) industrial wastewater treatment and discharge and
  - (iii) manufacturing industries and construction (Table 2.16).
- With LUCF, the first three main categories are all from the LUCF sector: (i) forest and grassland conversion, (ii) peat fire and (iii) CO_2 emissions and removals from soils.
- This analysis suggests that improvement of activity data and emission factors for these key categories are important for the improvement of the NGHGI. It seems that activity data on land use and forest change area and the forested area are the most important. Local emission factors for these source categories need to be developed.

Key Category Analysis - 2

Sector	**Source Categories to be Assessed in Key Source Category Analysis**	Gases	Cumulative Contribution (%)
	Without LUCF		
Energy	Energy production (electricity, heat, oil & gas refining)	CO_2	19.8
Waste	Industrial Wastewater Treatment and Discharge	CH_4	38.5
Energy	Manufacturing Industries and Construction	CH_4	50.9
Energy	Transportation	CO_2	61.8
Agriculture	Rice Cultivation	CO_2	66.9
Industrial Process	Cement Production	CH_4	71.4
Energy	Residential	CO_2	75.6
Agriculture	Direct N2O Soils	CO_2	78.2
Energy	Oil and Natural Gas	N_2O	80.6
Waste	Unmanaged Waste Disposal Sites	CH_4	82.6
Energy	Non Specified	CH_4	84.6
Agriculture	Enteric Fermentation	CO_2	86.5
Waste	Domestic Wastewater Treatment and Discharge	CH_4	88.0
Waste	Unmanaged Dumpsite	CH_4	89.5
Energy	Residential	CH_4	91.0
Energy	Commercial/Institutional	CH_4	92.3
Industrial Process	Ammonia Production	CH_4	93.5
Agriculture	Indirect N2O Soils	CO_2	94.4
Energy	Oil and Natural Gas	CO_2	95.3

Key Category Analysis – 2 (continued ...)

Sector	Source Categories to be Assessed in Key Source Category Analysis	Gases	Cumulative Contribution (%)
With LUCF			
LUCF	Forest and grassland conversion	CO_2	39.6
LUCF	Peat Fire	CO_2	65.2
LUCF	CO_2 emissions and removals from soils	CO_2	79.3
Energy	Energy production (electricity, heat, oil & gas refining)	CO_2	86.9
Waste	Industrial Wastewater Treatment & Discharge	CH_4	94.1
Energy	Manufacturing Industries & Construction	CO_2	98.9

Lesson Learned of Key Categories in Energy

- In the 2006 IPCC Guidelines, various emission sources of energy system are classified in three main categories, namely:
  - fuel combustion emissions,
  - fugitive emission generated from energy production systems (coal mining, oil & gas production, refinery, fuel transportation, etc), and
  - emissions from transport, injection, and storage of CO_2 (which is related to CCS operations).
- The SNC only cover:
  - fuel combustion emissions
  - fugitive emissions
  - Emissions from transport, injection, and storage of CO_2 have not been covered in the SNC since CCS operation has not been started yet (still under consideration and discussion at national level)

Important Missing Sources of GHG in Energy

1. Fuel combustion activity in energy industries:
   - electricity & heat generation: combine heat power plant and heat plant
   - manufacture of solid fuel & other energy (coal, charcoal, refinery)
2. Data on fuel combustion in agriculture/fishing/fish farm and combustion in manufacturing, construction, and non-specified stationary/mobile combustion (off-road vehicle/other machinery, fishing).These activity data are agregated under ACM (Agriculture, Construction, and Mining) category of energy balance data.
3. Fugitive emission from spontaneous combustion & burning coal dumps in solid fuel production activities are not available.
4. Data of fugitive emission in oil and gas production is agregated since detail data regarding venting, flaring, leakage, and other activies that are considered as fugitive emissions sources are very limited.

Uncertainty Analysis and Improvement Plan

- An uncertainty analysis was conducted (Tier 1) following the Good Practice Guidance (GPG) IPCC 2000. The levels of uncertainty for activity data & EF were assessed based on expert judgment and consultation with the Centre for Data and Information in the related sectors.
- Overall uncertainty of the Indonesian National GHG inventory for 2000 and 2004 without LUCF was approximately 16.3% and 13.9%, respectively, while the trend uncertainty was 16.9%. With the inclusion of LUCF, the level of uncertainty of the National GHG Inventory increased 15% and 20%.
- Improving activity data and EF for the LUCF sector (the first three key categories) could increase the certainty of the inventory.
- This improvement is possible with the use of satellite data. Emissions/ removal factors can also be improved with the use of data from National Forest Inventory (NFI).
- At the time of this inventory, the NFI data is still being processed and not available for use. With the availability of this data, the overall certainty of the Indonesian National GHG Inventory can be improved significantly.

Estimates of uncertainty level for activity data & EF

No.	Source/Sink Categories	Current Uncertainty		Improved	
		AD	EF/RF	AD	EF/RF
1	Energy and transportation	10	5	Same	Same
2	Industry[1]	10	10	Same	Same
3	Agriculture	15	30	Same	Same
4a	Change in forest and other woody biomass	25	50	15	25
4b	Forest and grassland conversion	30	75	15	25
4c	Abandonment of managed land	25	50	Same	Same
4d	Soil emissions	50	75	Same	Same
4e	Peat burning (van der Werf *et al* 2007)	25	50	15	25
5	Waste	50	50	Same	Same

Note: [1]The level of uncertainty for sub-categories of industrial process varied from 5 to 15 while for other sectors were assumed to be the same. AD = activity data; EF/RF = emissions factor/removal factor

Success Factors

- Seriousness of GOI in the SNC development
- Good institutional arrangement lead by MoE
- Competent WG member and supporting institutions
- Availability of GL
- Availability of national published data needed for activity data estimation
- Sufficient support from relevant ministries in activities data collection and compilation
- Frequent and productive FGD and WG meetings
- Good support from sponsor and international reviewer

Improvement After the SNC

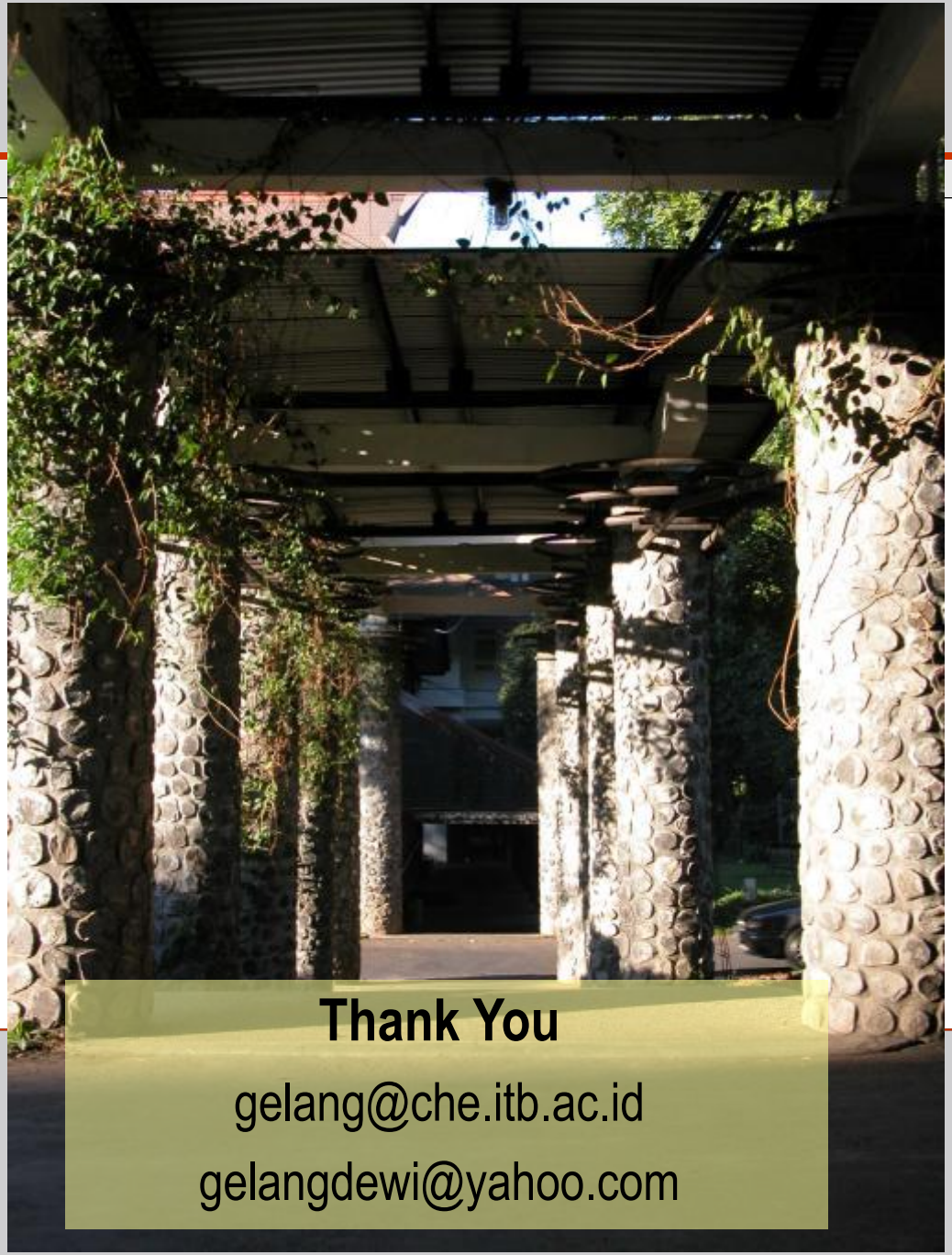
- Establishment of special division in the MoE specifically dedicated to preparing the NGHGI (already done in 2010).
- MoE is strengthening current system of NGHGI through establishment a NGHGI System called as *Sistem Inventarisasi Gas Rumah Kaca Nasional* (SIGN). Under this system, all relevant ministries will carry out GHG inventory for their related GHG scope. Each ministry will carry out QA/QC of their data activities, EFs, and GHG estimation. MOE will coordinate inventory activities and will compile GHG inventory of all relevant activities such as written in the IPCC 2006 GL. MoE will carry out final QA/QC.
- To support the NGHGI system, GOI has prepared a draft of Presidential Regulation on “The Implementation of GHG Inventory with Measureable, Reportable, and Verifiable”.
- Capacity building of personnel in key ministries & regional officers (recently conducted by MoE using GOI budget & assisted by JICA)

Proposed Improvements of NGHGI

Reduce uncertainty in key sources of GHG emissions by conducting primary survey (direct measurement of EF and activity data for sample)

Energy Sector (example)

ITEM	SNC	Needs of improvement
Emissions sources	Energy sector: all sources of combustion and fugitive	Complete important missing sources
Inventory Methodology	2006 IPCC Guidelines	Full implementation of methodology provided in 2006 IPCC guideline
Methodology to calculate GHG emissions	Tier 1, 20006 IPCC guidelines: •Reference approach •Sectoral approach	Tier 2/3 2006 IPCC Guideline; will require database of fuel consumption by technology type for each key-sources
Emission factors	Local heating value of fuels but still use default value of carbon content of 2006 IPCC guideline (it can be considered as local emission factor); aggregated according to source category	Use local emission factor for each type of technology



Thank You

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