Center for Research on Energy Policy
Chemical Engineering, Faculty of Industrial Technology
INSTITUT TEKNOLOGI BANDUNG

Challenges For Developing Effective MRV System for Industrial Energy Sector in Indonesia

RETNO GUMILANG DEWI

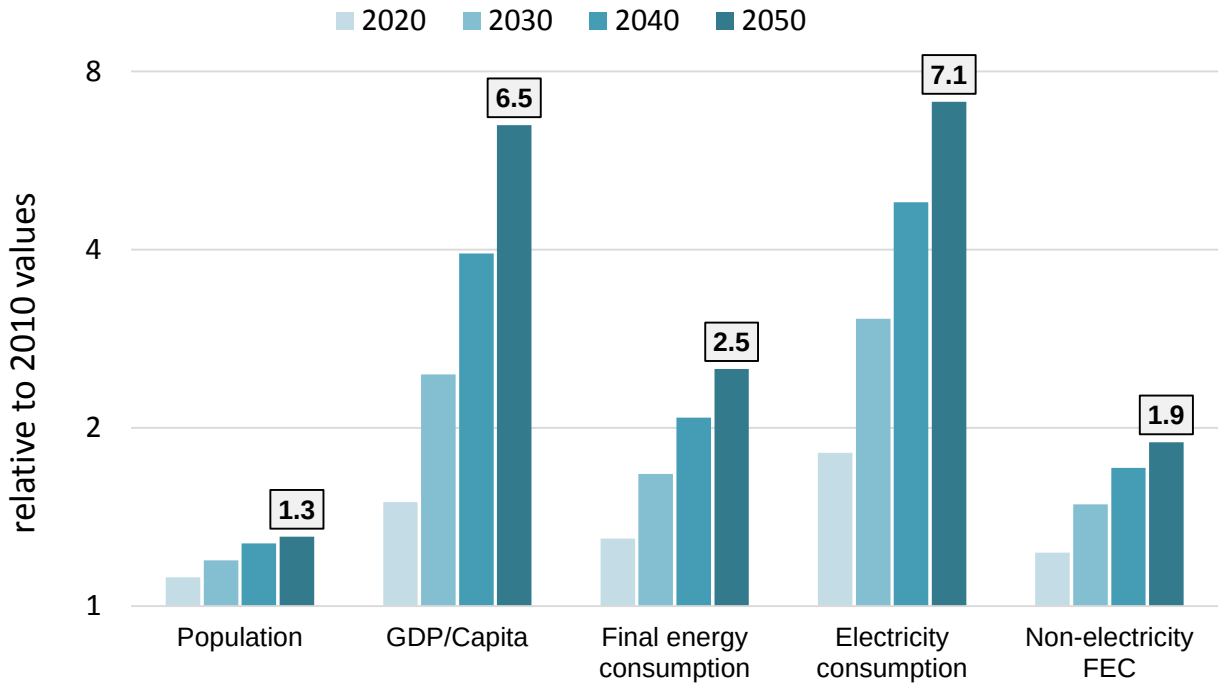
"**LoCARNet 7TH Annual Meeting"**
21st – 22nd November 2018, Jakarta Indonesia

OUTLINE

- **Background: Where are we now?**
- Where do we want to go
- Challenges for Industry Sector in Indonesia
- How do we get there
- The Needs for Monitoring the Achievement of GHG Emission Reduction from Mitigation Actions Implemented to Meet the Target of Indonesia Commitment on Climate Change: An Effective MRV System for Industrial Sector in Indonesia

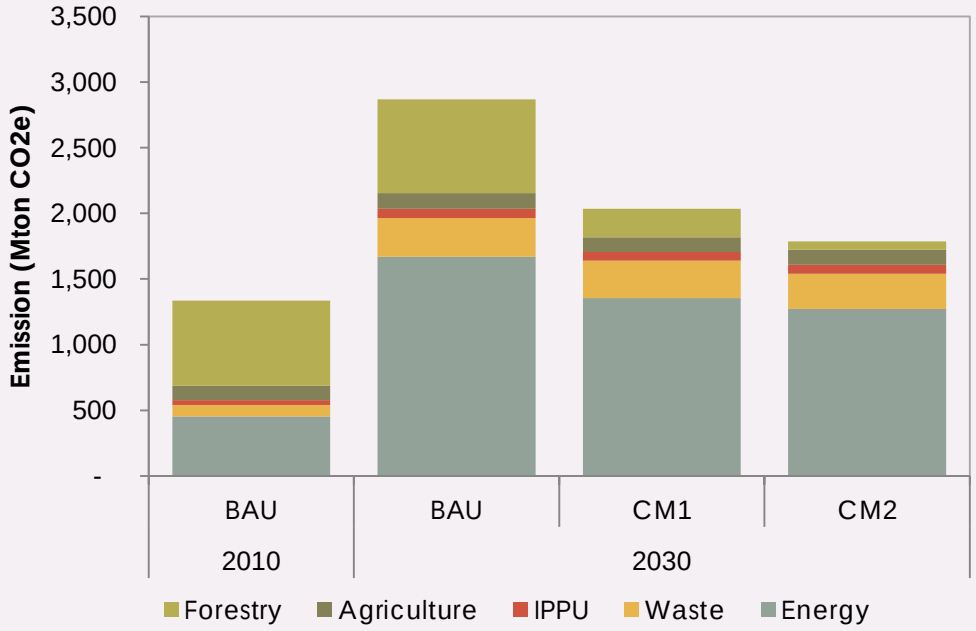
High economic growth means greater access for energy. Considering the use of baseline technologies, this could lead to a climb in future energy related emissions.

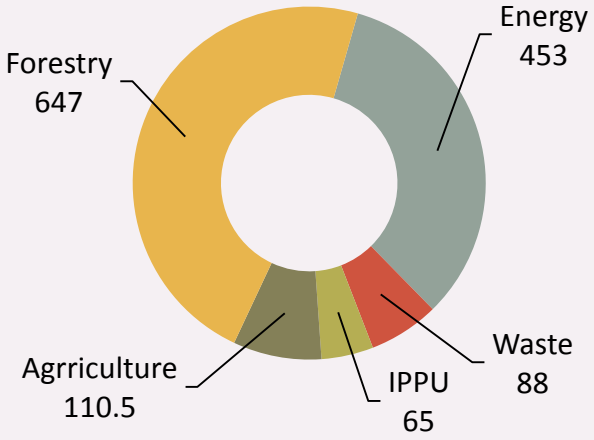
- Fast-growing economy – rapidly increasing growing and fast-changing demand for energy.
- National Energy Policy: Security & Independence.
  - ✓ Moving away from Oil, reducing Oil to 25% of total supply in 2025
  - ✓ Utilization of strategic assets (Coal and Natural Gas)
  - ✓ Energy efficiency improvements
  - ✓ New (nuclear, CBM, shale-gas) & Renewable energies.
- Distribution challenge for a nation of thousands island



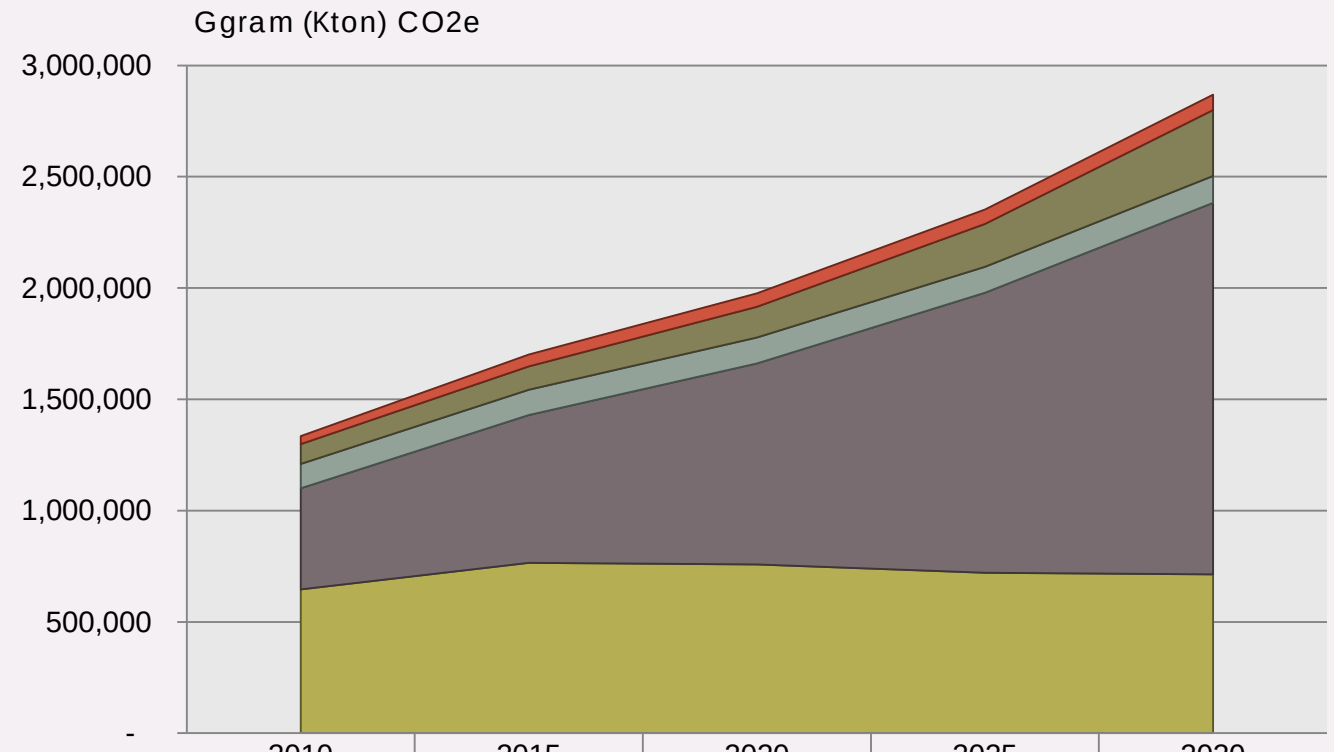
Source: Calculated base on National Energy Policy (DEN 2014), and The World Fact-book (CIA 2018)

INDONESIA NDC AND GHG EMISSION GROWTH



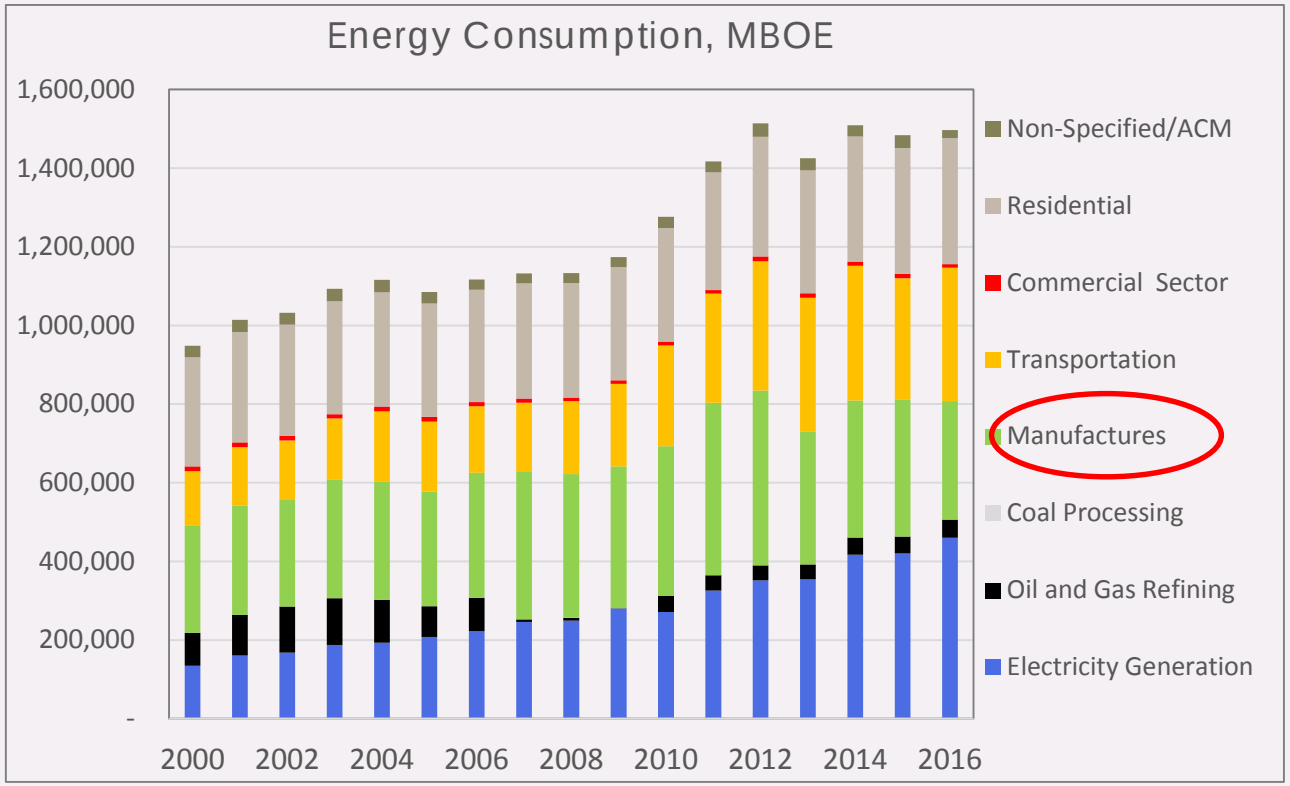


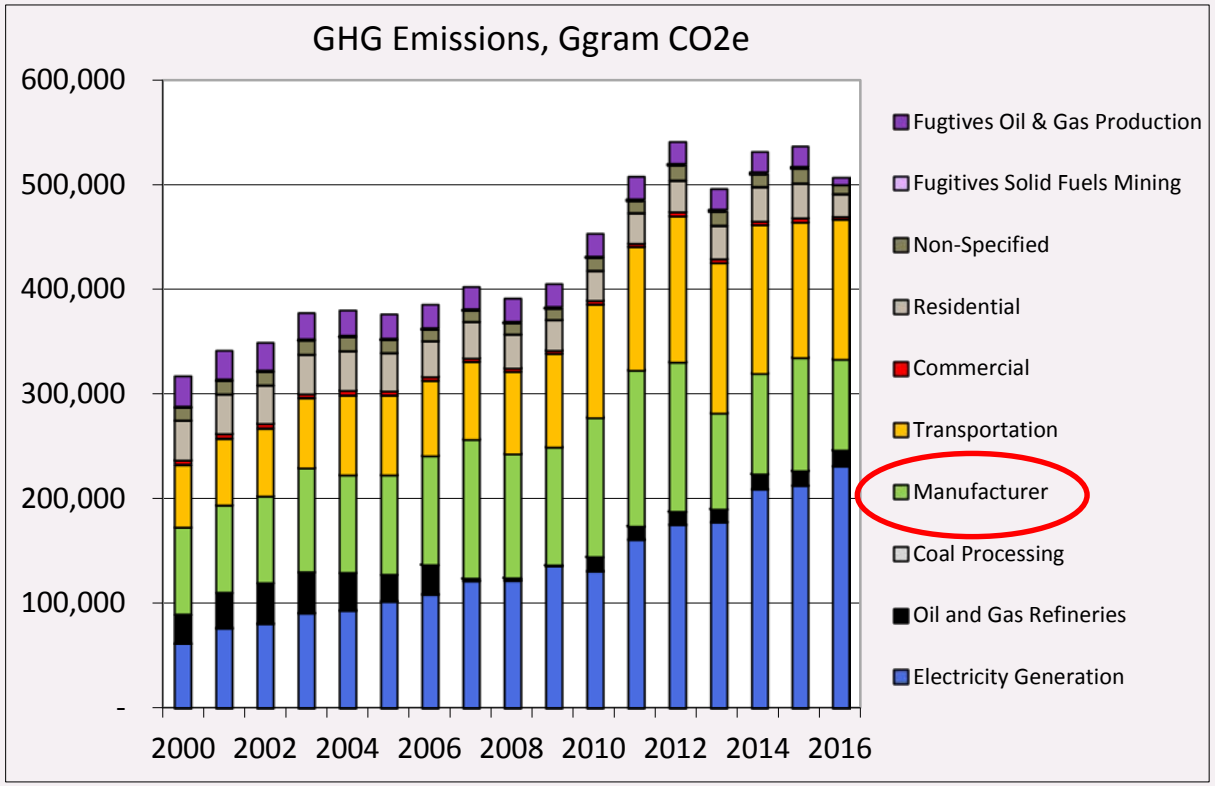
GHG emissions (Mton CO2-eq) by source, 2010



	2010	2015	2020	2025	2030
IPPU	36,033	52,922	59,494	64,844	69,603
Waste	88,013	105,803	138,696	192,438	295,632
Agriculture	110,510	113,516	115,925	117,422	120,457
Energy	453,178	664,382	903,929	1,257,726	1,669,250
Forestry	646,545	765,087	757,566	720,753	714,241
Total	1,334,279	1,701,710	1,975,610	2,353,183	2,869,183

Direct GHG Emissions from Energy Category



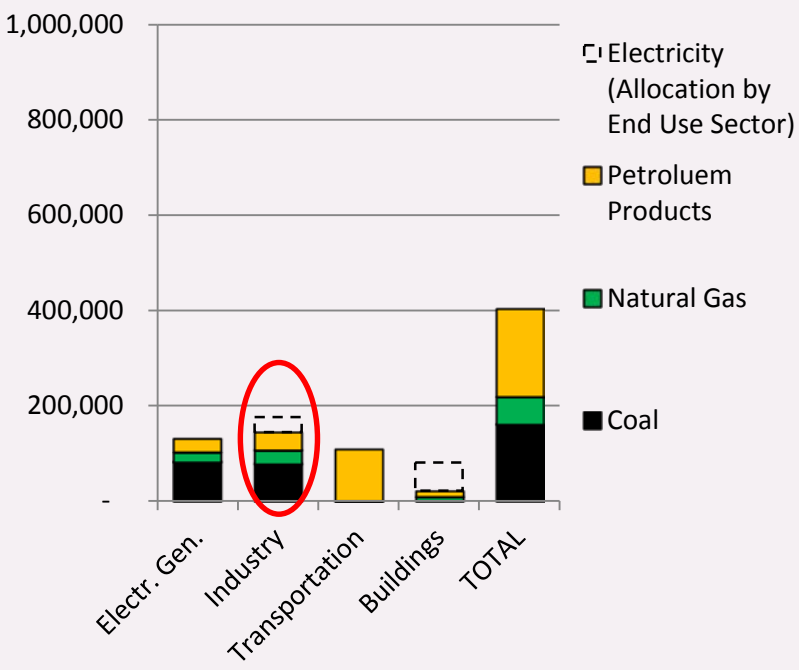


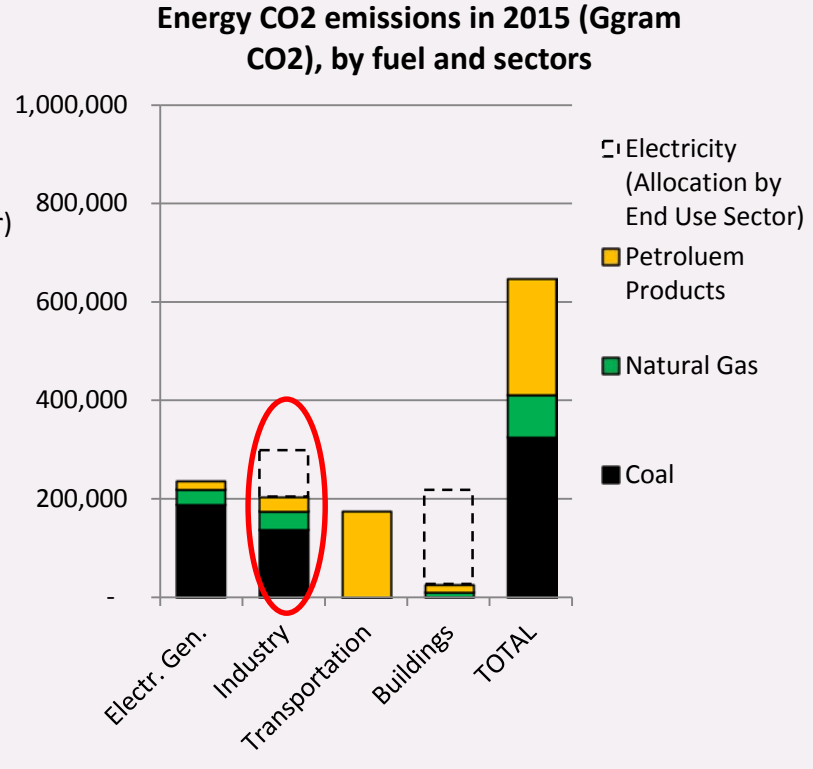
- Industry is the largest energy consumption and laso the largest sources of direct GHG emissions from energy category of demand side

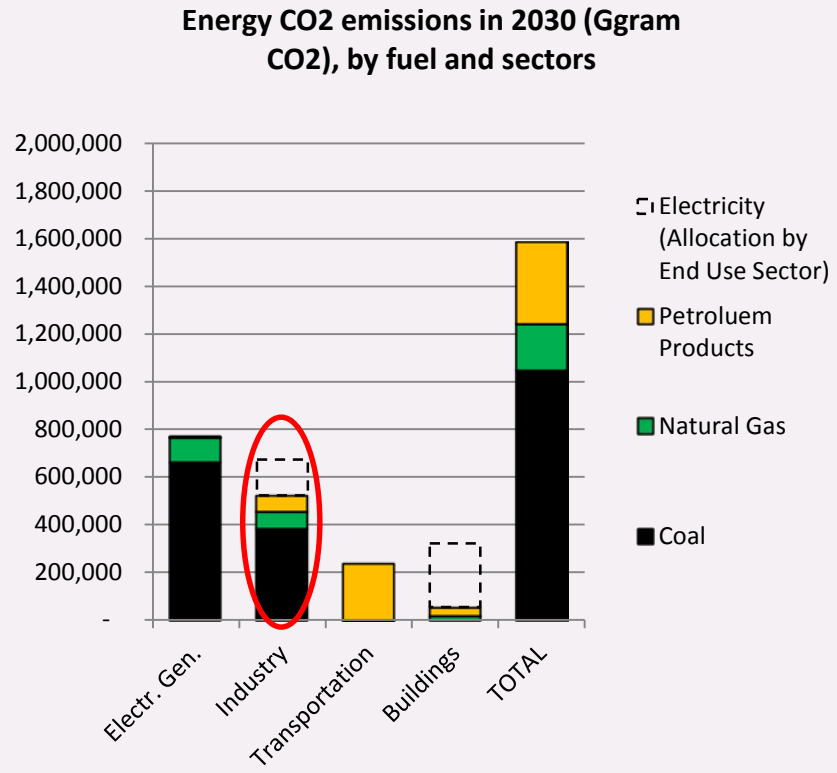
Direct and Indirect GHG Emissions from Energy Category

Historical GHG Inventory

Projections, BaU







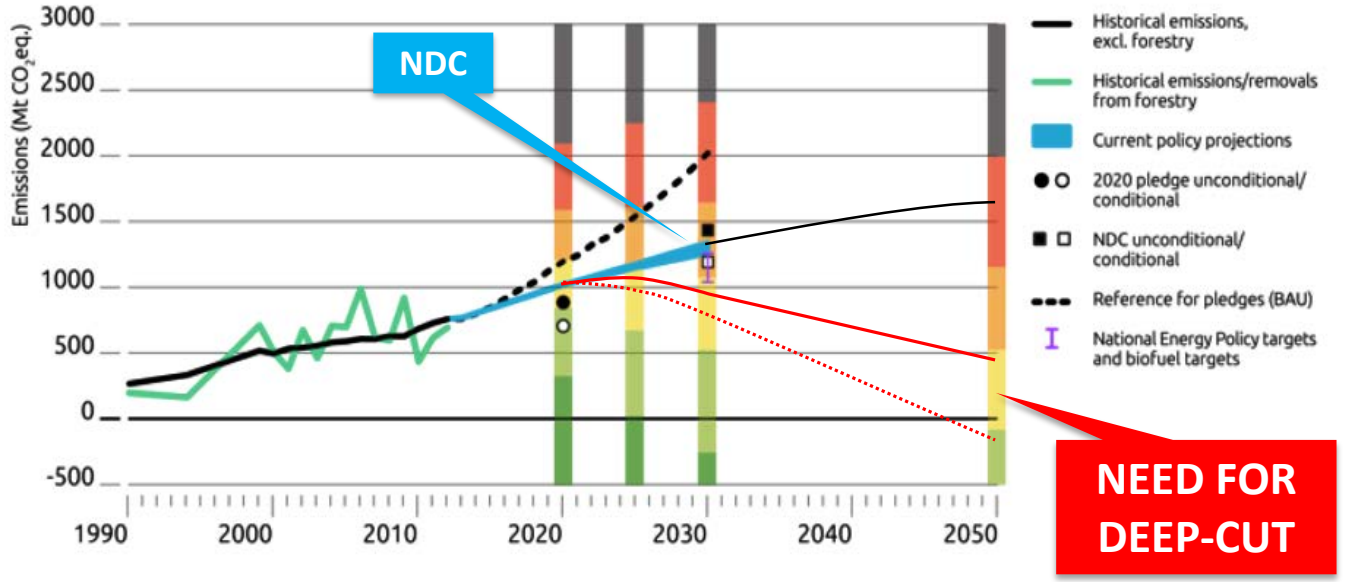
End-use sector: one-half of direct combustion emissions are from fuel burning in industry;

Emissions from power is accounted by building (63-66%) and industry (34-37%)

Industry sector is the largest sources of GHG emissions from energy category, followed by transportation, however, the projection showed buildings sector will surpass the transportation

OUTLINE

- Background: Where are we now?
- **Where do we want to go?**
- Challenges for Industry Sector in Indonesia
- How do we get there
- The Needs for Monitoring the Achievement of GHG Emission Reduction from Mitigation Actions Implemented to Meet the Target of Indonesia Commitment on Climate Change: An Effective MRV System for Industrial Sector in Indonesia



Indonesia NDC (Nationally Determine Contribution)

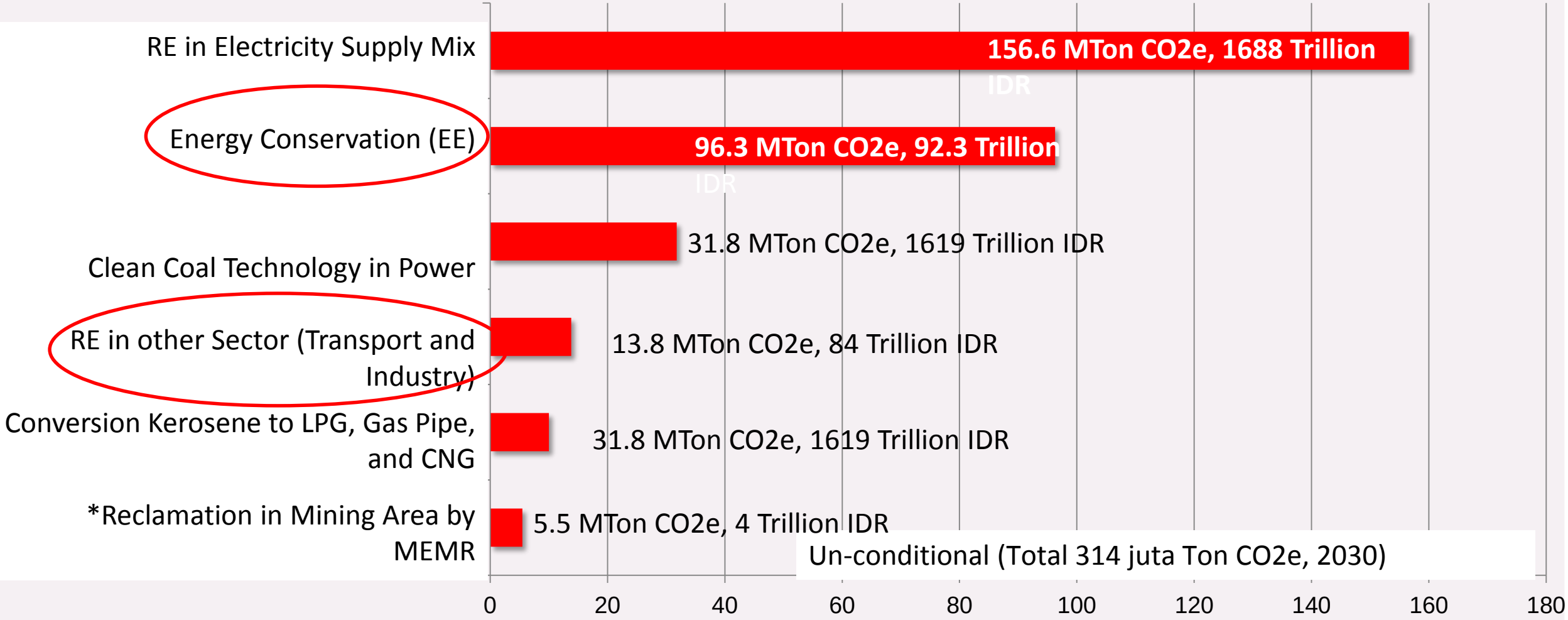
Sector	Base Year, 2010 (MTon CO2-e)	GHG Emission 2030 (Mton CO_2-e)			% reduction of BaU		% Average Growth	
		BaU	CM1	CM2	CM1	CM2	2010 - 2014	2010-2030
Energy*	**453.2**	**1,669**	**1,355**	**1,271**	**11%**	**14%**	**4.5**	**6.7**
Waste	88	296	285	270	0.38%	1%	4.0	6.3
IPPU	36	69.6	66.85	66.35	0.10%	0.11%	0.1	3.4
Agriculture	110.5	119.66	110.39	115.86	0.32%	0.13%	1.3	0.4
Forestry**	647	714	217	64	17.20%	23%	2.7	0.5
Total	1,334	2,869	2,034	1,787	29%	38%	**3.2**	**3.9**

*Including fugitive; **Including peat fire; CM1 = unconditional, CM2 = conditional Source: Climate Action Tracker (2017); Indonesia first NDC (2016)

Remarks

BaU	Development Path <u>not</u> deliberated the mitigation policies
CM1	Mitigation scenario & considers sectoral development target (Unconditionally)
CM2	Ambitious mitigation scenario + additional International support available (conditionally)

TARGET OF INDONESIA NDC FROM ENERGY CATEGORY - UNCONDITIONAL SCENARIO (CM1) 2030



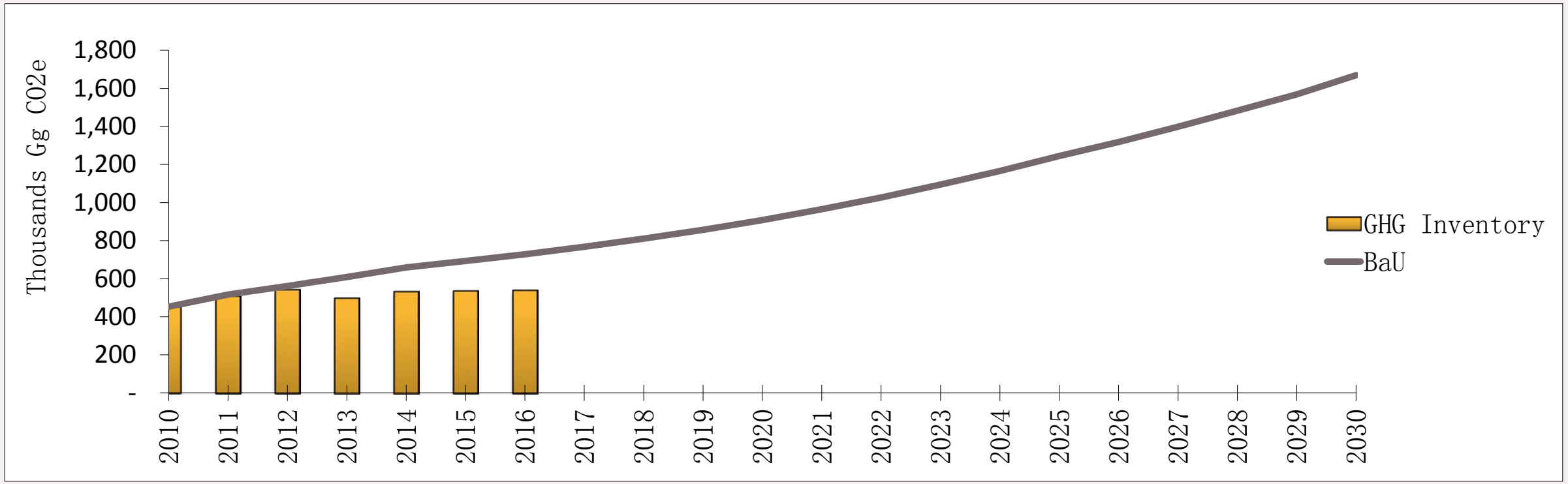
) AFOLU Category

EVALUATION OF THE ACHIEVEMENT MITIGATION ACTION IN ENERGY SECTOR

	Mitigation Actions	Reduction Ggram CO_2-eq)					
		2011	2012	2013	2014	Target 2020	2014/2020
1	Implementation of energy management mandatory for energy intensive user	197	291	300	826	10,160	8.10%
2	Implementation of energy conservation partnership program	147	252	292	330	2,110	15.70%
3	Energy efficiency in household appliances		1,346	1,400	1,422	9,750	14.60%
4	Provision and management of new and renewable energy and energy conservation	391	855	1,125	2,120	4,400	48.20%
	- PLTP (geothermal power)			22.3	34.3		
	- PLTMH (microhydro power plant)		1	1	6.7		
	- PLTM (minihydro power plant)	123	475	475	1,439		
	- PLTS (solar power)			6	12.6		
	- PLT Hybrid (hybrid power plant)			0.09	0.12		
	- PLT Biomassa (biomass power)	245	356	589	597		
	- Desa Mandiri Energi (energy sufficient village)	23	23	31	31		
5	Utilization of biogas*	3.4	4	7.3	27.5	130	21.10%
6	Natural gas utilization for public transportation	37.2	55.7	74.3	86.7	3,070	2.80%
7	Increased deployment of gas pipe for household in cities	6.1	12	32.8	32.2	150	21.50%
8	Development of mini refinery plant for Liquid Petroleum Gas (LPG)					30	0.00%
9	Post mining land reclamation	711	953	1,200	1,448	2,730	53.00%
	Total	**1,492**	**3,769**	**4,431**	**6,293**	**32,530**	**19.30%**

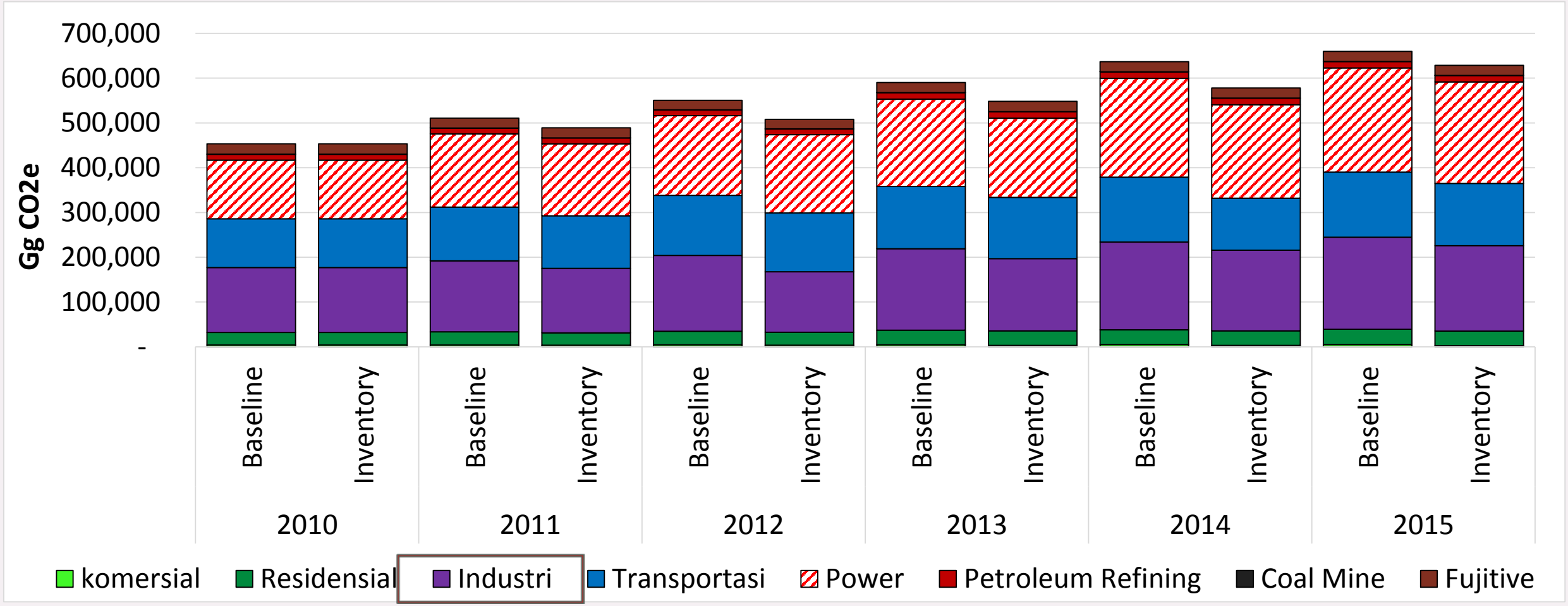
Monitoring of the success of Mitigations (GHG Emissions) using project baseline 19.3% national target 2020 [Source: PEP RAN GRK, 2016]

GHG EMISSION REDUCTION POTENTIAL IN ENERGY SECTOR



Ggram CO2e	2011	2012	2013	2014	2015	2016	Target 2020	Target 2030
Reduction Potential	8,976	20,998	112,333	127,753	157,045	190,576	32,530	314,000
% Achievement to 2020 target	28%	65%	345%	393%	483%	586%		
% Achievement to 2030 target	2.86%	6.69%	35.77%	40.69%	50.01%	60.69%		

BASELINE VS INVENTORY OF ENERGY SECTOR (2010-2015)



OUTLINE

- Background: Where are we now?
- Where do we want to go?
- **How do we get there: Challenges for Industry Sector in Indonesia**
- The Needs for Monitoring the Achievement of GHG Emission Reduction from Mitigation Actions Implemented to Meet the Target of Indonesia Commitment on Climate Change: An Effective MRV System for Industrial Sector in Indonesia

MAIN SOURCES OF GHG EMISSIONS IN INDUSTRIES

ENERGY

- **Scope 1** Direct Emission from Fossil Fuels Combustion
- **Scope 2** Indirect Emission from Electricity Utilization
- **Biomass Utilization**

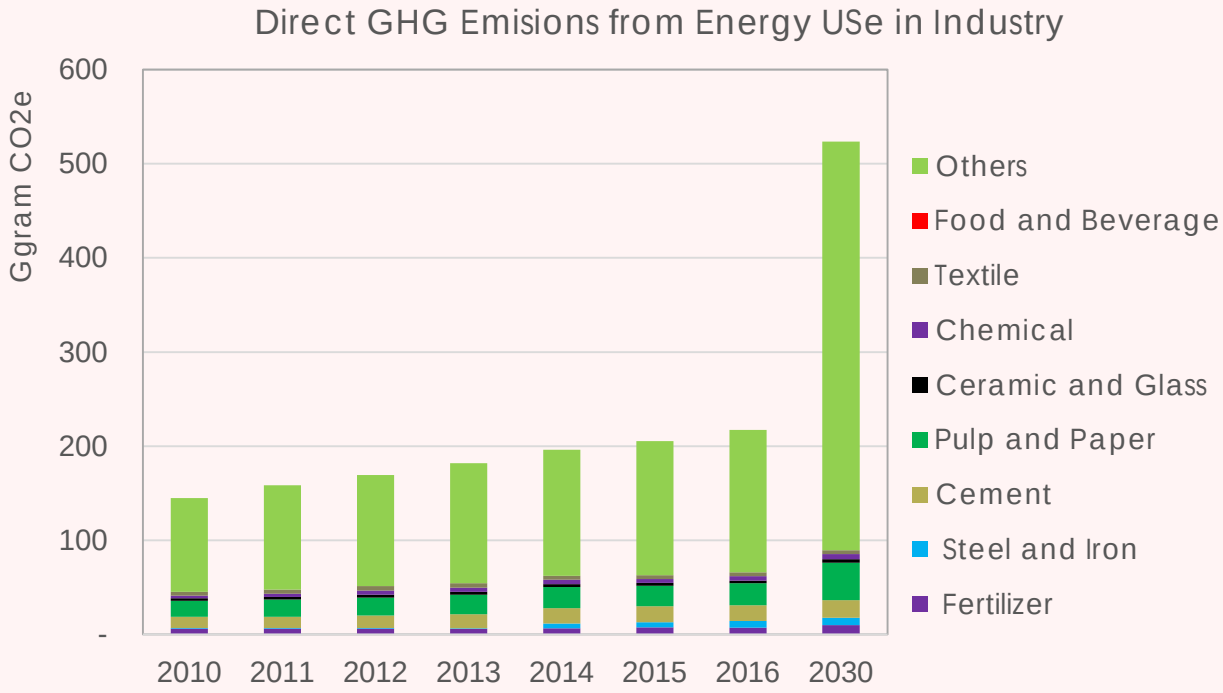
WASTE

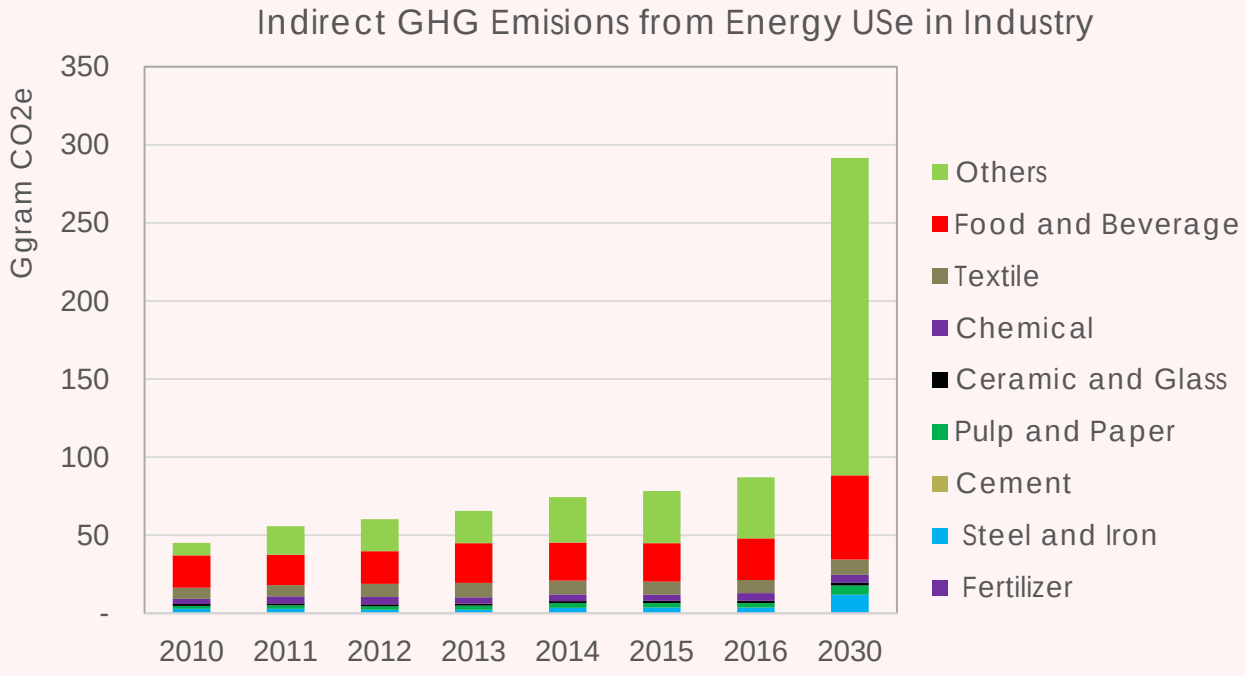
- Waste Water Treatment (WTP)
- Sludge Treatment
- Solid Waste or Contaminated Materials

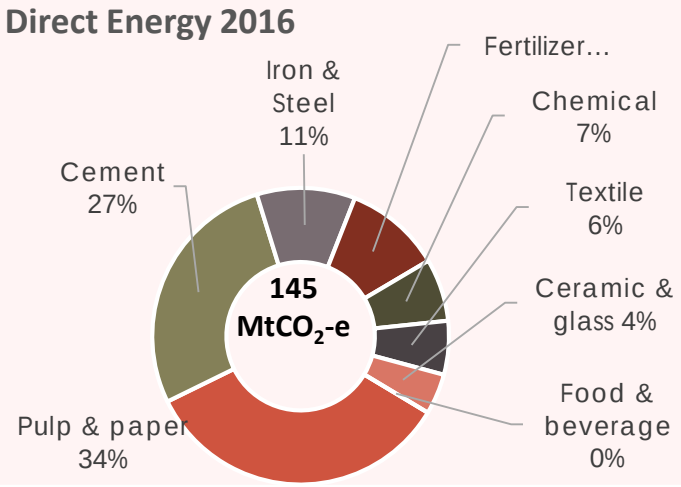
IPPU

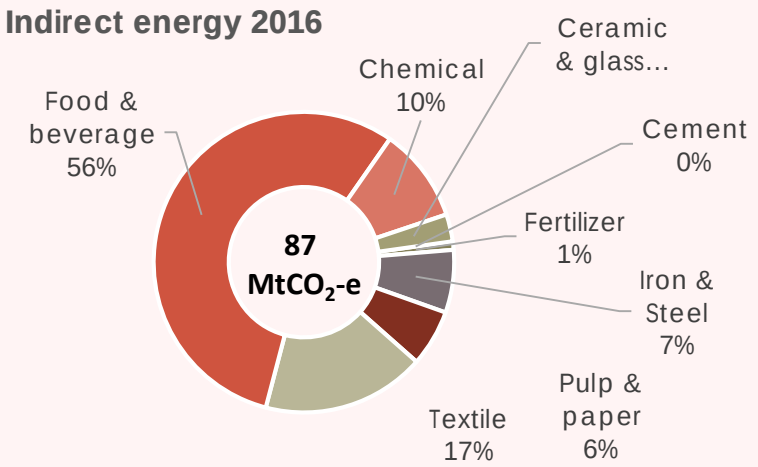
- Industrial Processes (carbonate utilization)
- Product Utilization (Lube oil utilization)

GHG Emissions from Energy Used By 8 Energy Intensive Industries

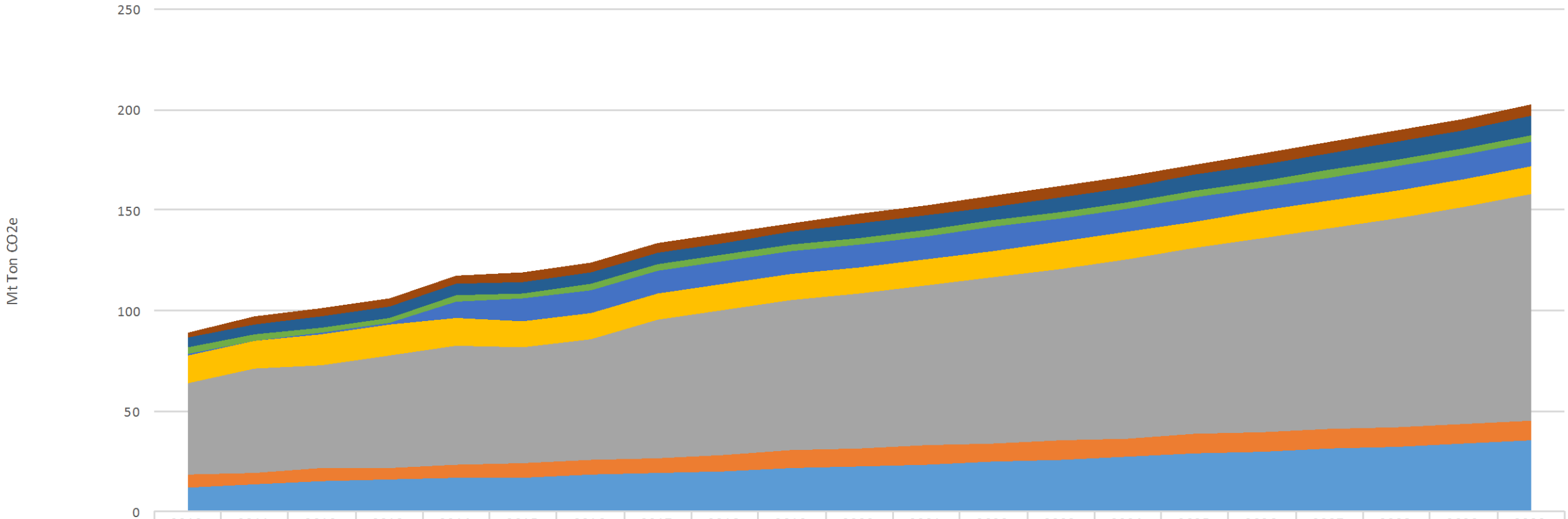






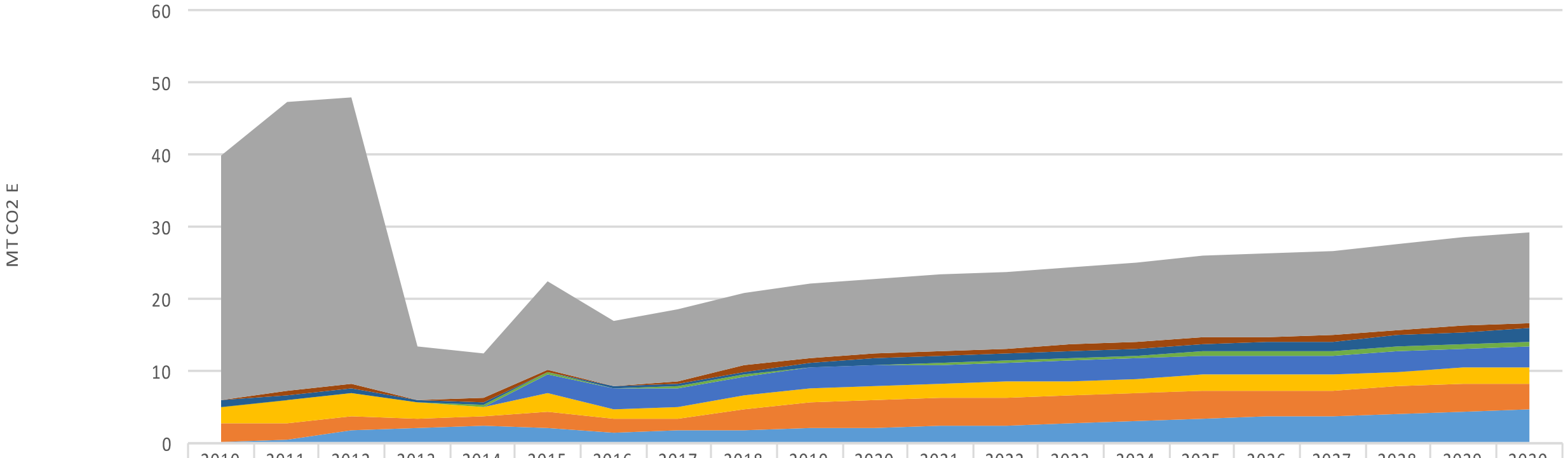


GHG Emission of BaU Scenario from 8 Energy Intensive Industries



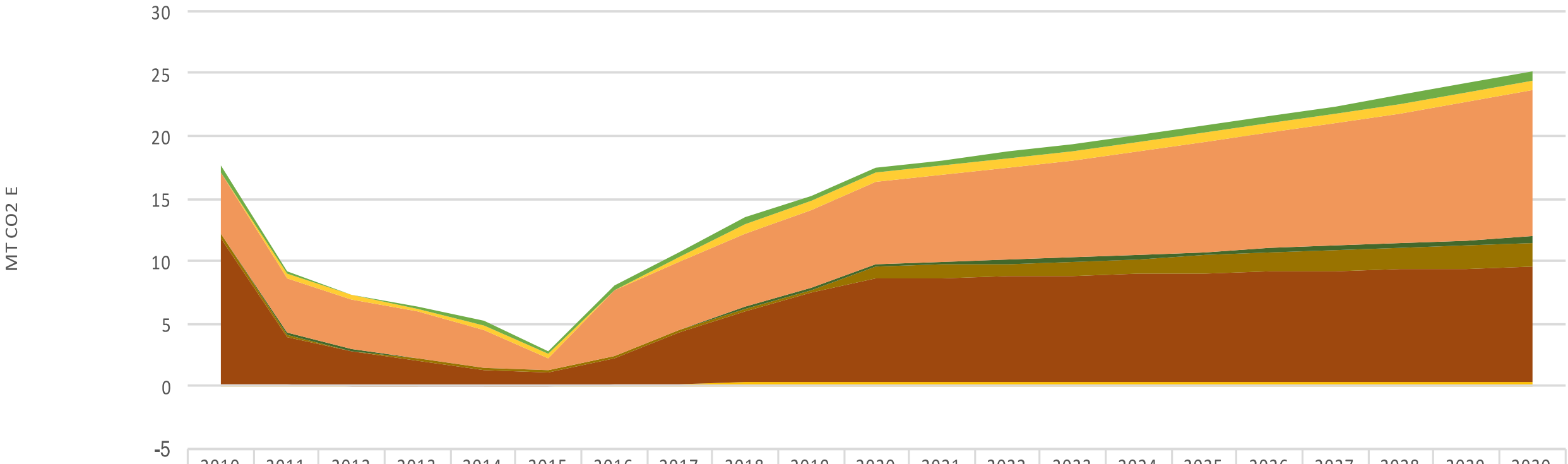
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Chemical	2,67	3,40	4,42	4,25	4,60	4,29	4,64	4,42	4,60	4,73	4,85	4,96	5,05	5,11	5,17	5,22	5,26	5,29	5,32	5,36	5,39
Food and Beverages	4,96	5,14	5,25	5,47	5,55	5,67	5,89	6,05	6,24	6,44	6,65	6,87	7,10	7,34	7,60	7,87	8,16	8,47	8,79	9,12	9,48
Ceramic and Glass	2,91	2,96	3,10	3,09	3,14	3,06	3,01	3,12	3,17	3,20	3,23	3,27	3,31	3,35	3,39	3,43	3,47	3,52	3,57	3,63	3,68
Iron and Steel	0,61	0,64	0,64	0,60	7,99	11,20	11,25	11,27	11,30	11,34	11,38	11,42	11,46	11,51	11,55	11,60	11,66	11,71	11,77	11,83	11,90
Textile	13,74	13,81	15,04	15,66	13,61	12,86	12,92	12,98	13,04	13,11	13,17	13,24	13,30	13,36	13,43	13,49	13,56	13,63	13,69	13,76	13,83
Pulp and Paper	45,87	51,21	51,67	55,43	59,47	57,55	60,16	69,24	71,68	74,23	76,92	79,74	82,71	85,82	89,08	92,51	96,12	99,90	103,87	108,04	113,04
Fertilizer	6,19	6,10	6,13	5,79	6,48	7,42	7,16	6,82	8,10	9,21	9,22	9,17	9,17	9,17	9,17	9,75	9,75	9,75	9,75	9,75	9,75
Cement	12,10	13,49	15,19	16,03	16,90	16,61	18,68	19,39	20,36	21,38	22,45	23,57	24,75	25,99	27,29	28,65	30,09	31,29	32,54	33,84	35,20

Projection of Annual Reduction from Direct Emission



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Pulp and Paper	34,07	39,91	39,74	7,12	6,34	12,24	8,96	9,83	9,99	10,15	10,32	10,50	10,69	10,89	11,10	11,32	11,55	11,80	12,05	12,32	12,67
Chemical	-	0,48	0,52	0,20	0,47	0,28	0,03	0,30	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80
Food and Beverages	0,76	0,87	0,54	0,27	0,53	0,27	0,37	0,45	0,53	0,61	0,70	0,79	0,89	0,99	1,09	1,21	1,32	1,45	1,58	1,72	1,86
Ceramic and Glass	0,00	0,00	0,04	0,07	0,09	0,10	0,07	0,19	0,15	0,19	0,23	0,27	0,32	0,36	0,41	0,45	0,50	0,55	0,61	0,66	0,71
Iron and Steel	0,02	0,02	0,02	0,02	0,02	2,71	2,72	2,72	2,72	2,72	2,72	2,72	2,72	2,72	2,72	2,73	2,73	2,73	2,73	2,73	2,74
Textile	2,31	3,25	3,22	2,02	1,23	2,49	1,26	1,51	1,72	1,92	2,09	2,10	2,11	2,12	2,13	2,14	2,15	2,16	2,17	2,18	2,19
Fertilizer	2,66	2,02	2,09	1,42	1,53	2,37	2,06	1,83	3,02	3,75	3,76	3,81	3,80	3,81	3,80	4,02	3,63	3,37	3,63	3,75	3,63
Cement	-	0,52	1,64	2,05	2,23	1,97	1,38	1,55	1,71	1,88	2,07	2,27	2,48	2,72	2,96	3,23	3,51	3,78	4,06	4,36	4,68

Projection of Annual Reduction from Indirect Emission

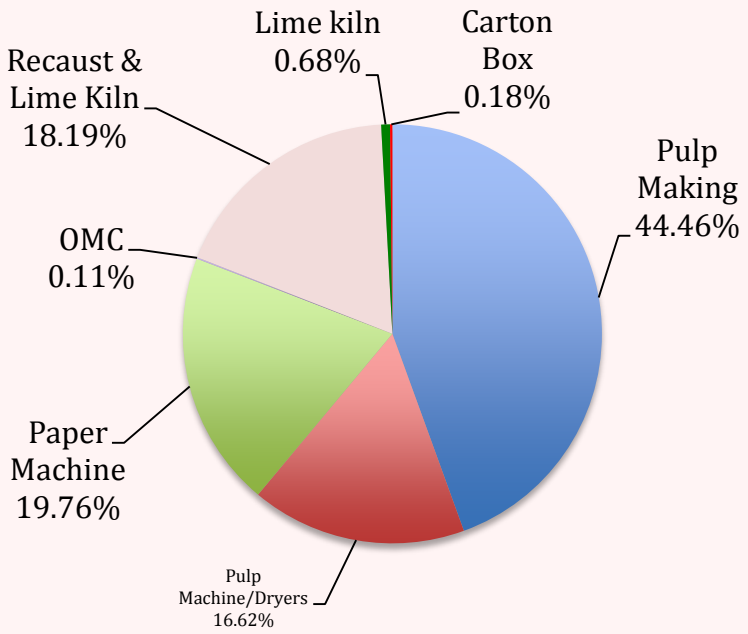


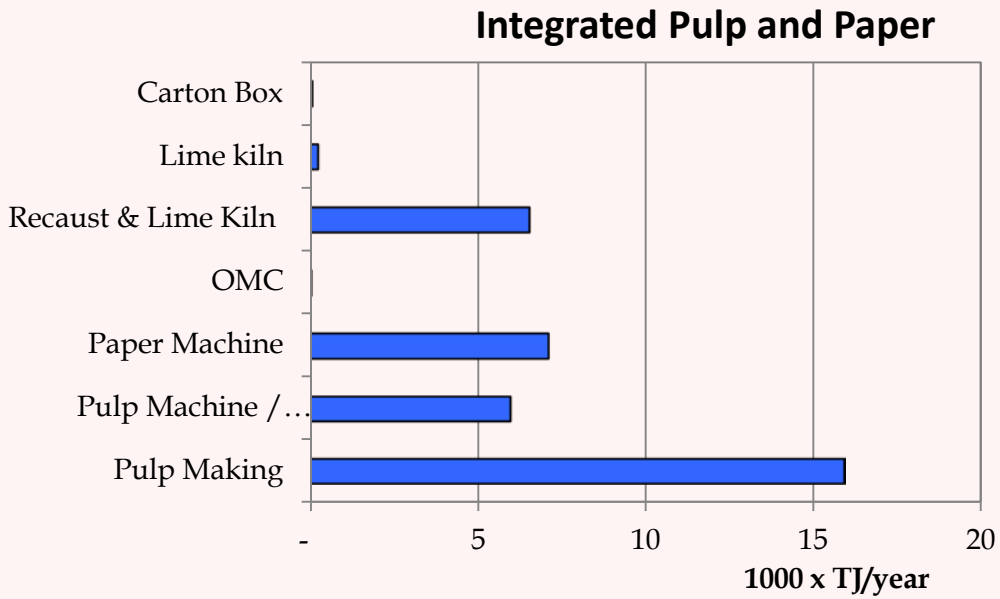
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Pulp and Paper	0,69	0,16	-	0,05	0,23	0,23	0,36	0,38	0,40	0,42	0,44	0,46	0,49	0,51	0,54	0,56	0,59	0,62	0,65	0,68	0,72
Chemical	-	0,48	0,52	0,20	0,47	0,28	0,03	0,30	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80
Food and Beverages	4,83	4,40	3,93	3,83	2,92	0,96	5,24	5,53	5,85	6,19	6,56	6,94	7,35	7,78	8,24	8,73	9,26	9,81	10,40	11,02	11,69
Ceramic and Glass	0,00	0,07	0,09	0,09	0,09	0,07	0,02	0,09	0,18	0,20	0,22	0,24	0,26	0,28	0,30	0,33	0,35	0,38	0,40	0,43	0,45
Iron and Steel	0,32	0,26	0,12	0,08	0,20	0,12	0,15	0,17	0,18	0,20	0,89	0,98	1,06	1,16	1,26	1,36	1,47	1,58	1,71	1,83	1,97
Textile	11,70	3,77	2,70	2,08	1,27	1,12	2,01	4,03	5,72	7,15	8,34	8,43	8,51	8,60	8,69	8,78	8,87	8,96	9,05	9,15	9,24
Fertilizer	0,14	0,09	0,02	(0,04)	(0,06)	0,02	0,20	0,18	0,29	0,25	0,25	0,25	0,25	0,25	0,25	0,28	0,28	0,28	0,28	0,28	0,28
Cement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

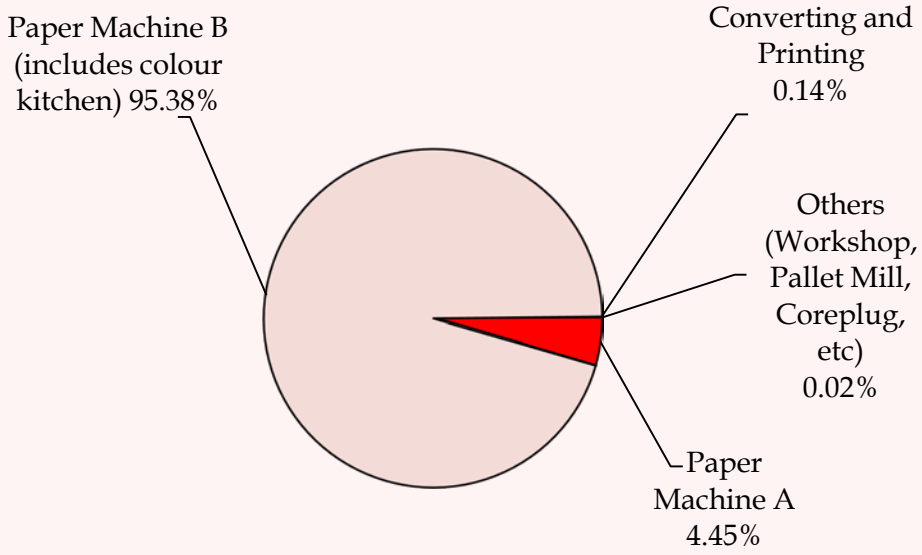
OUTLINE

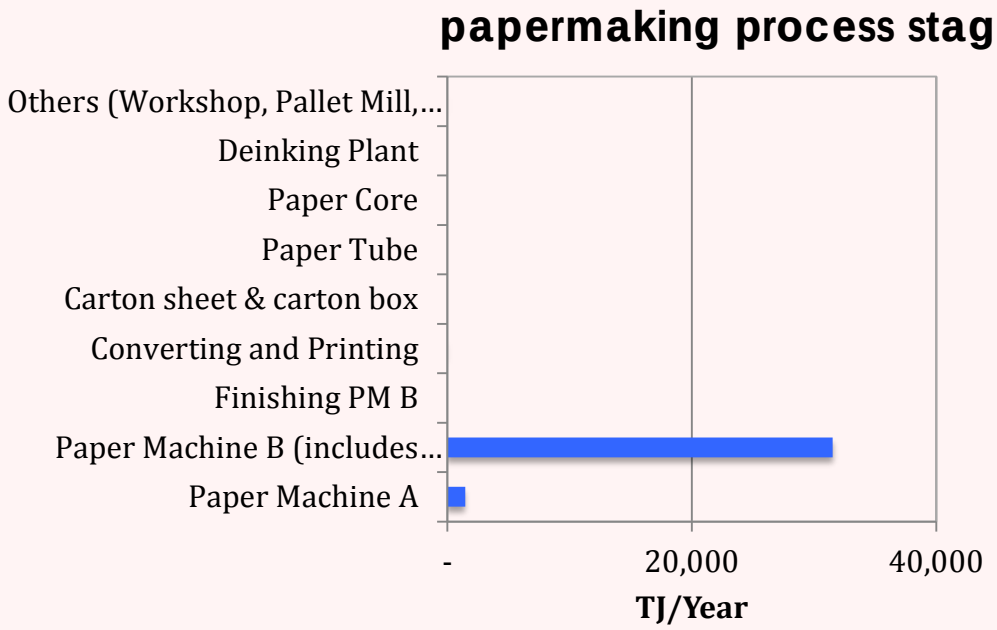
- Background: Where are we now?
- Where do we want to go?
- How do we get there: Challenges for Industry Sector in Indonesia
- The Needs for Monitoring the Achievement of GHG Emission Reduction from Mitigation Actions Implemented to Meet the Target of Indonesia Commitment on Climate Change: An Effective MRV System for Industrial Sector in Indonesia

ENERGY CONSUMPTION PROFILE

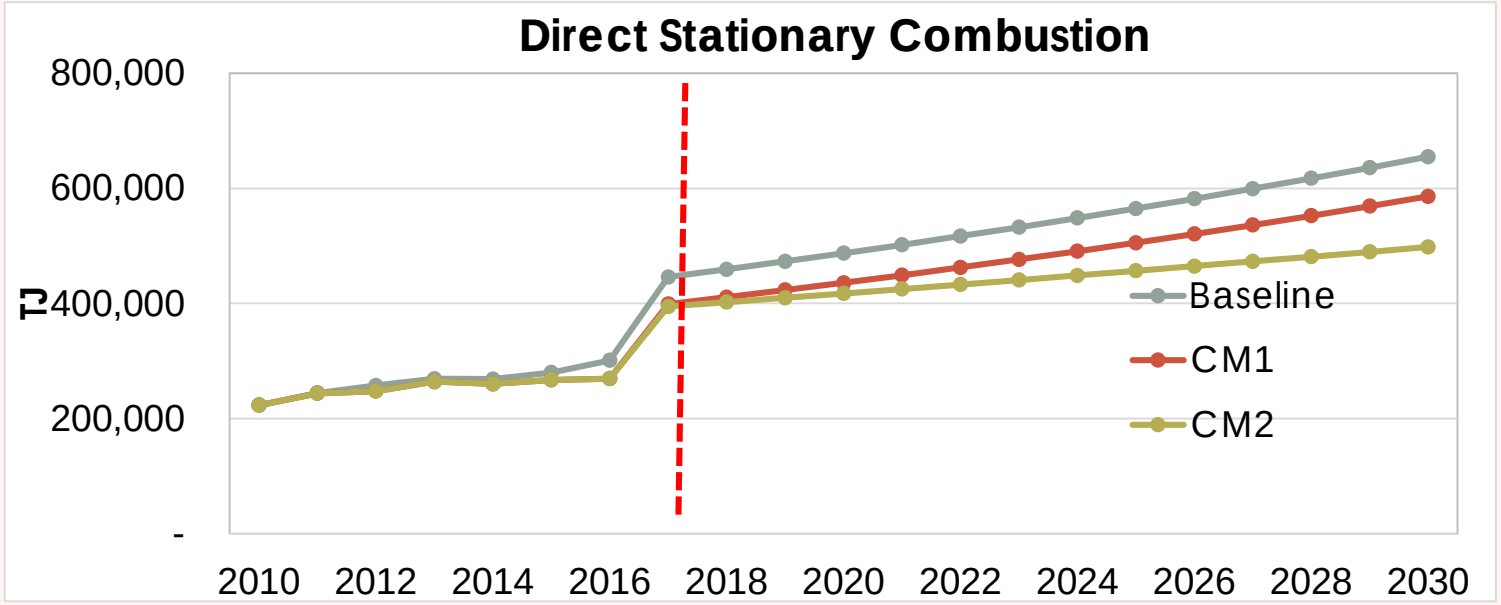


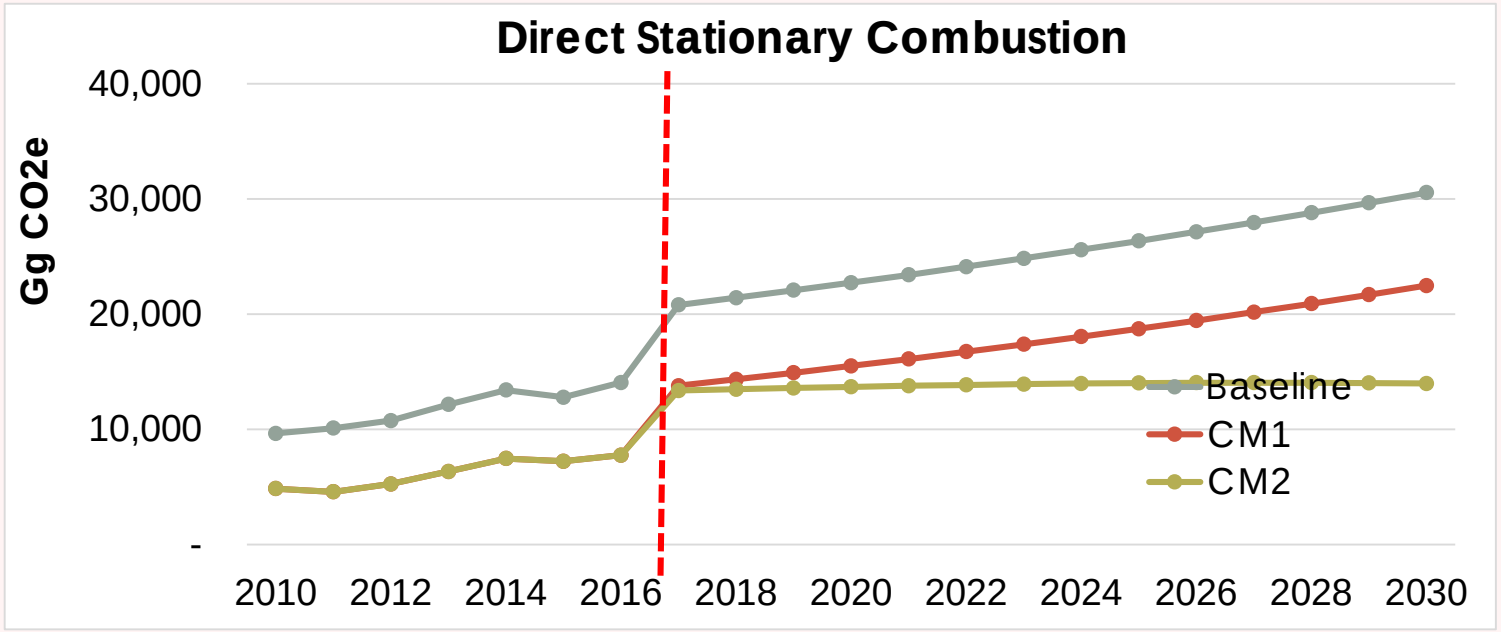




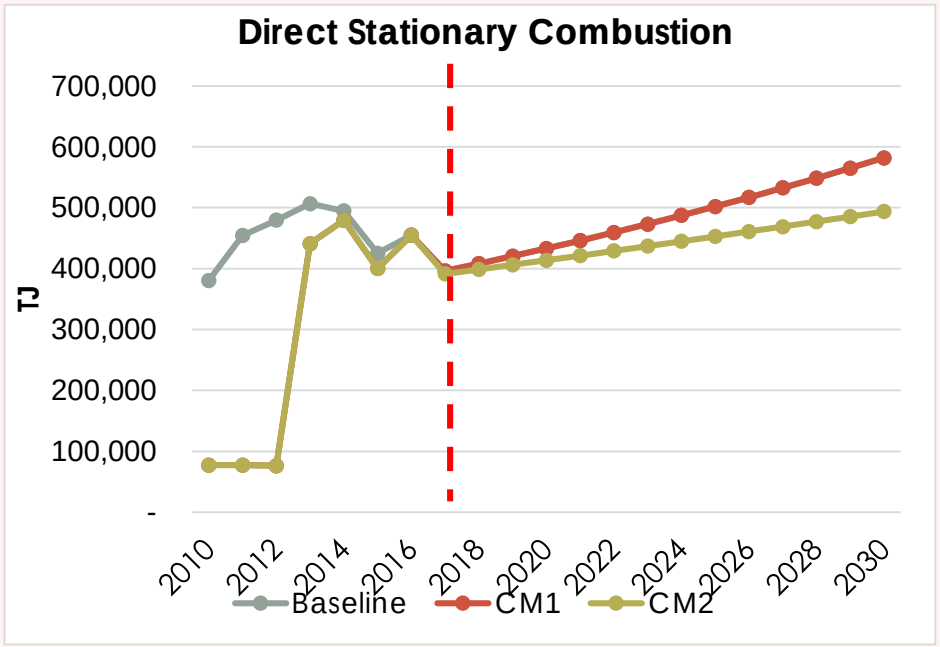


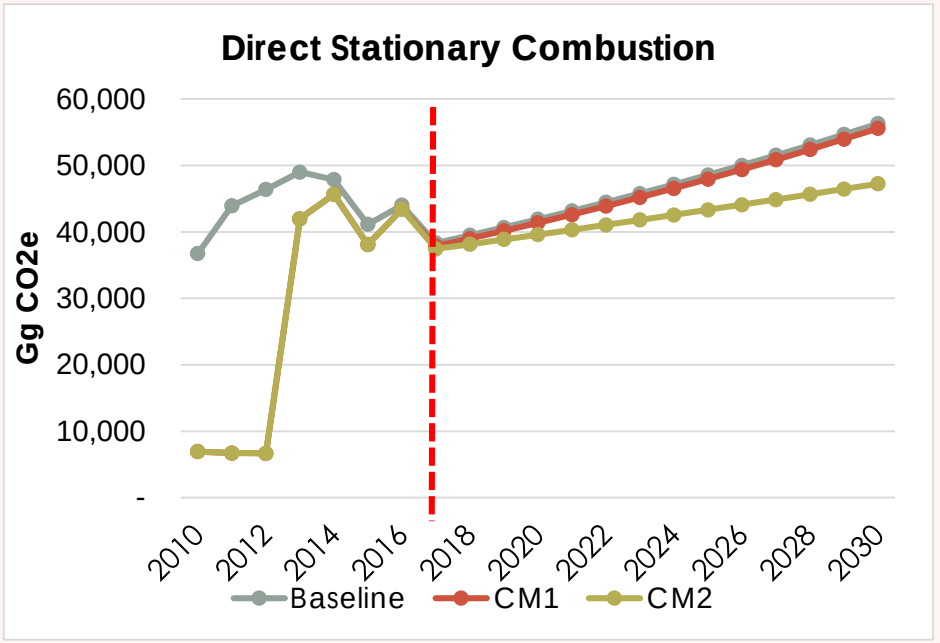
Integrated Pulp and Papermaking

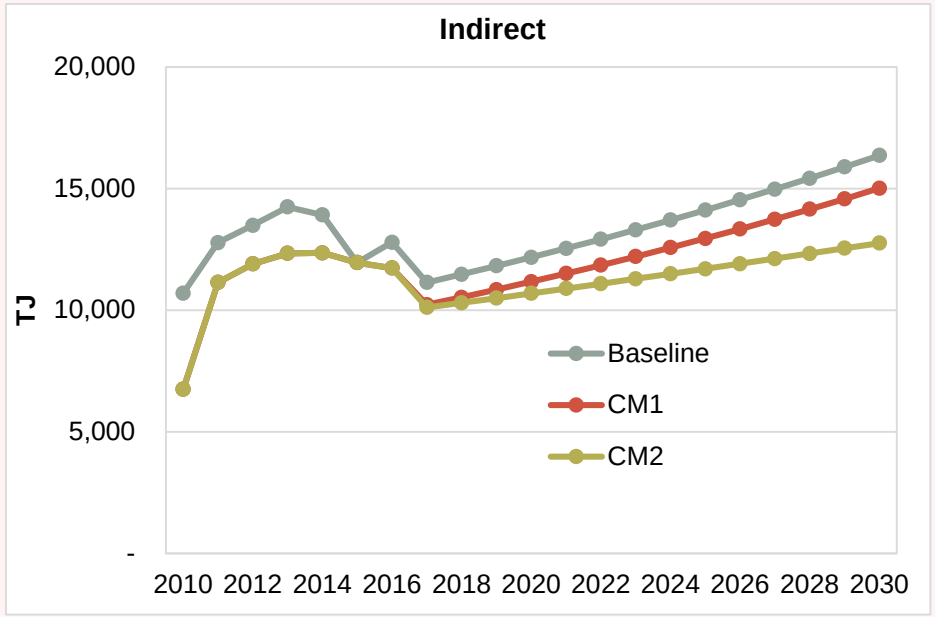


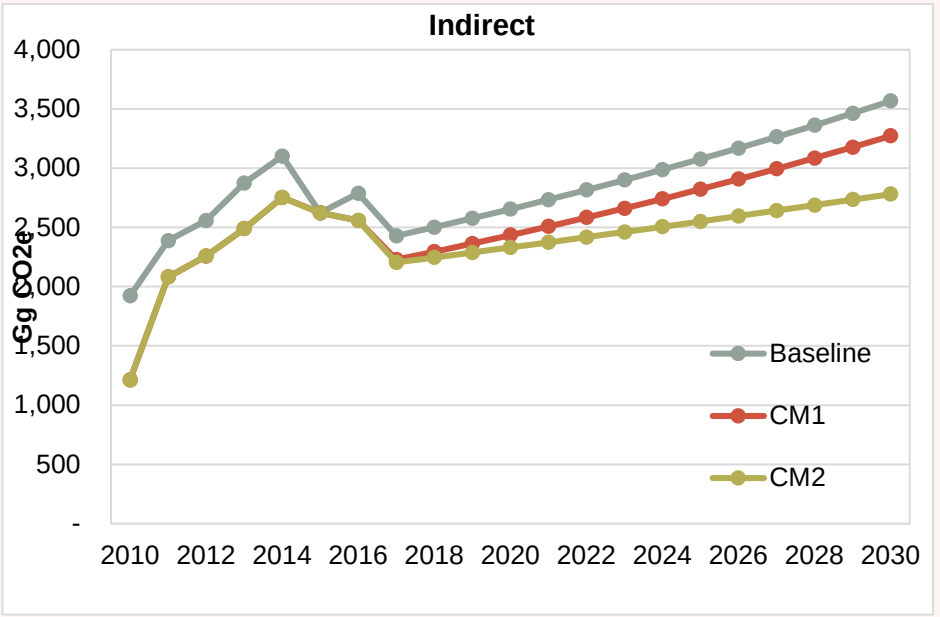


Papermaking Industry



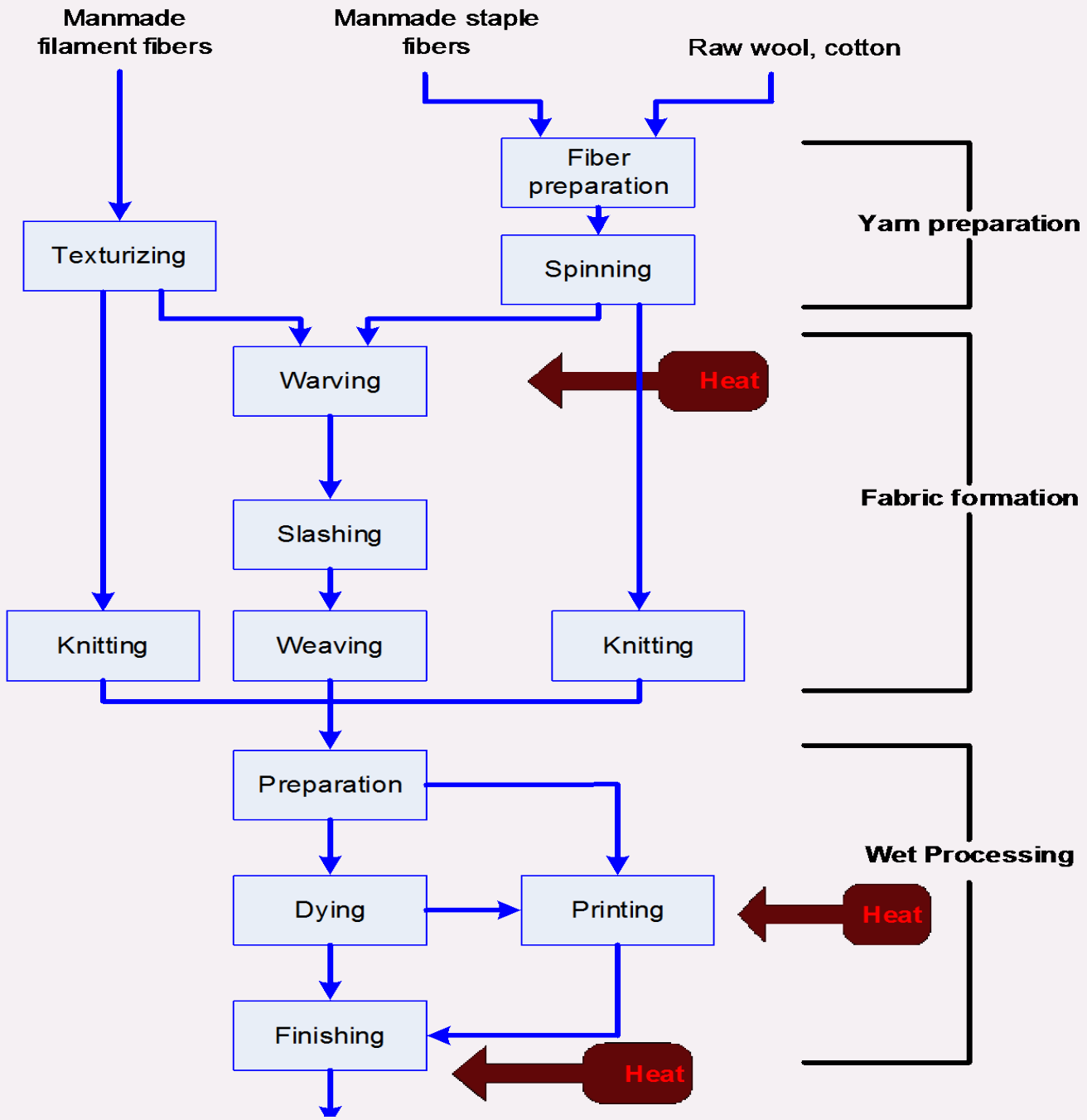






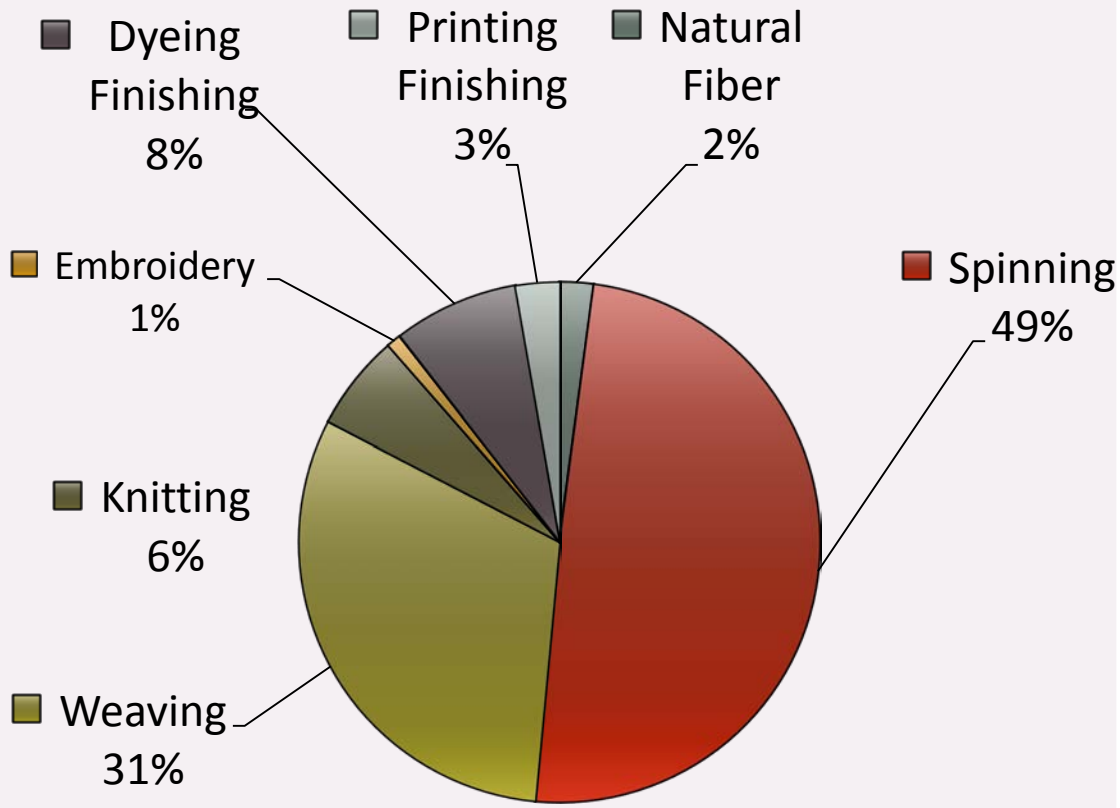
Energy saving and associated GHG emission reduction from mitigation actions for EE and RE

	2015	2017	2020	2025	2030
Energy Efficiency, TJ/Tonne product					
Integrated Pulp & Papermaking Industry					
Direct Stationary Fuel Combustion					
CM1	0.0016	0.0036	0.0036	0.0036	0.0036
CM2	-	-	0.0050	0.0066	0.0083
Papermaking Industry					
Fossil/Non-Fossil Fuels for Stationary					
CM1	0.003	-	-	-	-
CM2	-	-	0.002	0.005	0.008
Electricity Consumption					
CM1	-	0.0001	0.0002	0.0003	0.0003
CM2			0.0015	0.0015	0.0015
GHG Emission Reduction, KTon CO_2e					
Integrated Pulp & Papermaking and Pulp Industry					
Direct Emissions (Stationary Combustion)					
CM1	5,553	7,027	7,233	7,621	8,070
CM2	-	-	9,042	12,338	16,577
Papermaking Industry					
Direct Emissions (Stationary Fuel Combustion)					
CM1	3,046	489	534	619	718
CM2	-	-	2,307	5,243	9,056
Indirect Emission (3rd Party's Electricity Use)					
CM1	-	200	219	254	294
CM2			323	526	785
Sub-Total	3,046	689	3,383	6,642	10,854
Total Reduction (Energy Category), KTon CO2-e	**8,600**	**7,716**	**19,658**	**26,601**	**35,500**

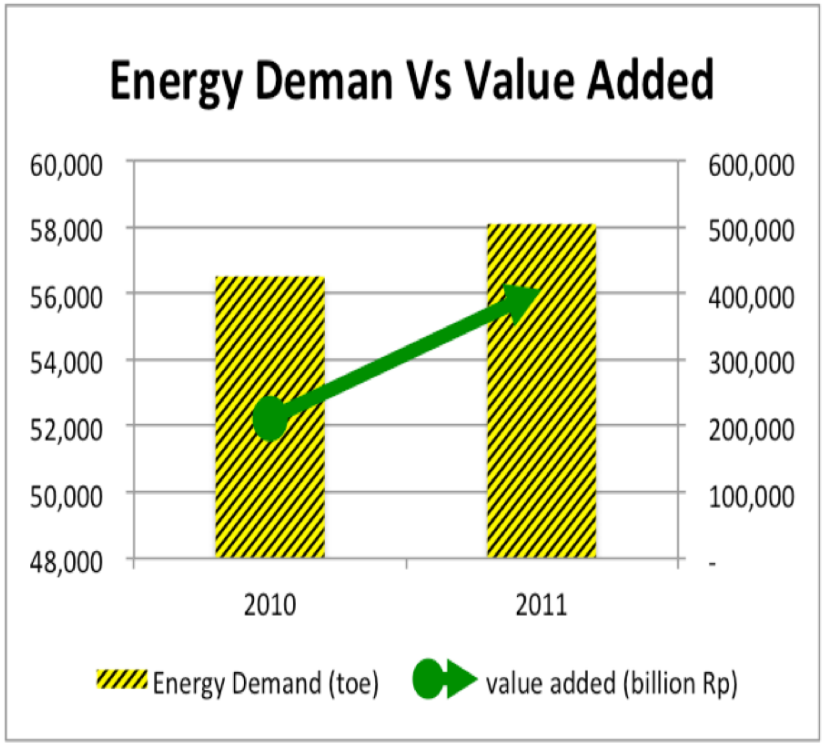


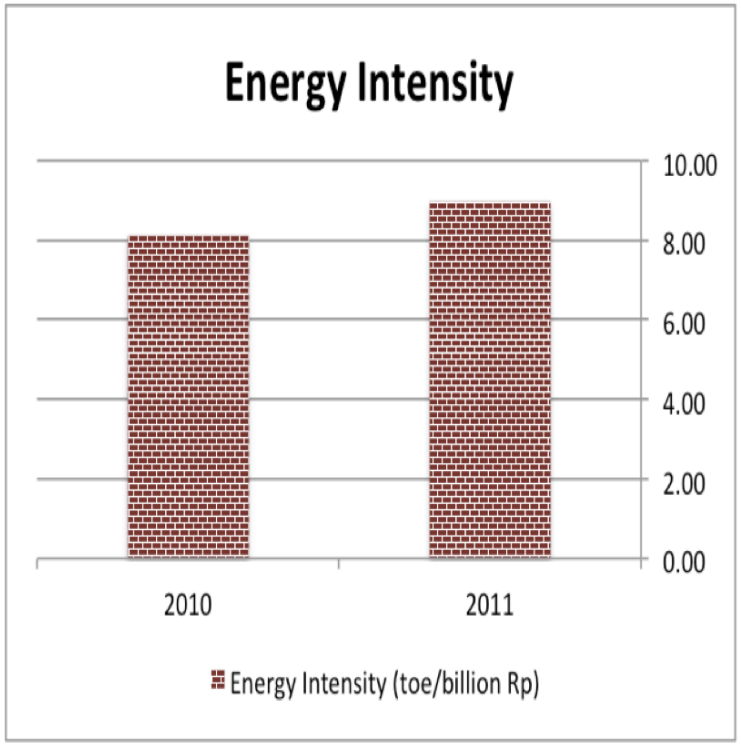
Textile Industry Categories

Activity Characteristic	Number of Companies
Natural Fiber	7
Spinning	165
Weaving	104
Knitting	20
Embroidery	3
Dyeing Finishing	26
Printing Finishing	9



Energy Intensity





As comparison:

Energy intensity of Vietnam Textile Industry

2011: 0.773 TOE/ton product

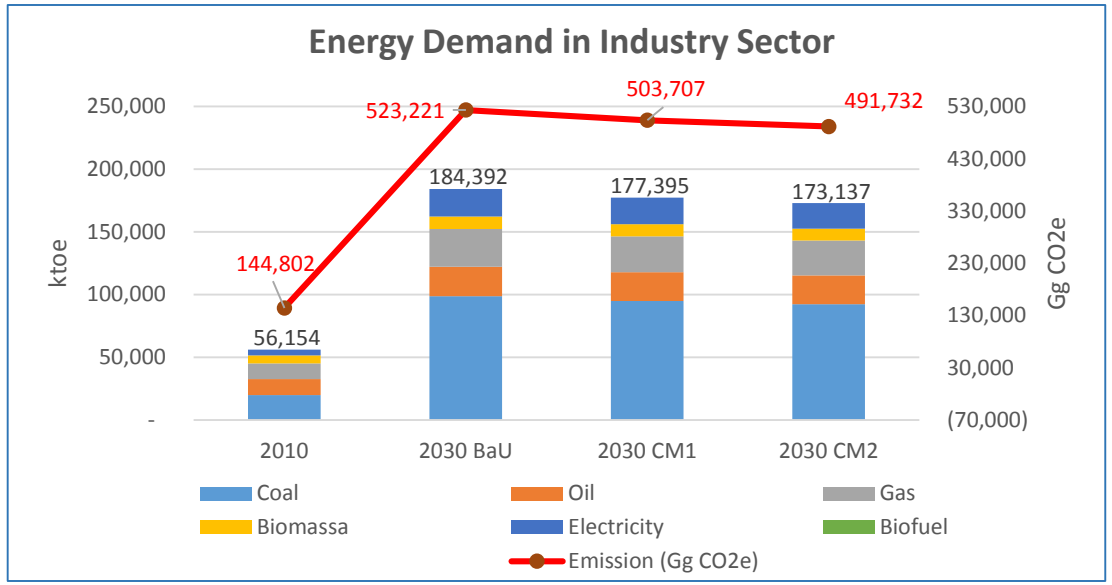
2015: 0.695 TOE/ton product

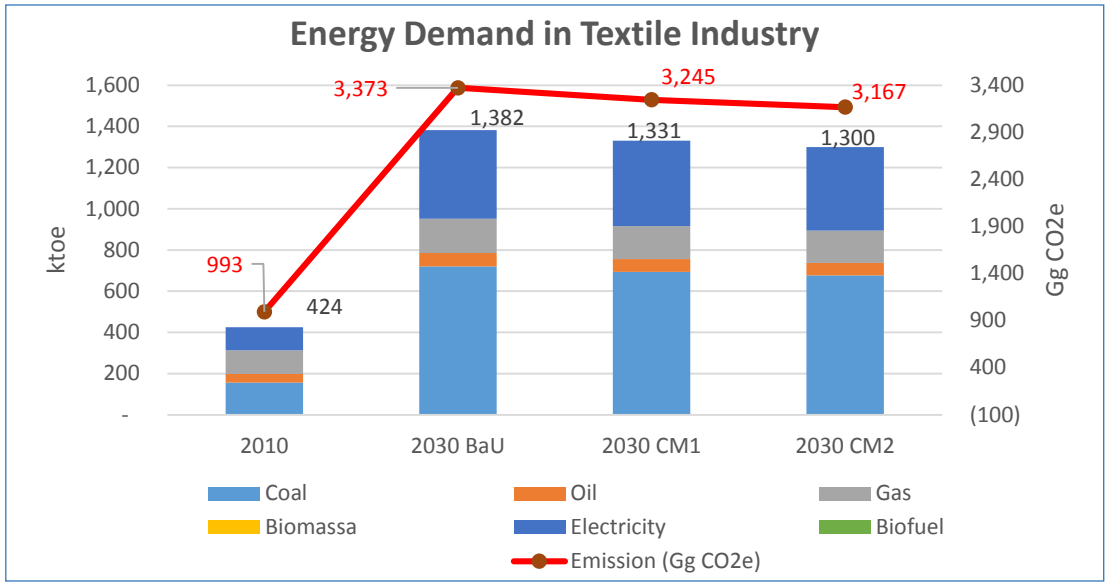
Savings: 10%

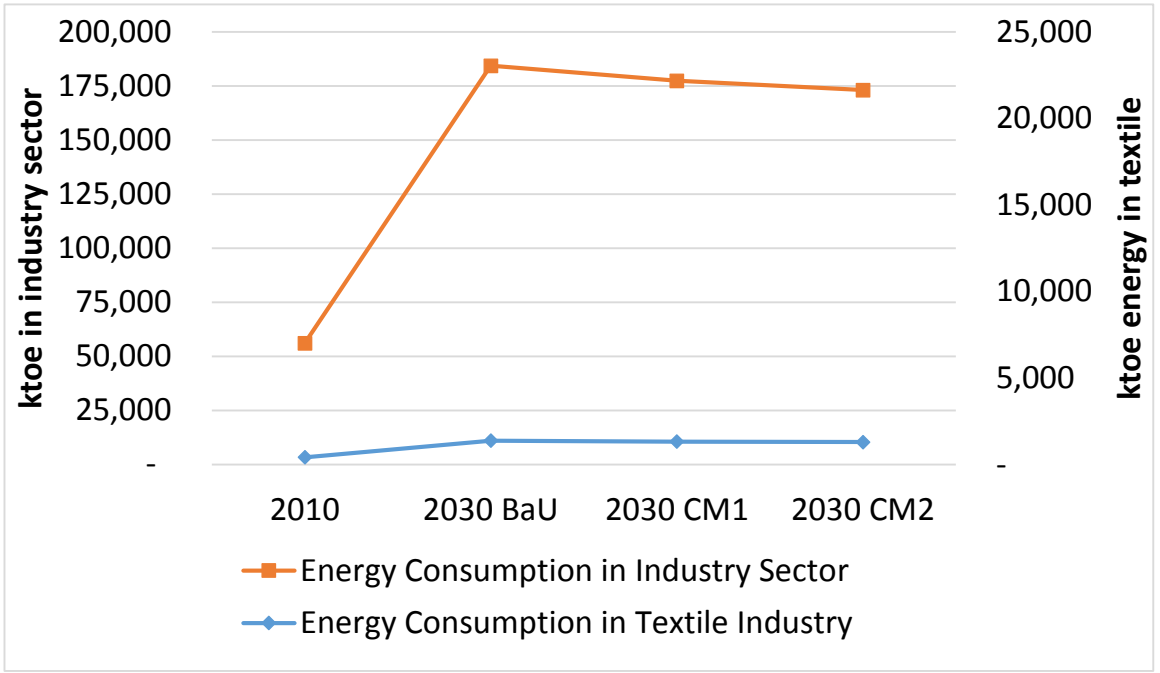
Spinning specific energy consumption in other country (kwh/kg)

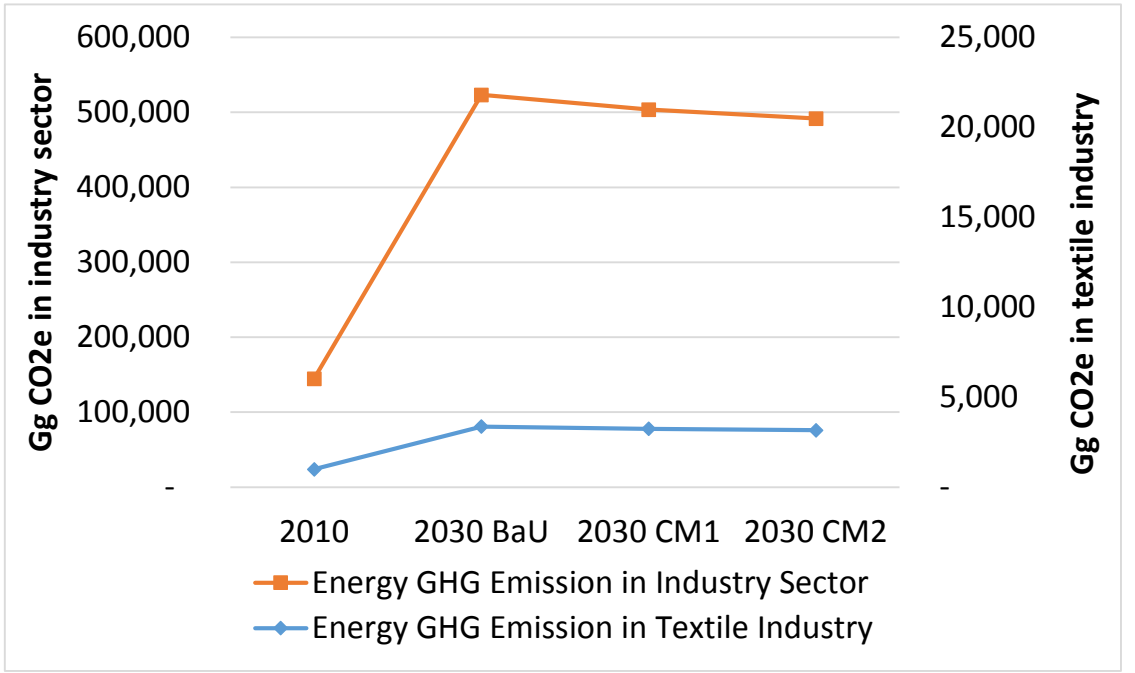
	PT Unitex	Brazil	China	India	Italy	Korea	Turkey
Energy Intensity, kWh/kg	n.a	2.28	2.58	2.5	2.57	2.55	2.44

Energy Demand in 2010 dan 2030

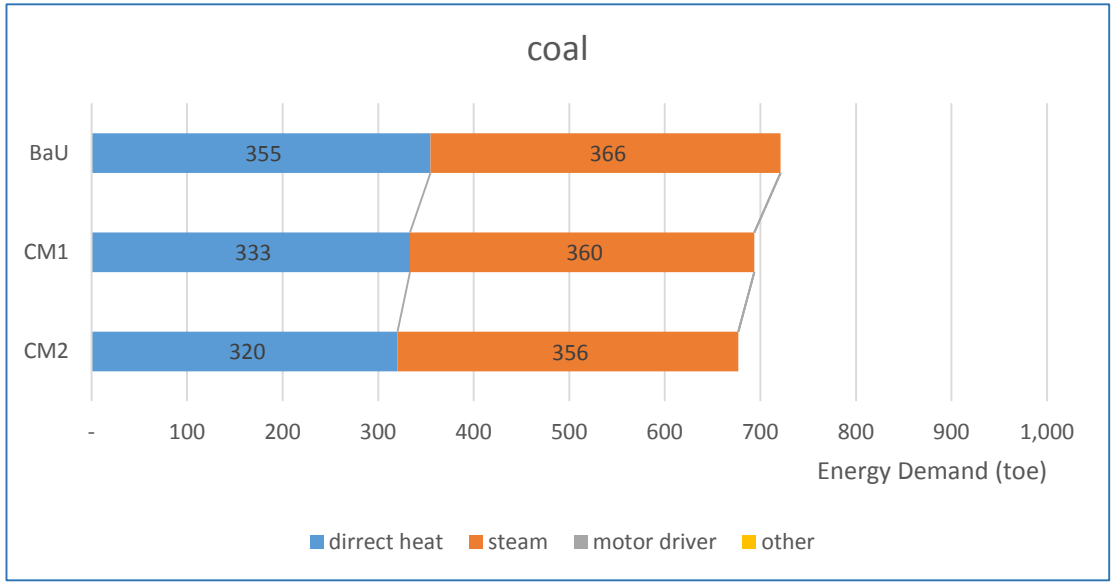


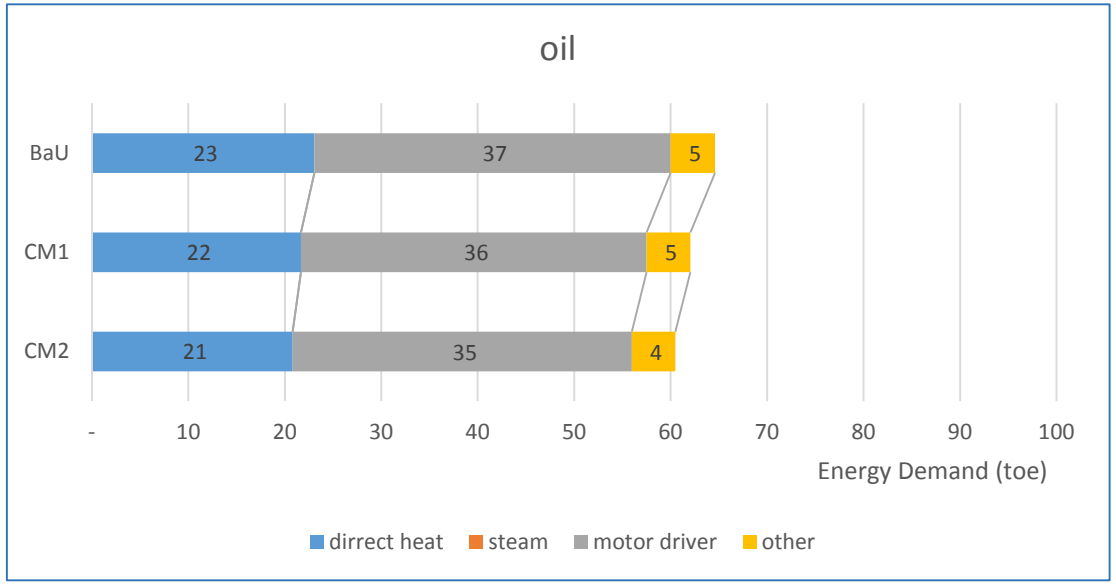


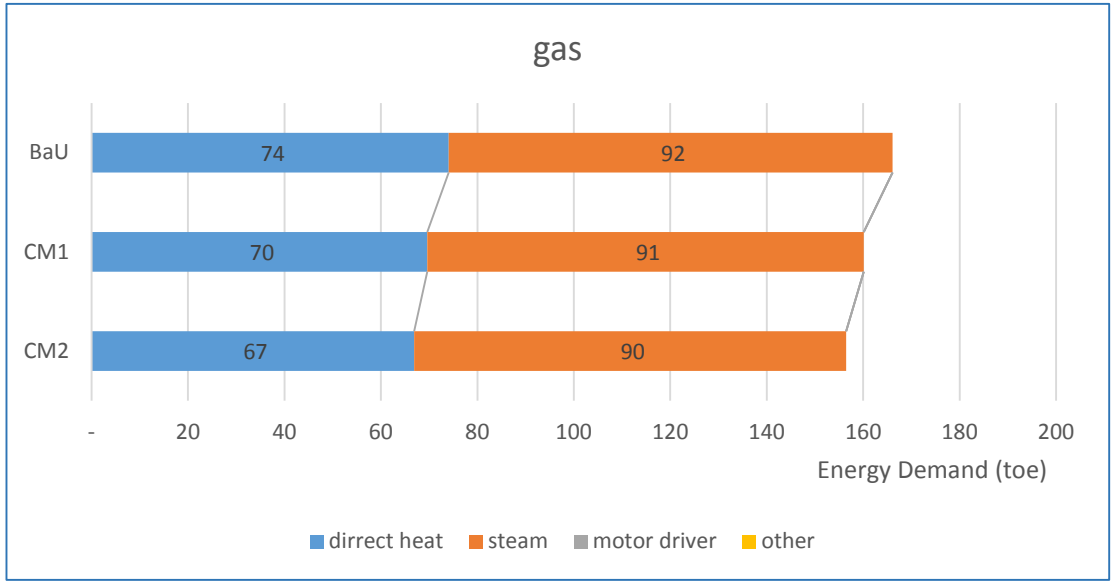


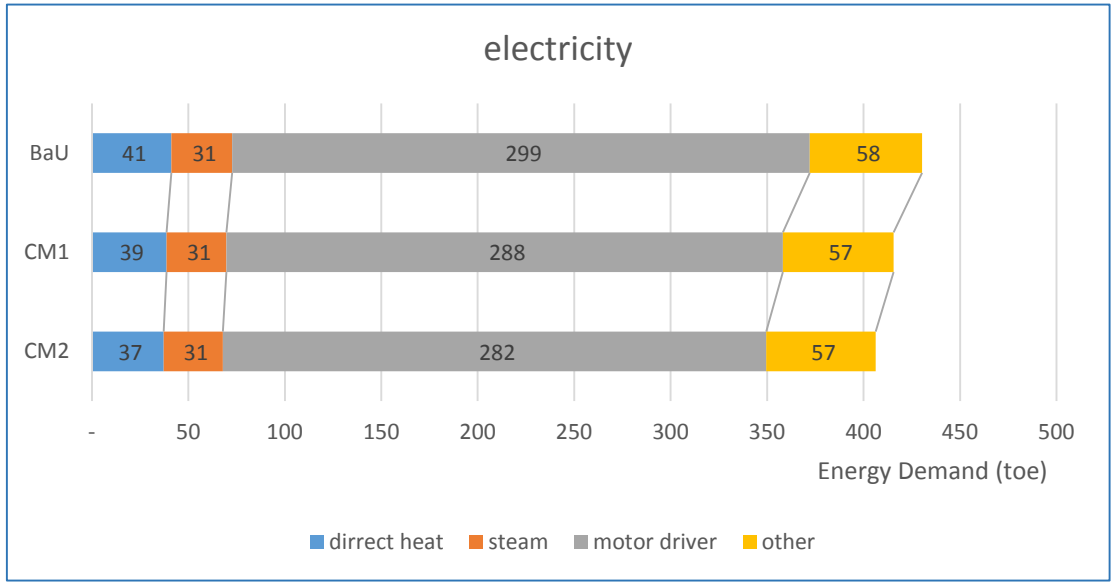


Projection of Energy Demand by Fuel in Textile Industry (2030)

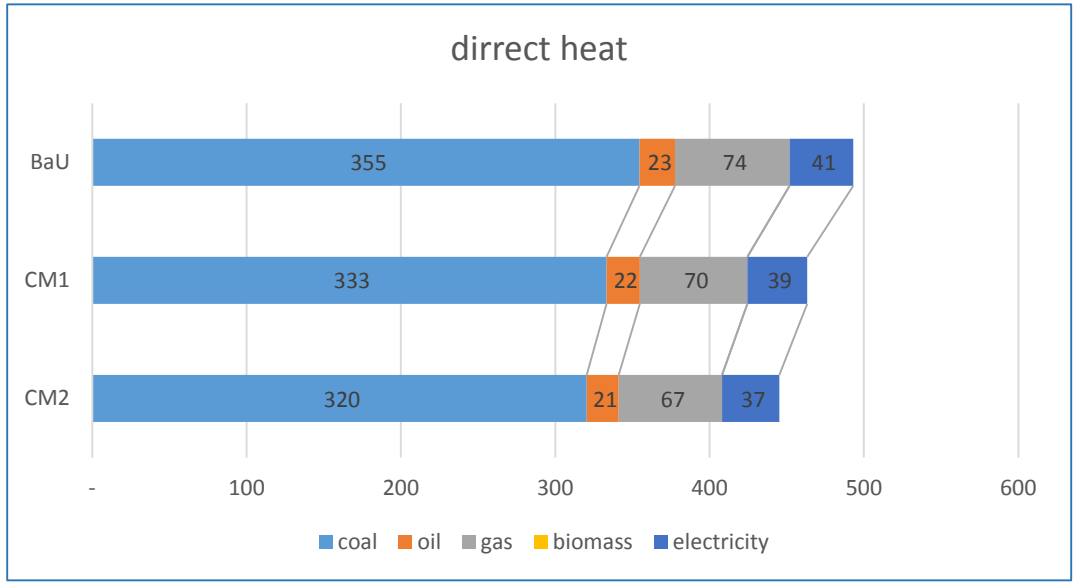


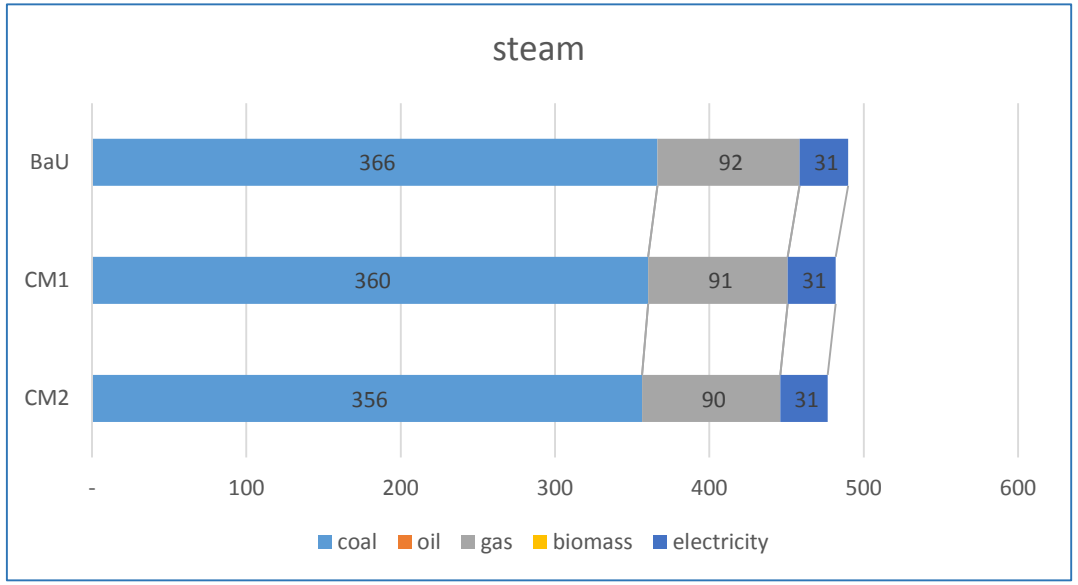


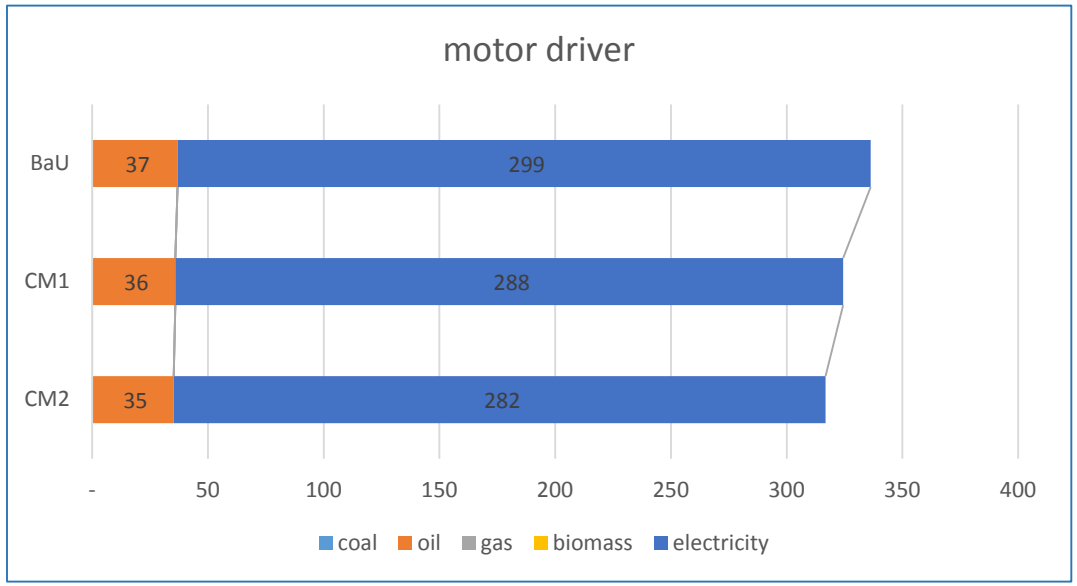


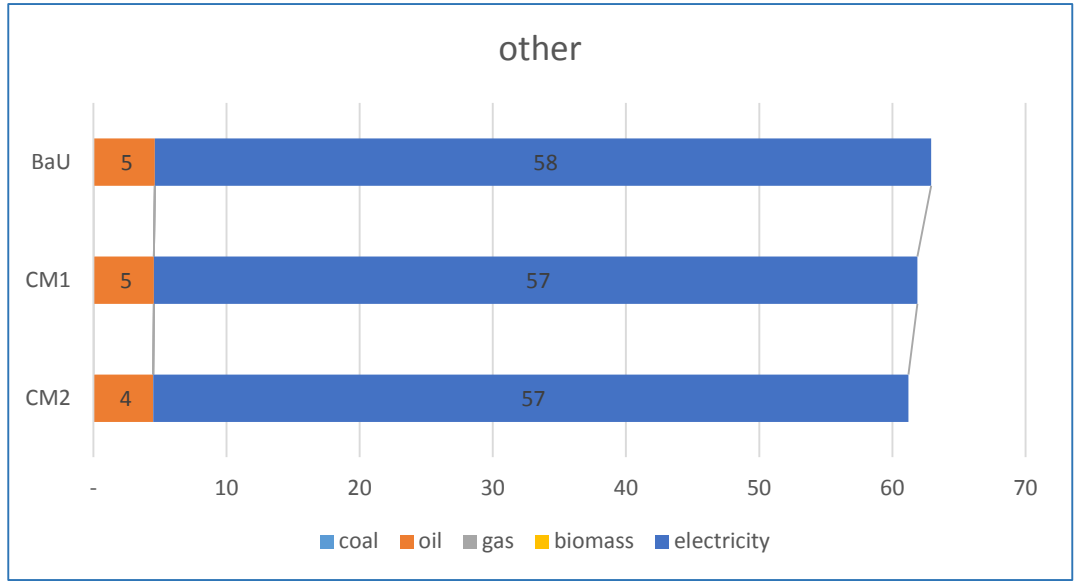


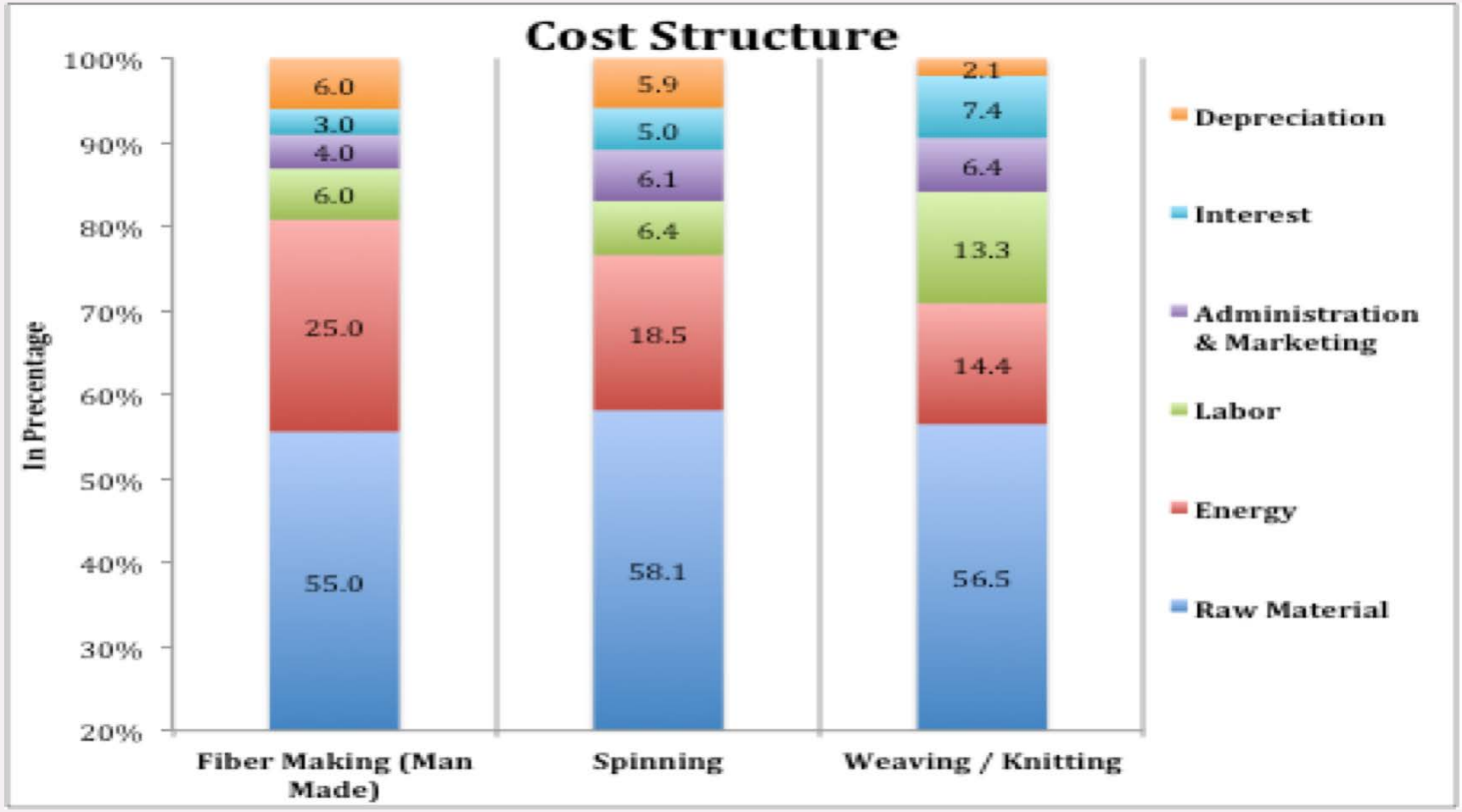
Projection of Energy Demand by Device in Textile Industry (2030)











Energy consumption account for 14 – 25% of total operation cost

Table 1. Share of Manufacturing Cost Factors for 20 Tex Combed Cotton Yarn in Several Countries in 2003 (Koç and Kaplan, 2007)

Cost factors	Brazil	China	India	Italy	Korea	Turkey	USA
Raw material	50%	61%	51%	40%	53%	49%	44%
Waste	7%	11%	7%	6%	8%	8%	6%
Labor	2%	2%	2%	24%	8%	4%	19%
Energy	5%	8%	12%	10%	6%	9%	6%
Auxiliary material	4%	4%	5%	3%	4%	4%	4%
Capital	32%	14%	23%	17%	21%	26%	21%
Total	100%	100%	100%	100%	100%	100%	100%

Concluding and Remarks

- There are still rooms for improvement in energy efficiency in industry sector, particularly the 8 intensive energy industries. Although GoI implements regulation for energy management and manager, however monitoring system is not proper developed.
- Since this type of industries have large contribution into the national GDP and export, these industries have to meet competitive markets in international, therefore supporting these type of industries to increase their energy efficiency at least to achieve energy intensity as similar industries of other countries will also reduce the cost of production. It should be noted, the energy cost in Indonesian textile industries accounts for 15-25% of total production cost since the cost of similar industries of other countries only account for 5% of total production cost.
- Measuring energy consumption in textile industries will provide information energy efficiency potential and the associated GHG emission reduction potential from the implementing of efficiency activities. By replicating these activities in the same industrial cluster or other industrial clusters (pulp and paper, cement, glass and ceramics, iron and steel making, etc.).
- GHG Emissions from Power sector has to be assessed/modeled to see the contribution of indirect emission reduction into the national target

Thank You

gelang@che.itb.ac.id

gelangdewi@gmail.com