

Center for Research on Energy Policy
INSTITUT TEKNOLOGI BANDUNG



Energy Efficiency Monitoring in Textile Industries for Achieving GHG Emission Reduction Target in Indonesia

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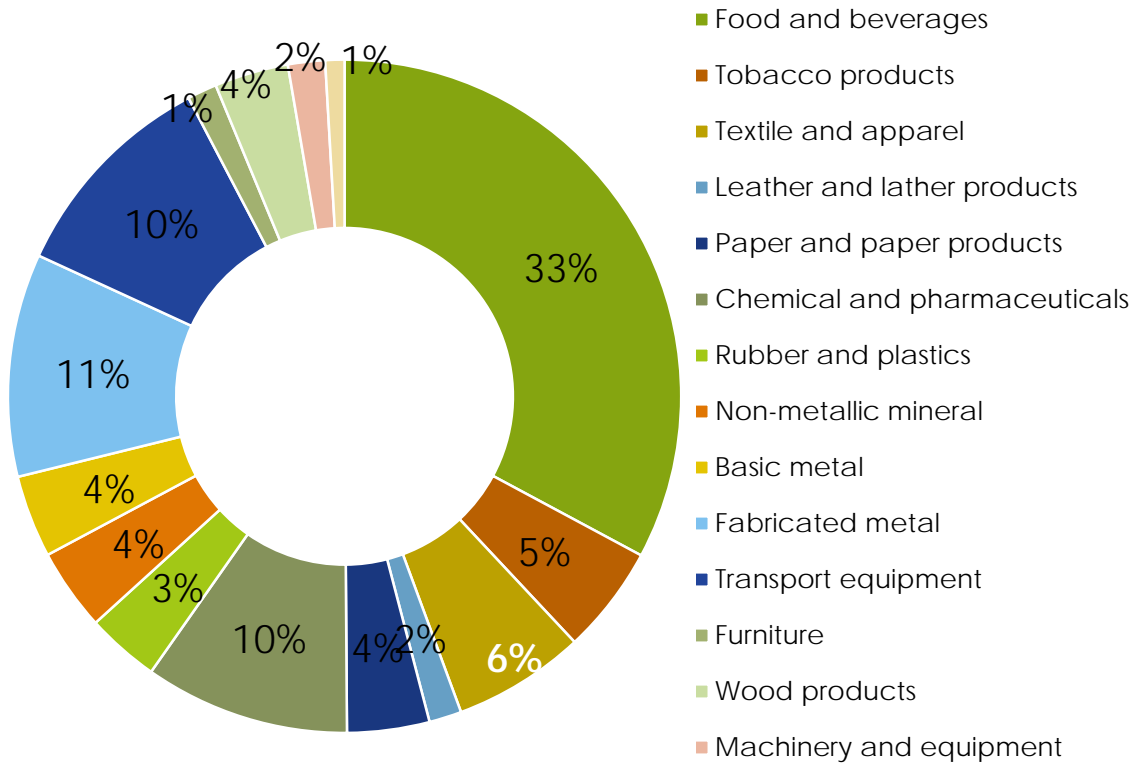
OUTLINE

- Why textile industry is important
- Energy efficiency potential in textile industry
- GHG emissions from energy use in industry
- Modeling to estimate GHG emissions reduction potential from energy efficiency in textile industry

WHY Textile Industry is important

The roles of textile industry in Indonesian economic

Economic: contribution of textile industry



GDP contribution of major industry (non Oil&Gas), 2016
Textile 6%

Source: Mol 2017

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

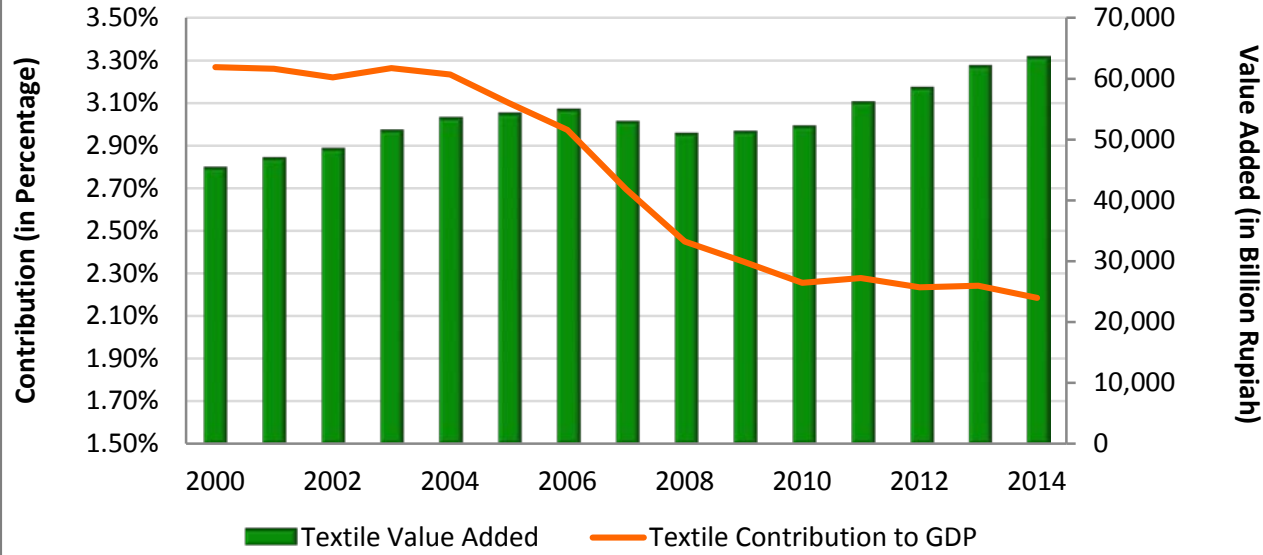
Source: BPS and Mol

Company Type	Number of Companies
Yarn	22
Spinning	300
Sewing	1400

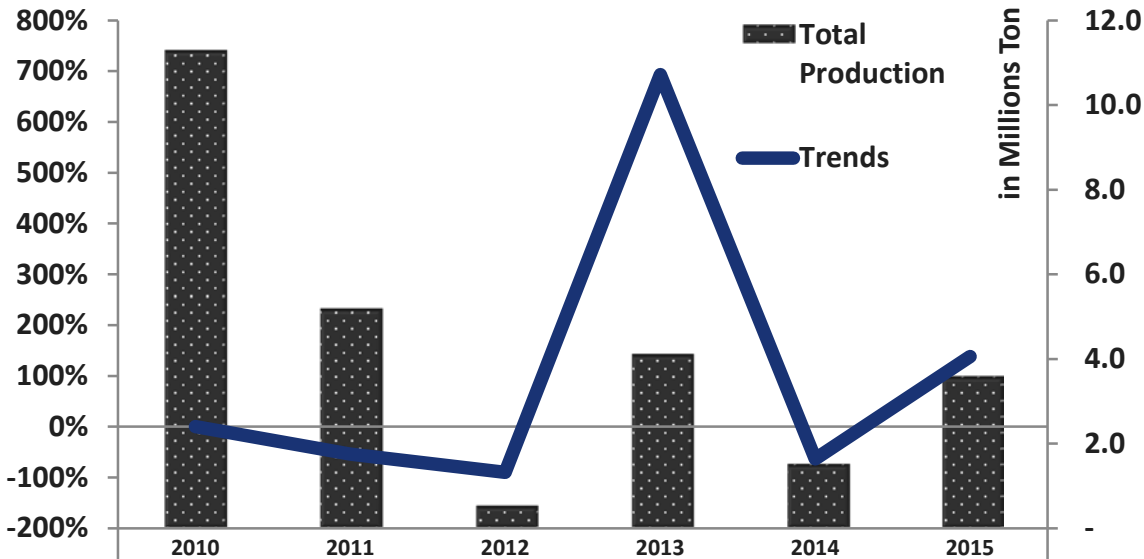
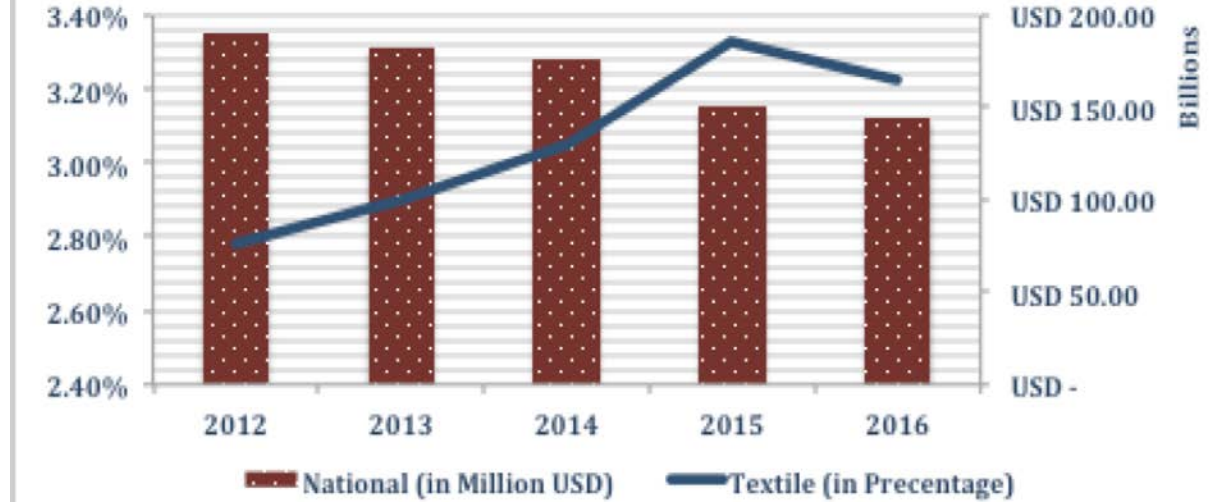
Source: Industry Association

- ✧ GDP: Textile is among top 5
- ✧ Number of factory: large
- ✧ Type of company: vary

Value Added & Contribution

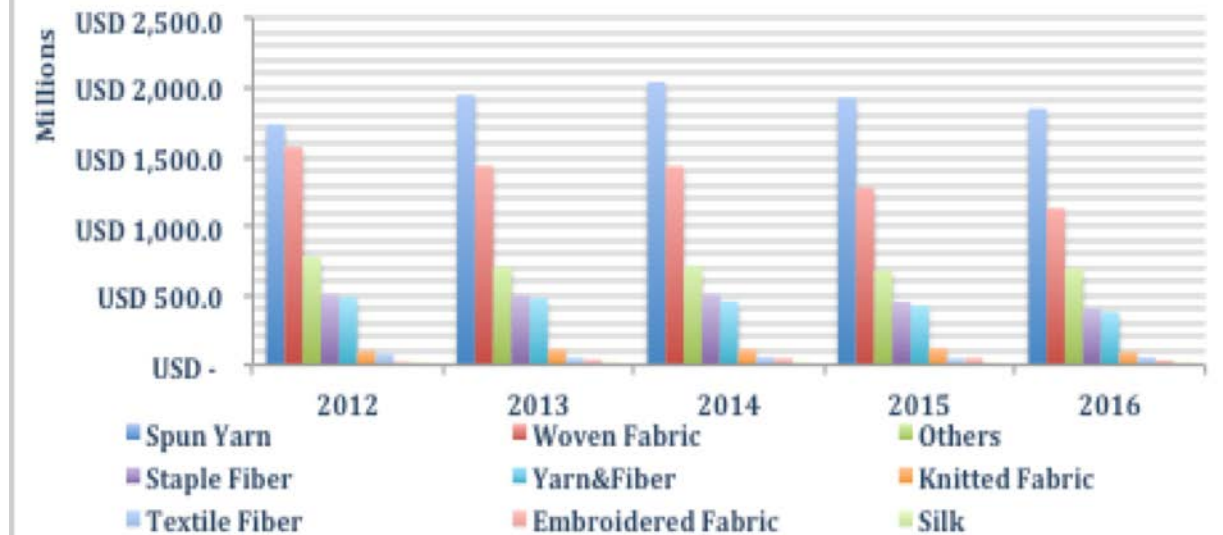


National & Textile Contribution (Export)



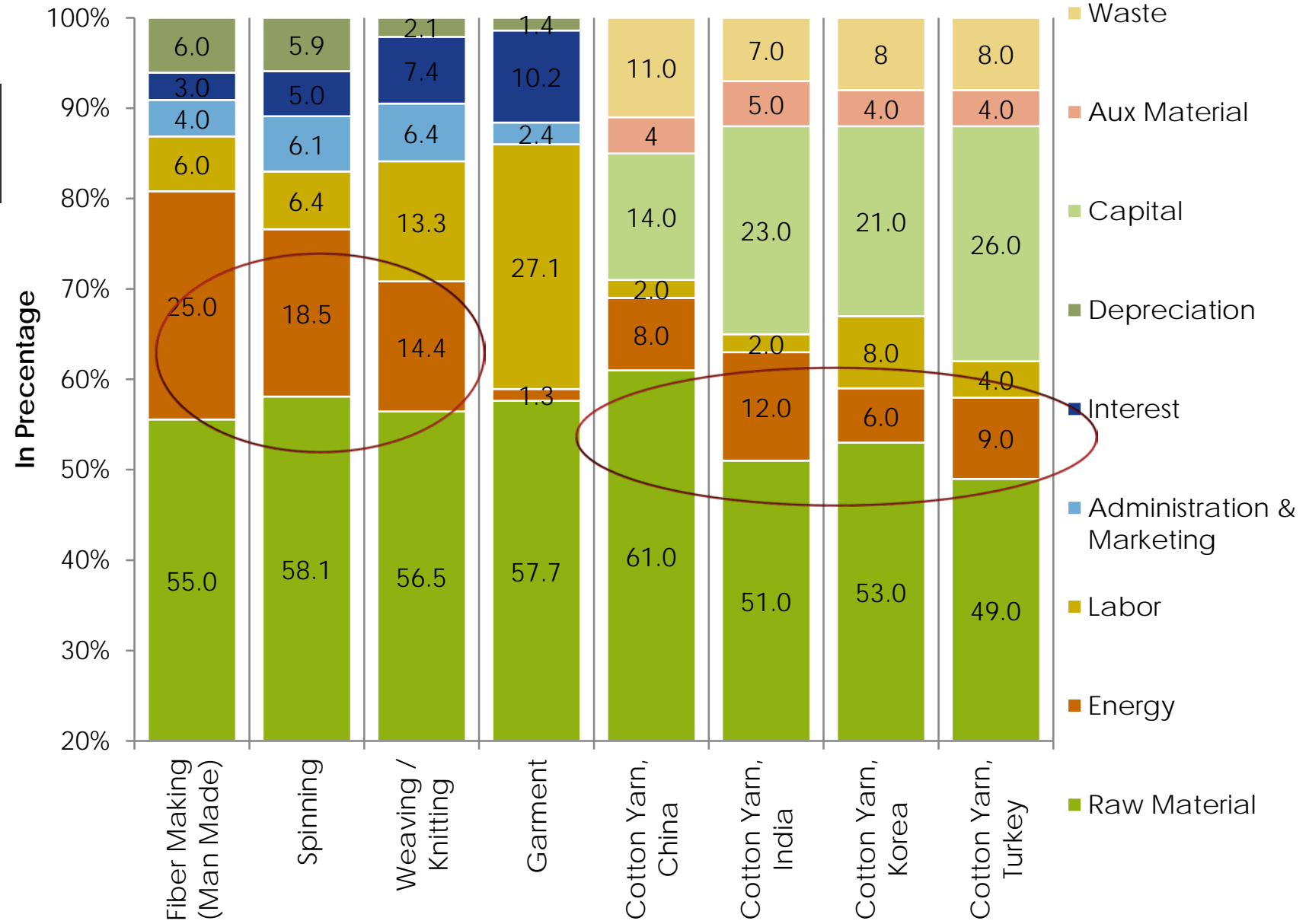
	2010	2011	2012	2013	2014	2015
Total Production	11,257,678.	5,185,613.8	518,551.71	4,114,540.6	1,507,514.5	3,589,744.6
Trends	0	-53.94%	-90.00%	693.47%	-63.36%	138.12%

Export Statistic (Sub-Sector)



ENERGY COST

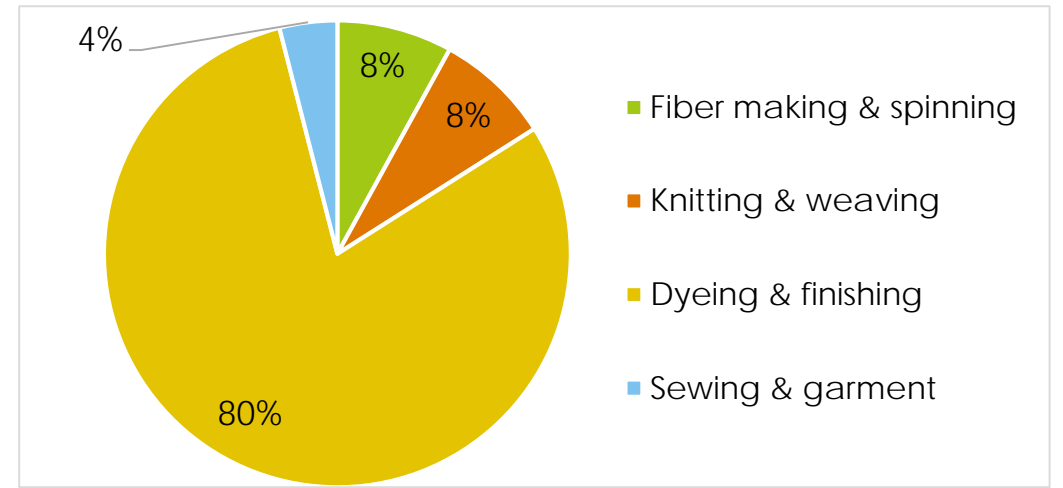
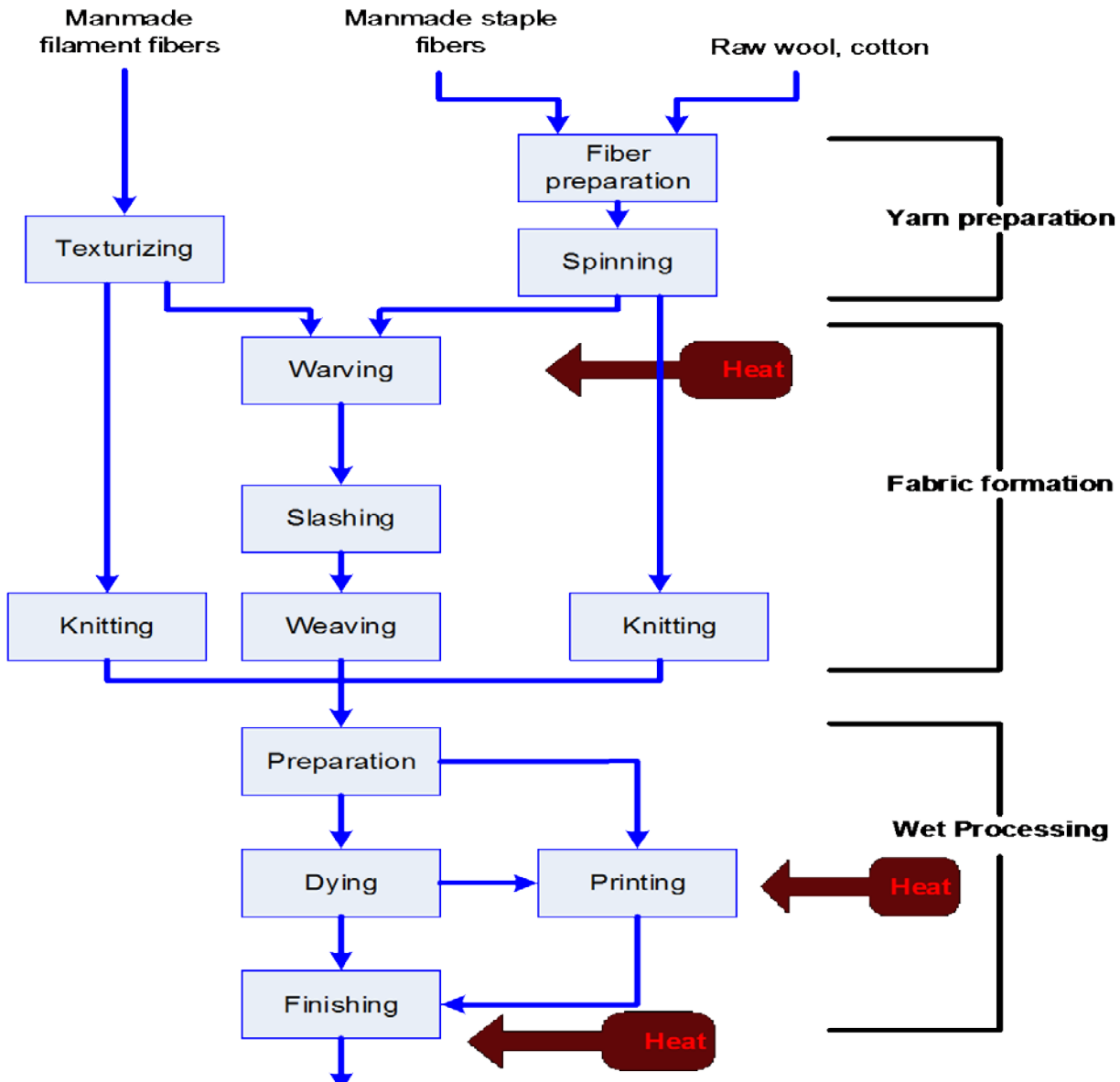
Cost Structure



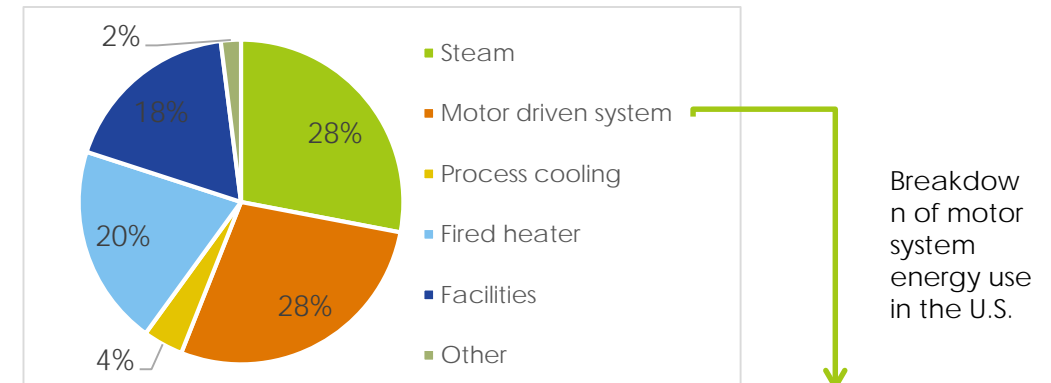
Energy Efficiency in Textile Industry

Energy Efficiency Potential in Textile Industry

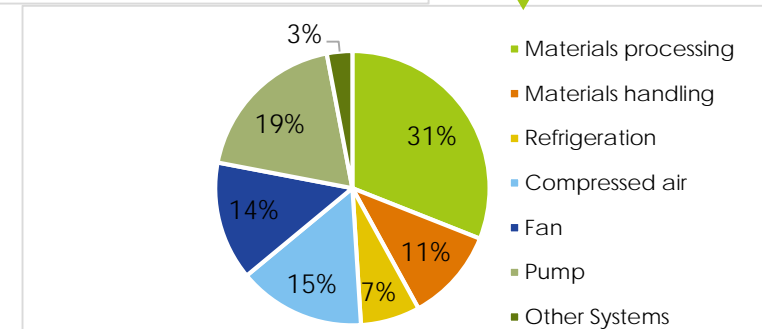
ENERGY USE

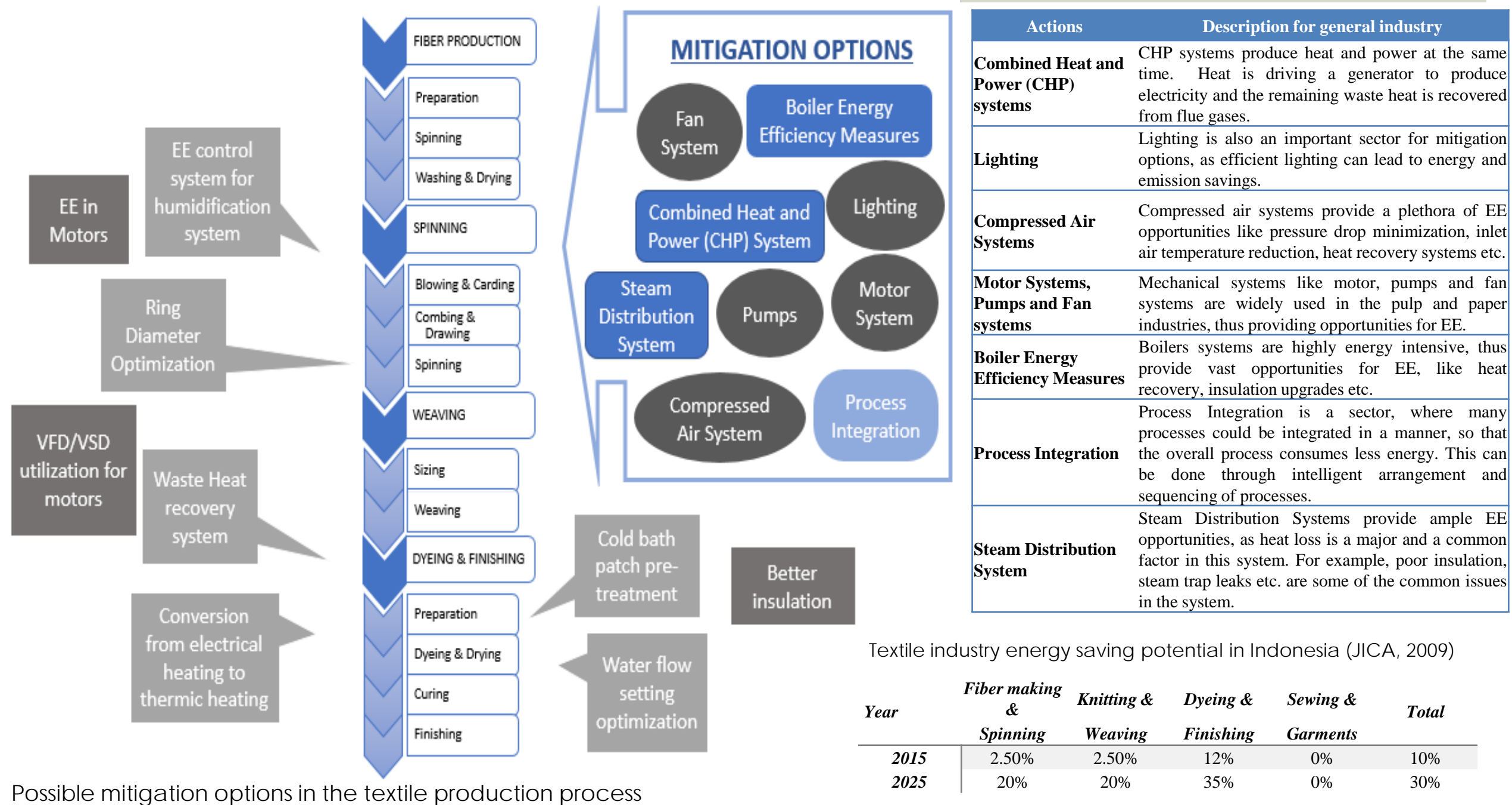


Energy use in textile industry by process (JICA, 2009)



Final energy end-use in the US textile industry (U.S DOE, 2004)





Actions	Description for general industry
Combined Heat and Power (CHP) systems	CHP systems produce heat and power at the same time. Heat is driving a generator to produce electricity and the remaining waste heat is recovered from flue gases.
Lighting	Lighting is also an important sector for mitigation options, as efficient lighting can lead to energy and emission savings.
Compressed Air Systems	Compressed air systems provide a plethora of EE opportunities like pressure drop minimization, inlet air temperature reduction, heat recovery systems etc.
Motor Systems, Pumps and Fan systems	Mechanical systems like motor, pumps and fan systems are widely used in the pulp and paper industries, thus providing opportunities for EE.
Boiler Energy Efficiency Measures	Boilers systems are highly energy intensive, thus provide vast opportunities for EE, like heat recovery, insulation upgrades etc.
Process Integration	Process Integration is a sector, where many processes could be integrated in a manner, so that the overall process consumes less energy. This can be done through intelligent arrangement and sequencing of processes.
Steam Distribution System	Steam Distribution Systems provide ample EE opportunities, as heat loss is a major and a common factor in this system. For example, poor insulation, steam trap leaks etc. are some of the common issues in the system.

Textile industry energy saving potential in Indonesia (JICA, 2009)

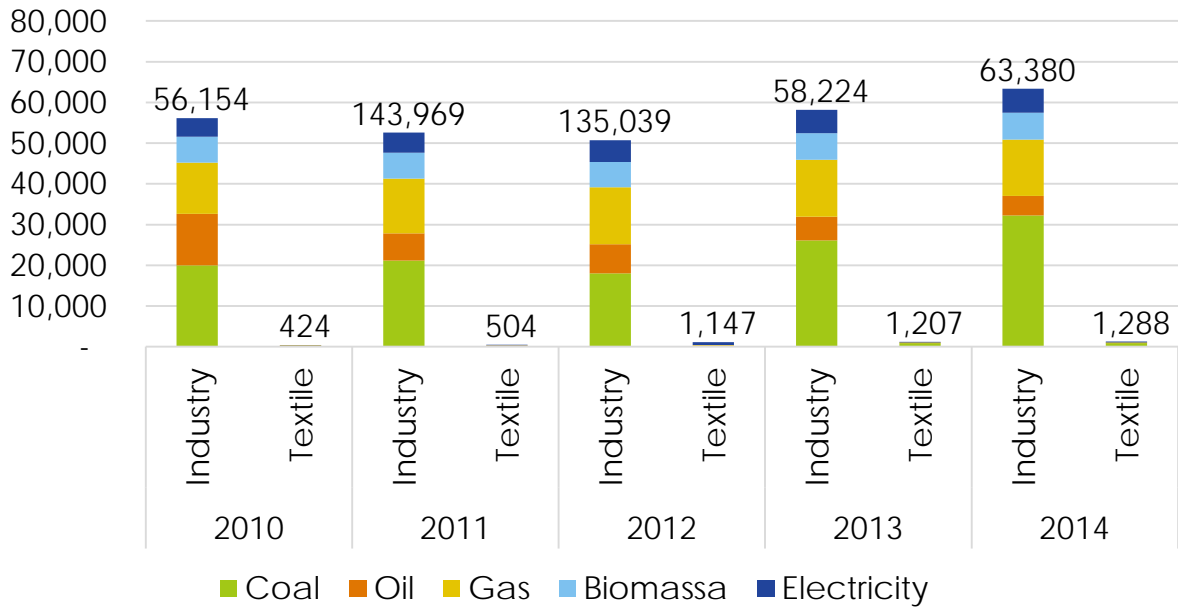
Year	Fiber making & Spinning	Knitting & Weaving	Dyeing & Finishing	Sewing & Garments	Total
2015	2.50%	2.50%	12%	0%	10%
2025	20%	20%	35%	0%	30%

Possible mitigation options in the textile production process

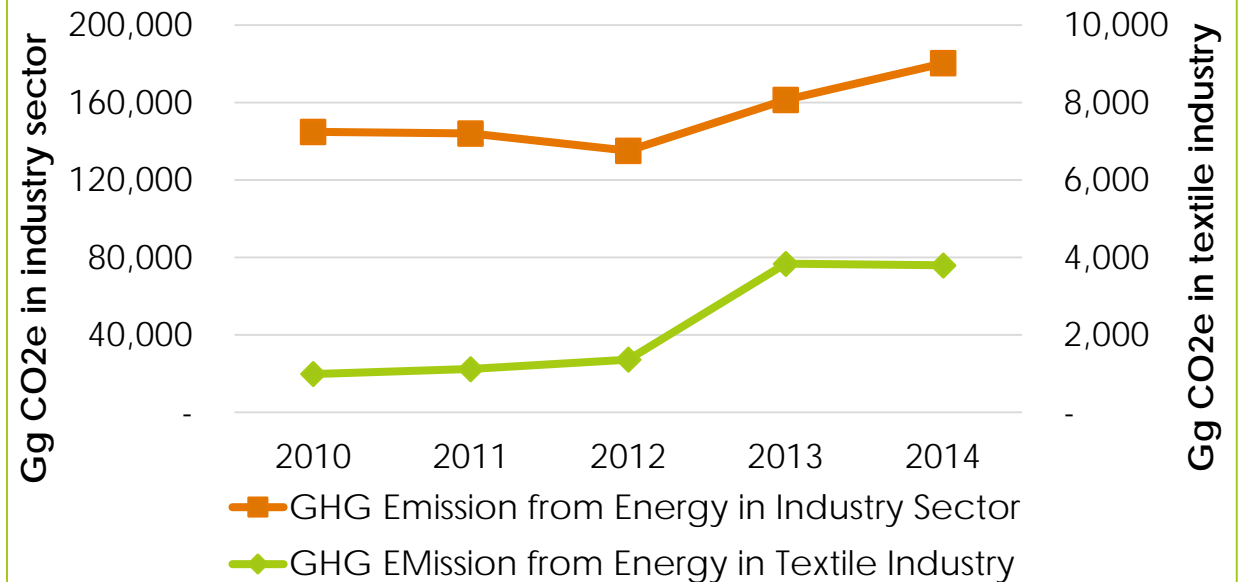
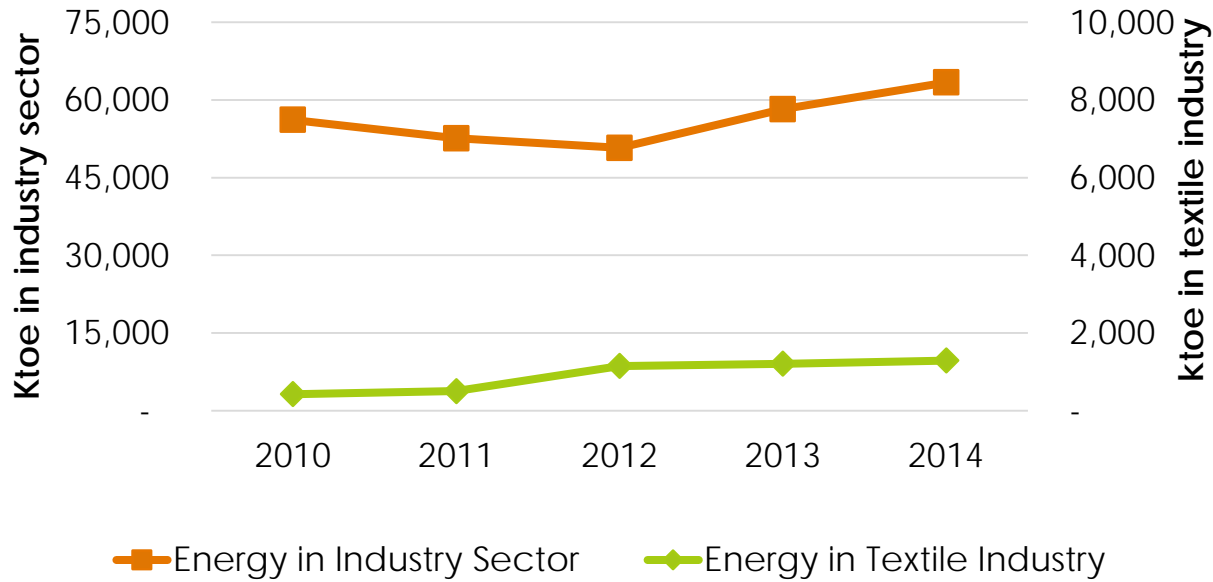
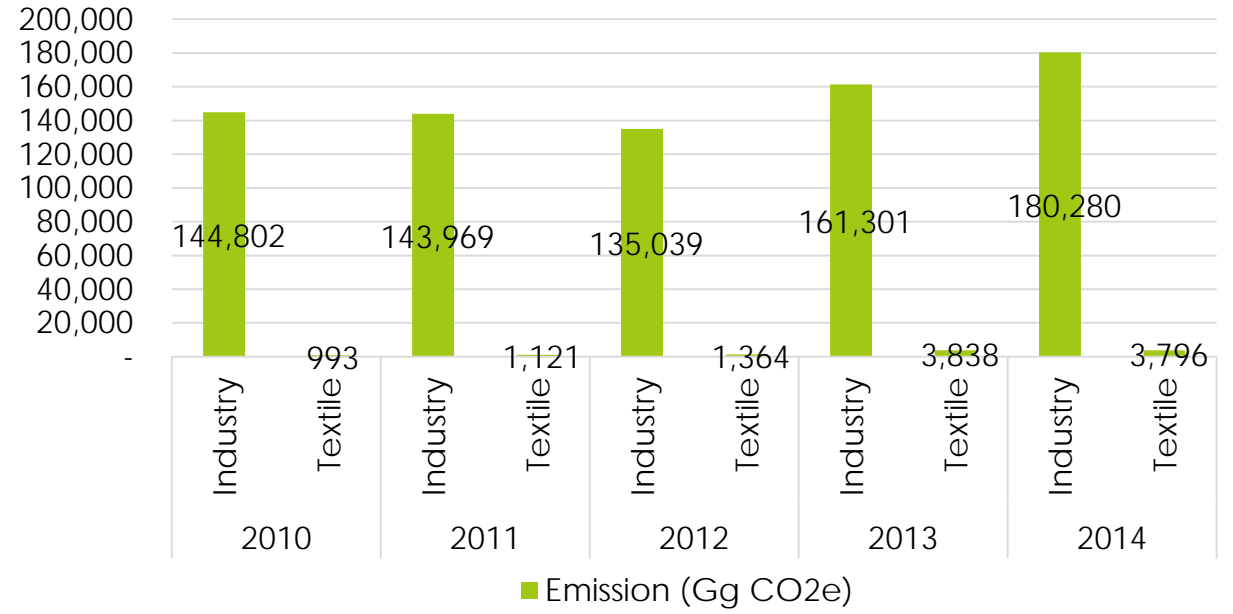
GHG Emissions from Energy Use in Industry

Contribution of textile industry

Energy Demand Textile vs Industry

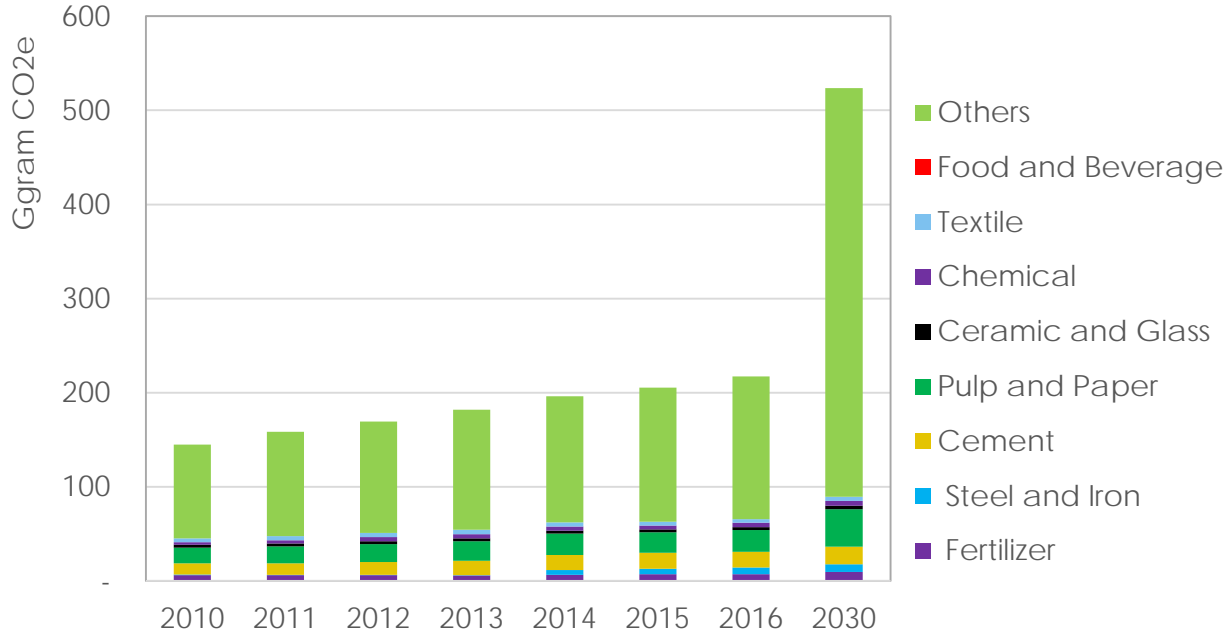


Emission Textile vs Industry

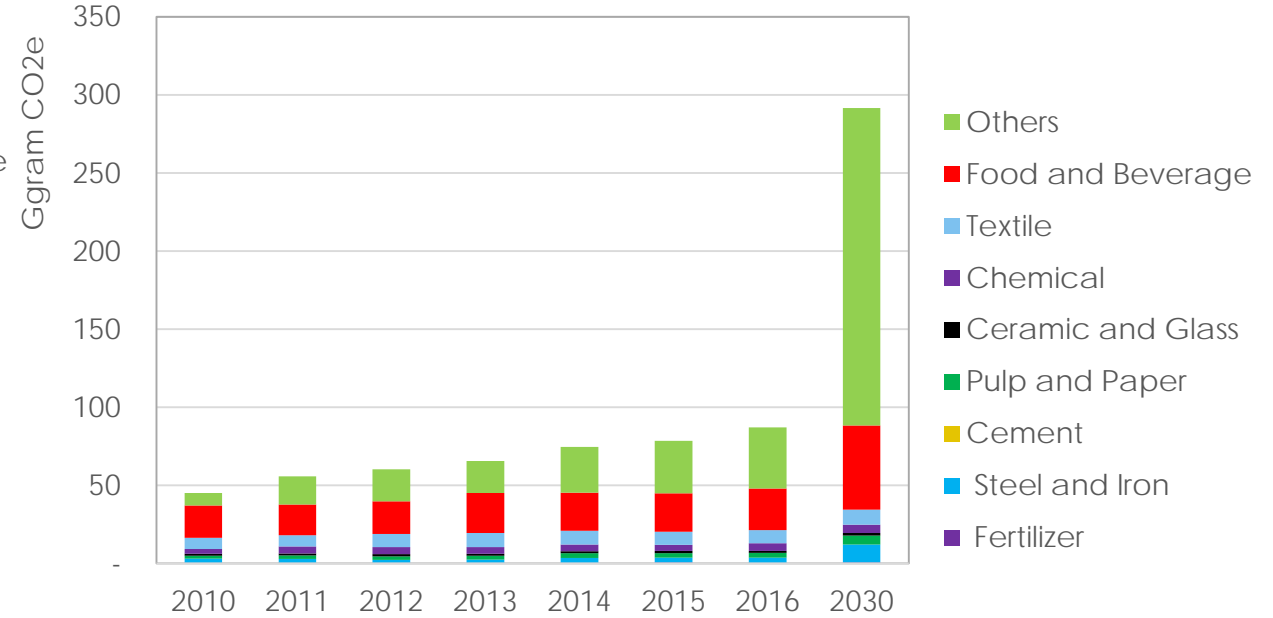


Others Manufacturing Industry is still the greatest

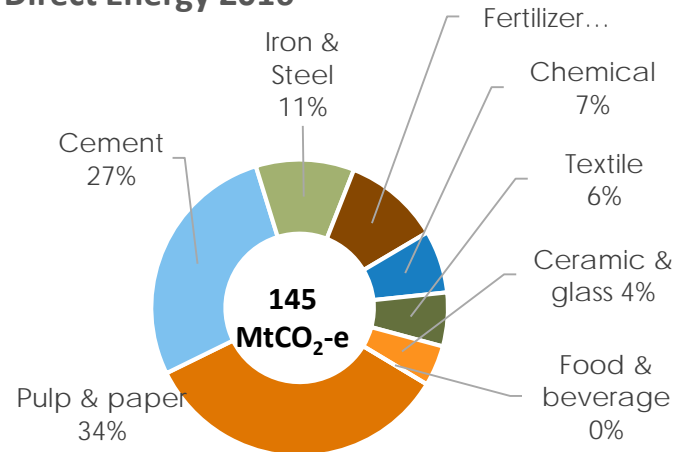
Direct GHG Emissions from Energy Use in Industry



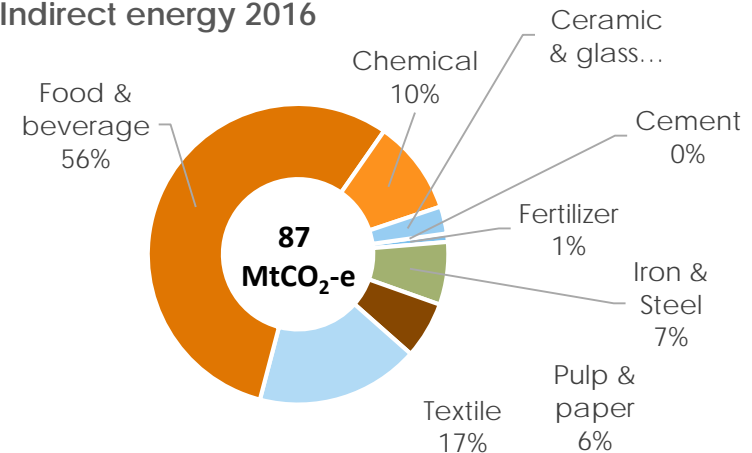
Indirect GHG Emissions from Energy Use in Industry



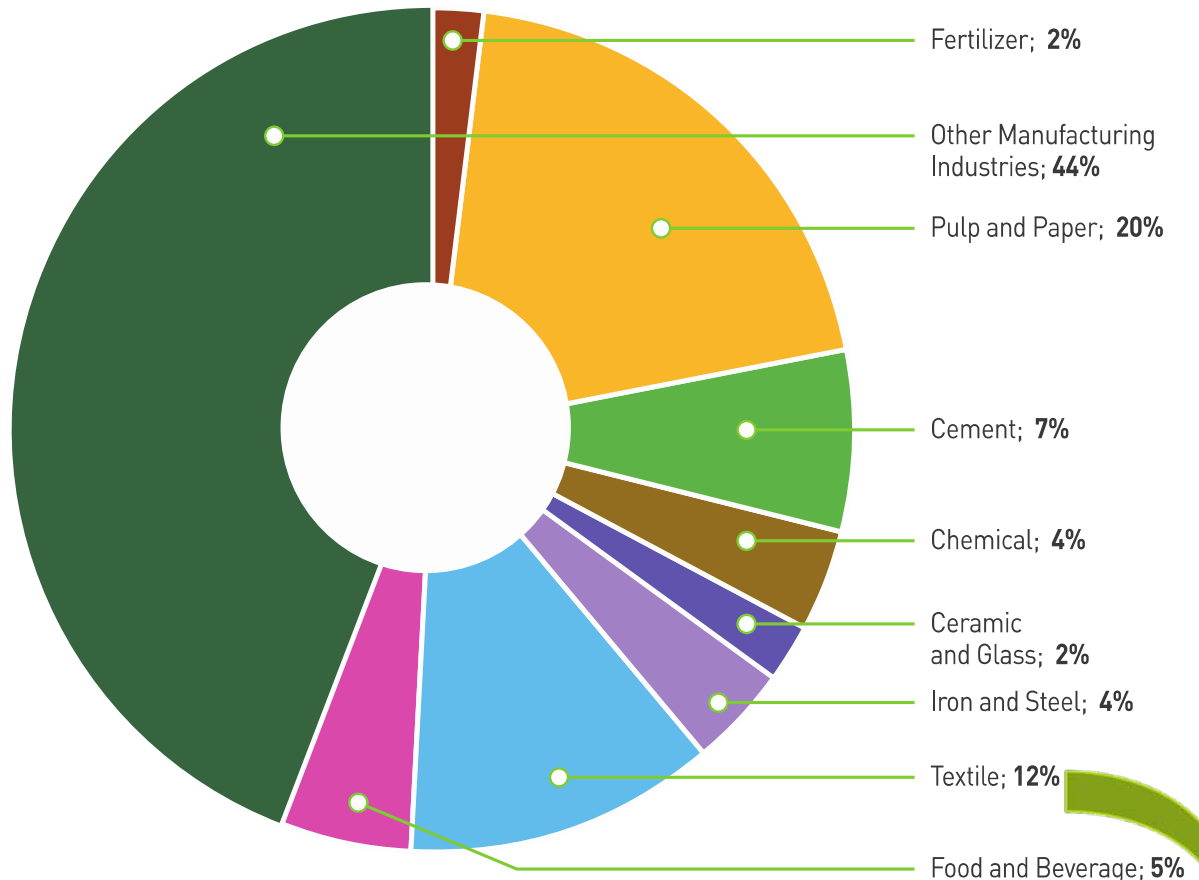
Direct Energy 2016



Indirect energy 2016



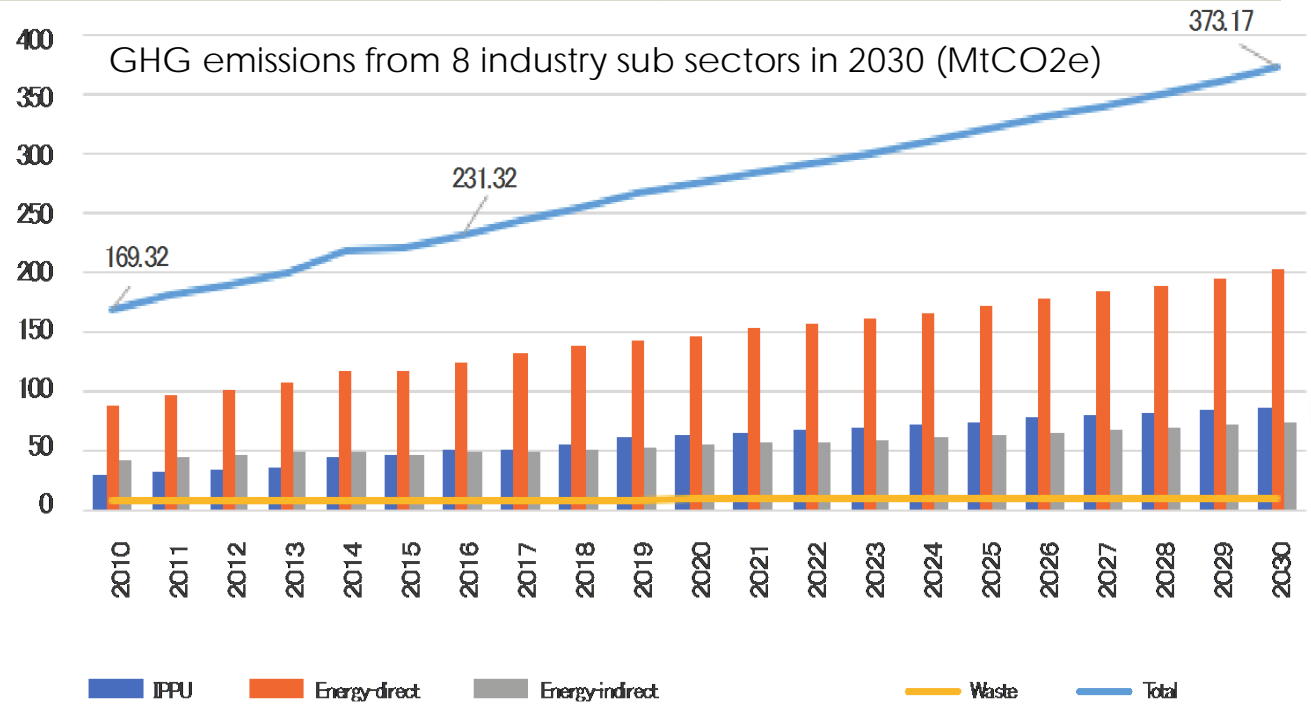
GHG EMISSIONS FROM 8 INTENSIVE INDUSTRY



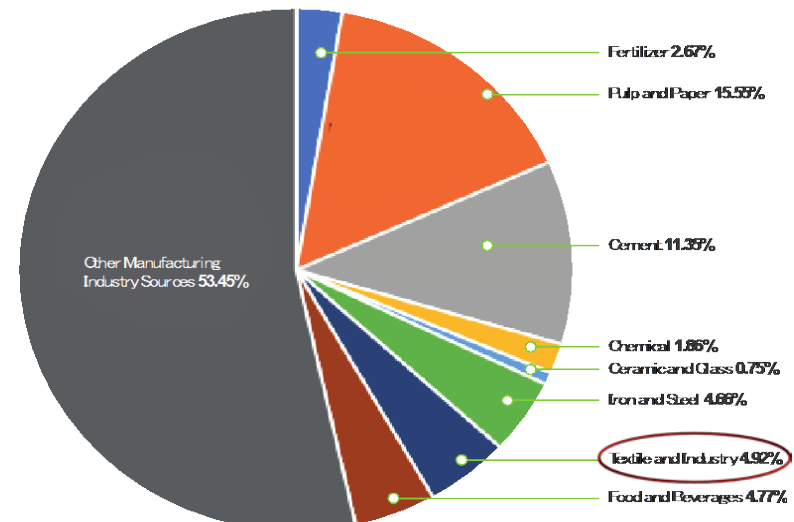
Share of energy emissions in manufacturing industry in 2016

Second biggest contributor among 8 energy intensive industries

Source: GHG emissions profile from Indonesia's industry sector, MoI-UNDP 2018

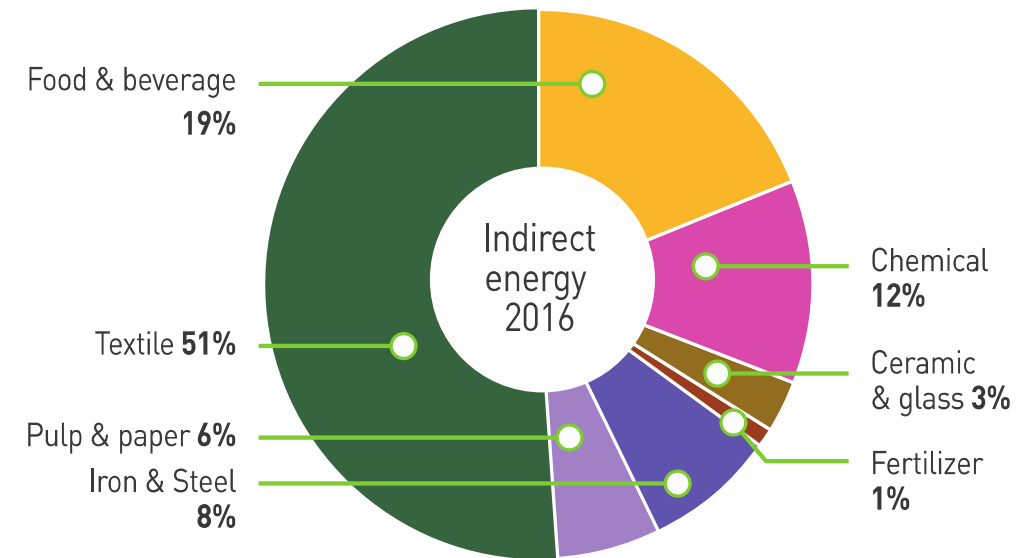
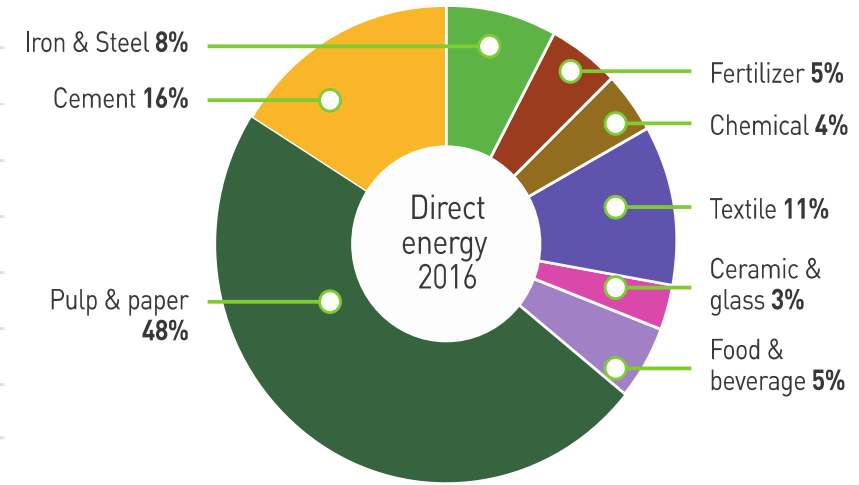
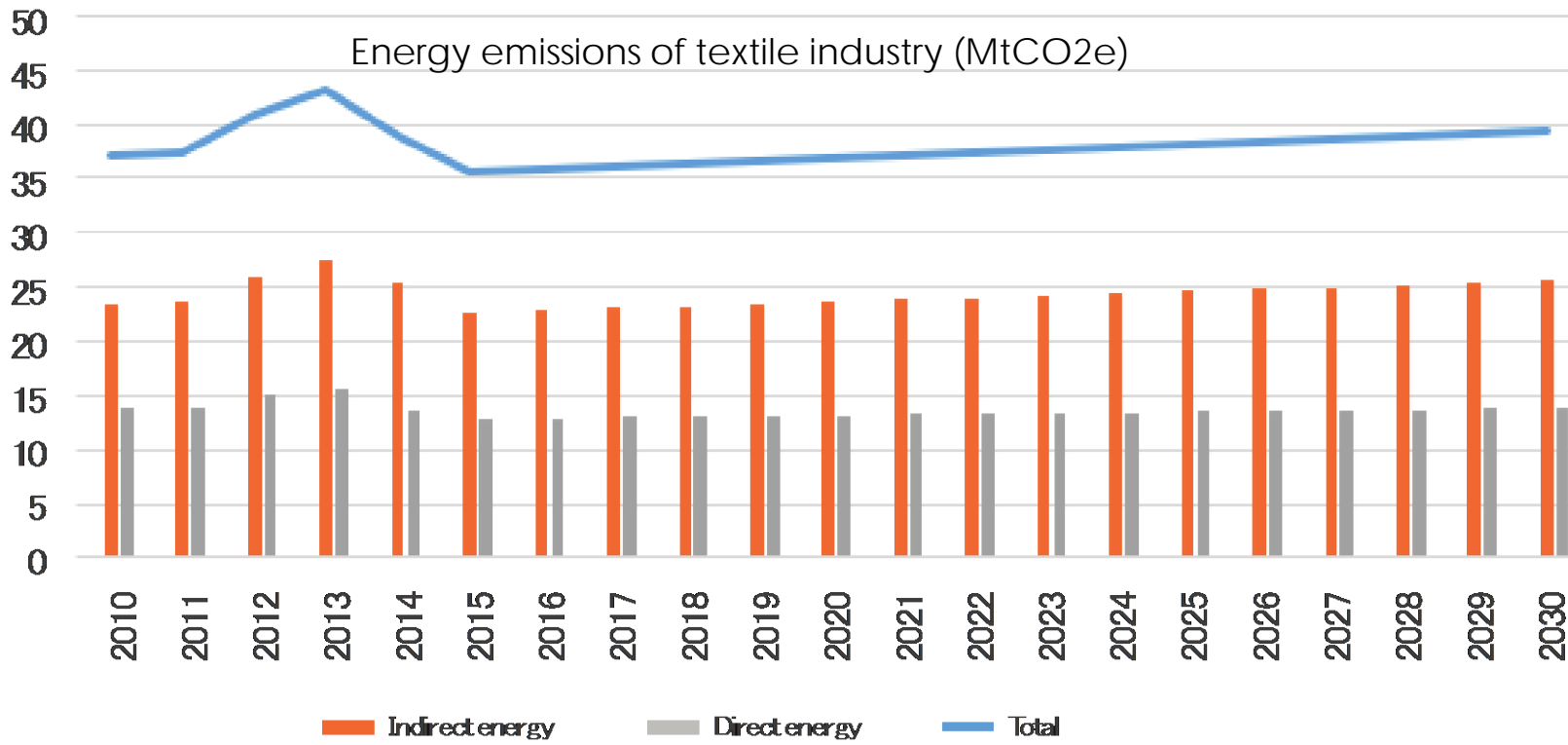


The main source of emissions in 8 industry is energy use. Direct energy is still bigger than indirect source



Though surpassed by others sub sector, still second biggest among 8 group

Share of BaU emissions from overall manufacturing industry in 2030

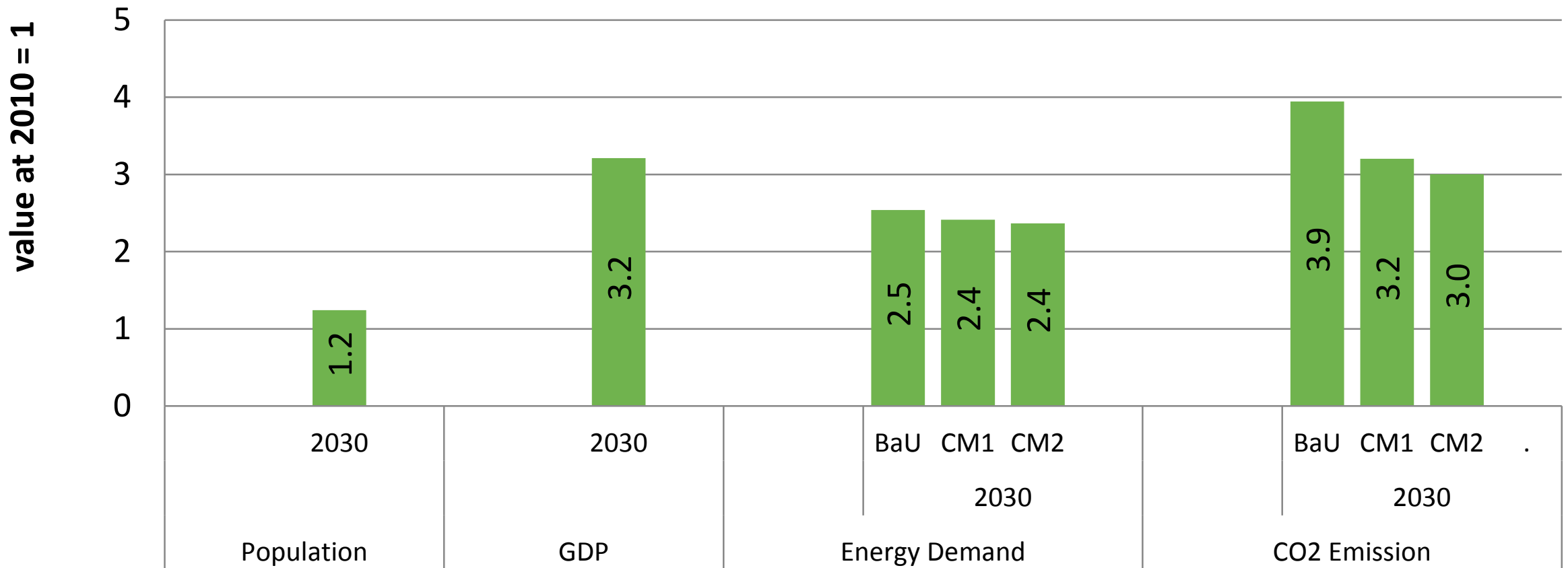


- ✓ Energy emissions from textile industry is dominated by indirect sources
- ✓ Top 3 of direct energy emitter
- ✓ 51% indirect energy emission comes from textile

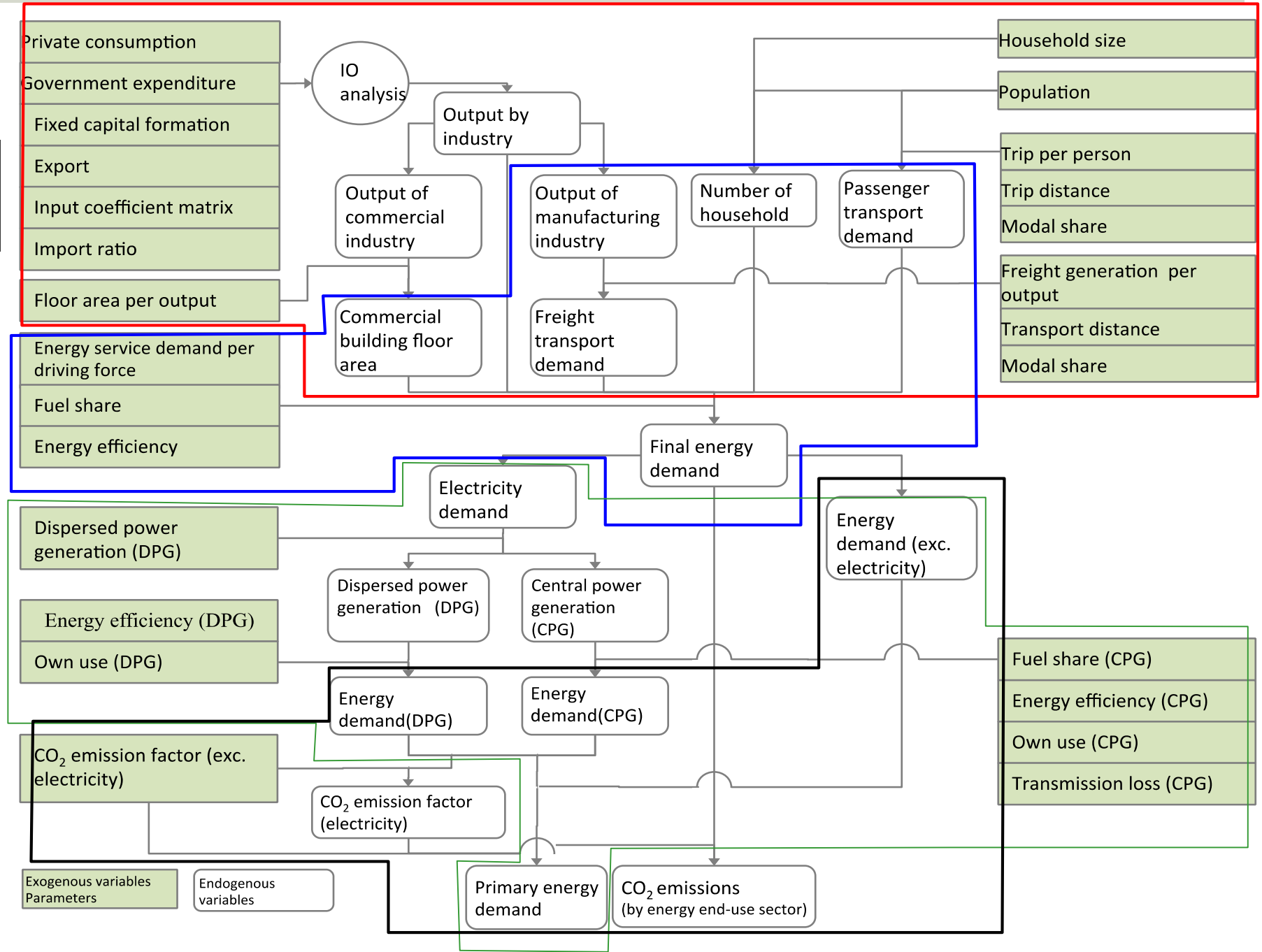
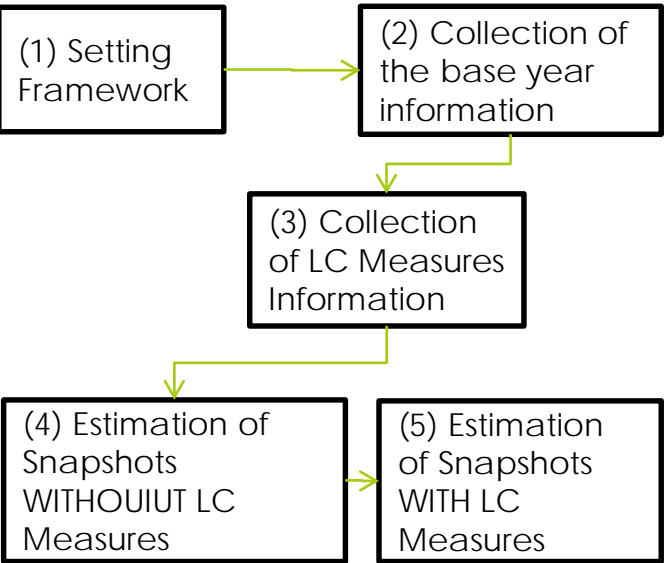
Projection of Energy and The Associated GHG Emissions

To estimate GHG emission reduction potential from energy efficiency in textile industry

2010 vs 2030



Methodology: ExSS



1. **Driving Force Settings**
2. **Final Energy Demand**
3. **Primary Energy Demand**
4. **CO2 emissions**

Assumed parameters in the model

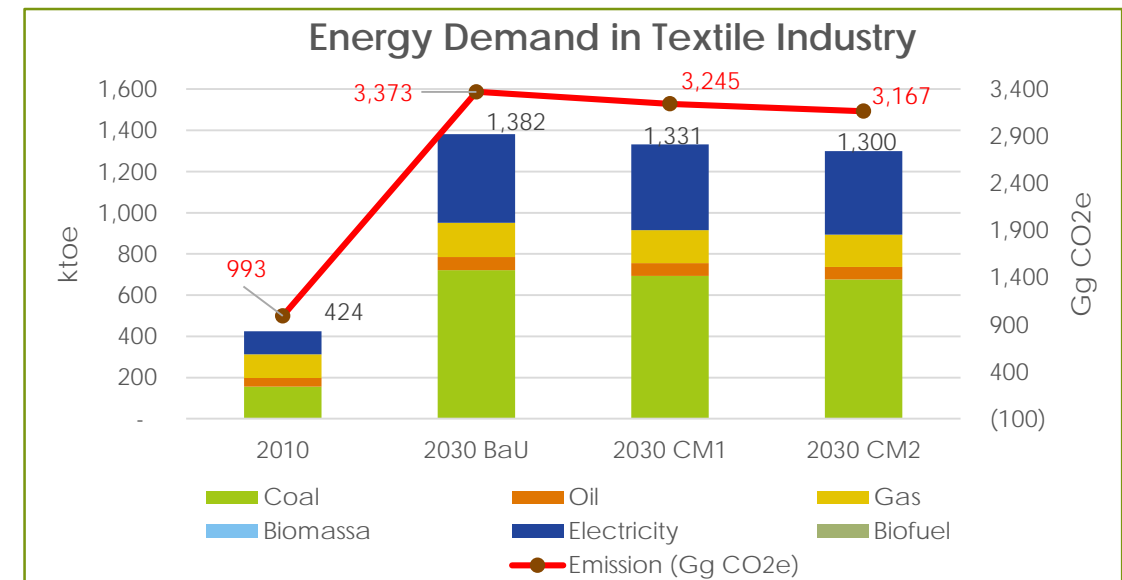
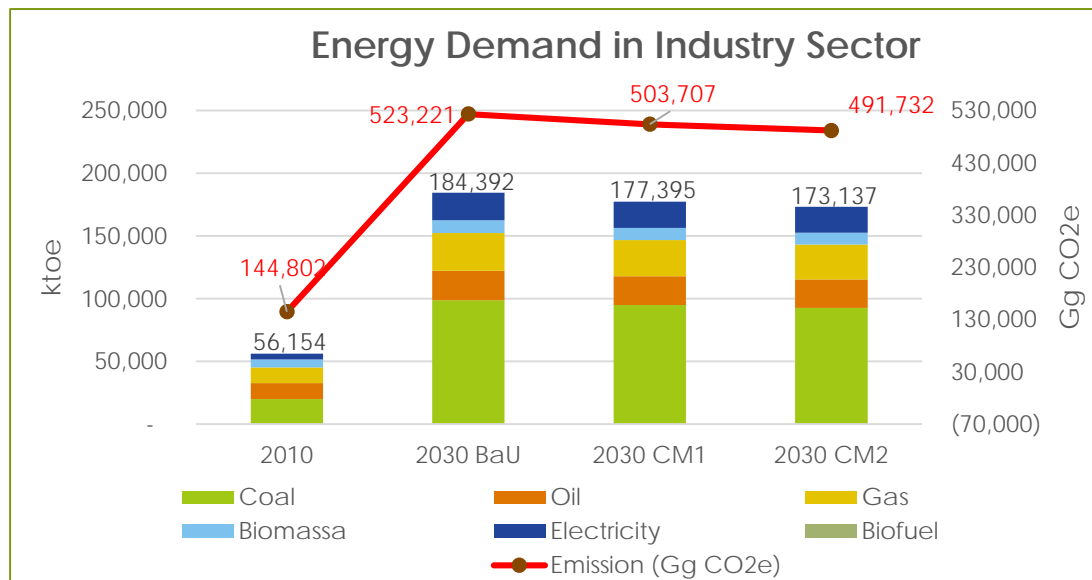
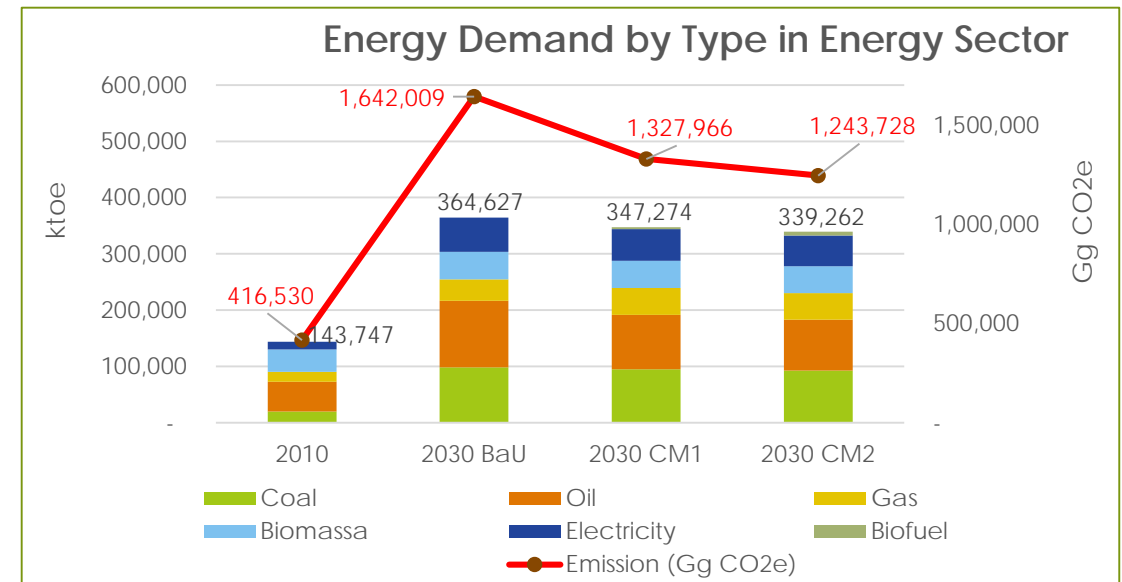
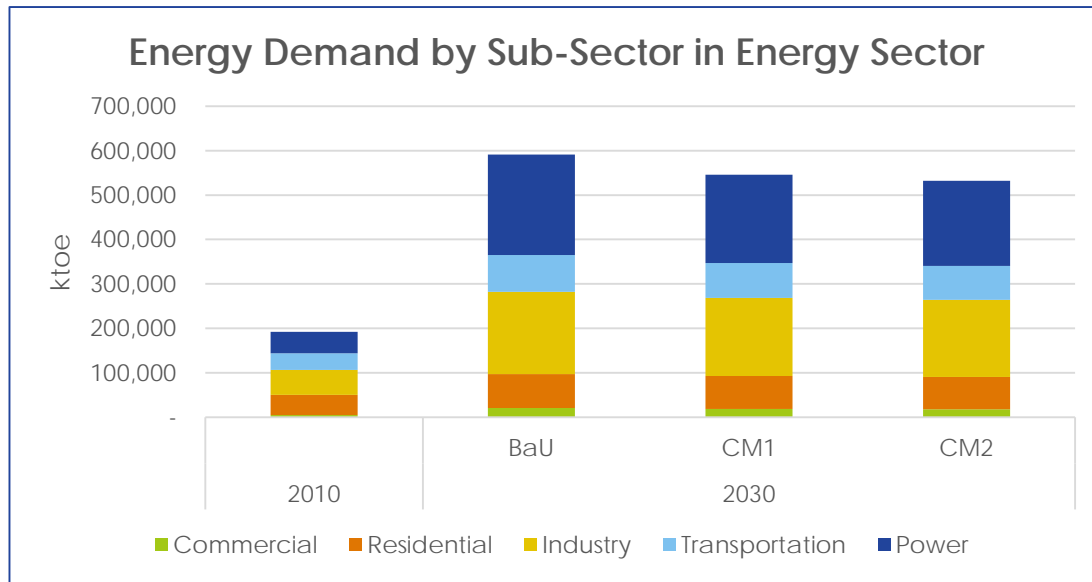
Parameters	Baseline	CM1	CM2
GDP growth	5.5%	5.5%	
Economics structure	Economics structure in 2030 is the same as that of 2010		
Share of energy in power	Share of energy in 2030 is the same as that of 2010	Following RUPTL	Following RUPTL and more renewables
Share of transportation modes	Share of transportation modes in 2030 is the same as that of 2010		
Efficiency	Efficiency of equipment in 2030 is the same as that of 2010		
BAT penetration		15% in industry, 20% in household, 20% in commercial and 20% in transportation	25% in industry, 30% in household, 30% in commercial and 30% in transportation
Biofuel		5%	10%
Others		kerosene is extinct	

CM1: efficient technology

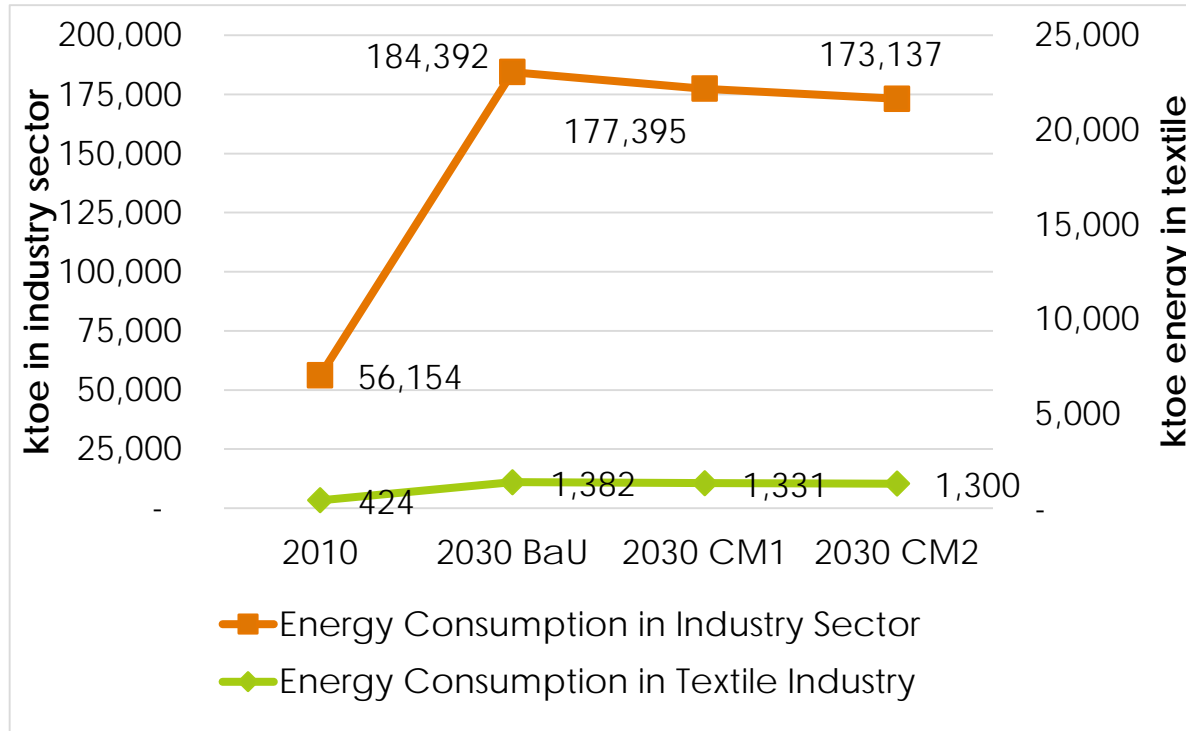
CM2: efficient technology + renewables

*RUPTL : general plans of power generation issued by state owned electricity company

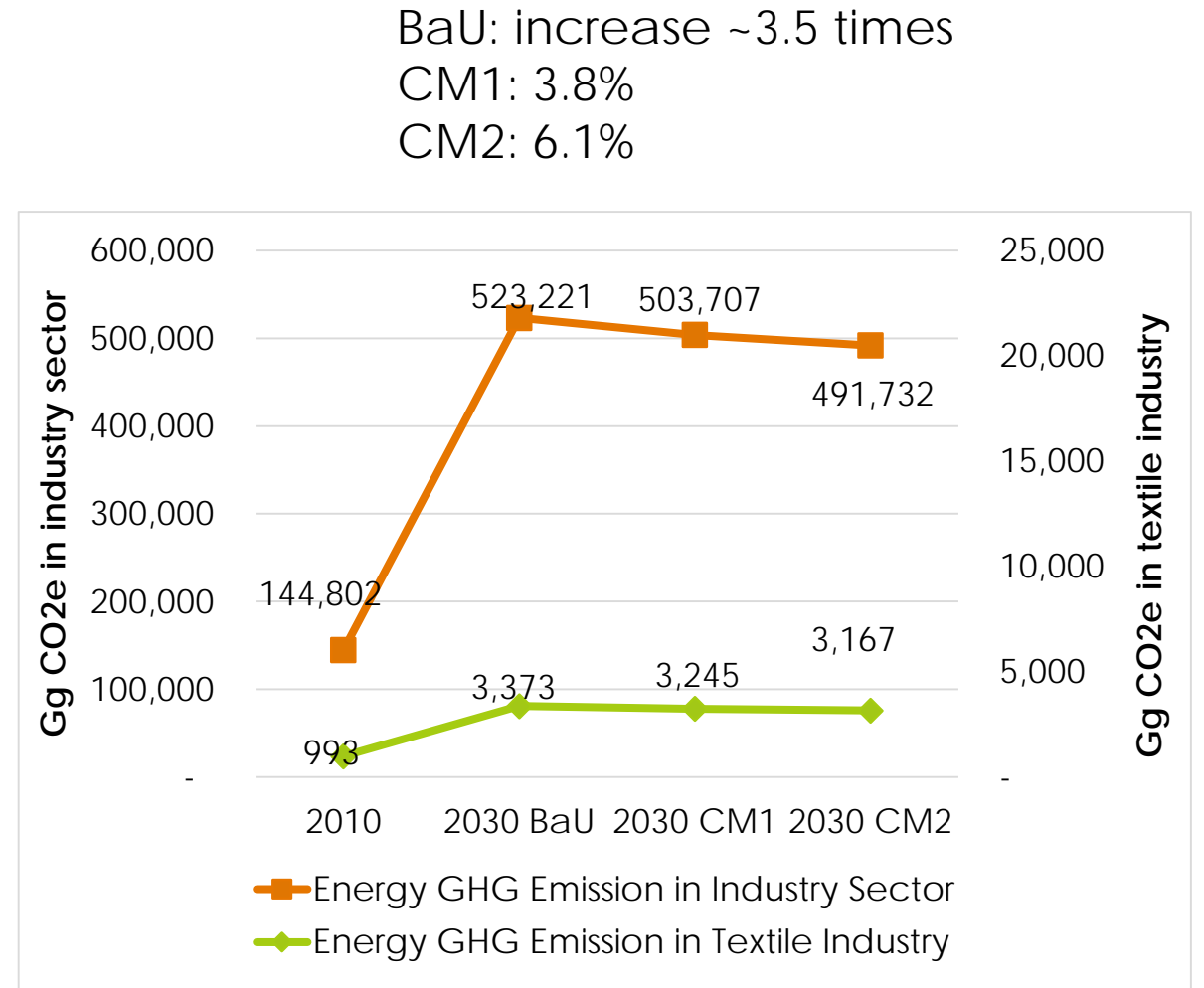
Energy Demand in 2010 dan 2030



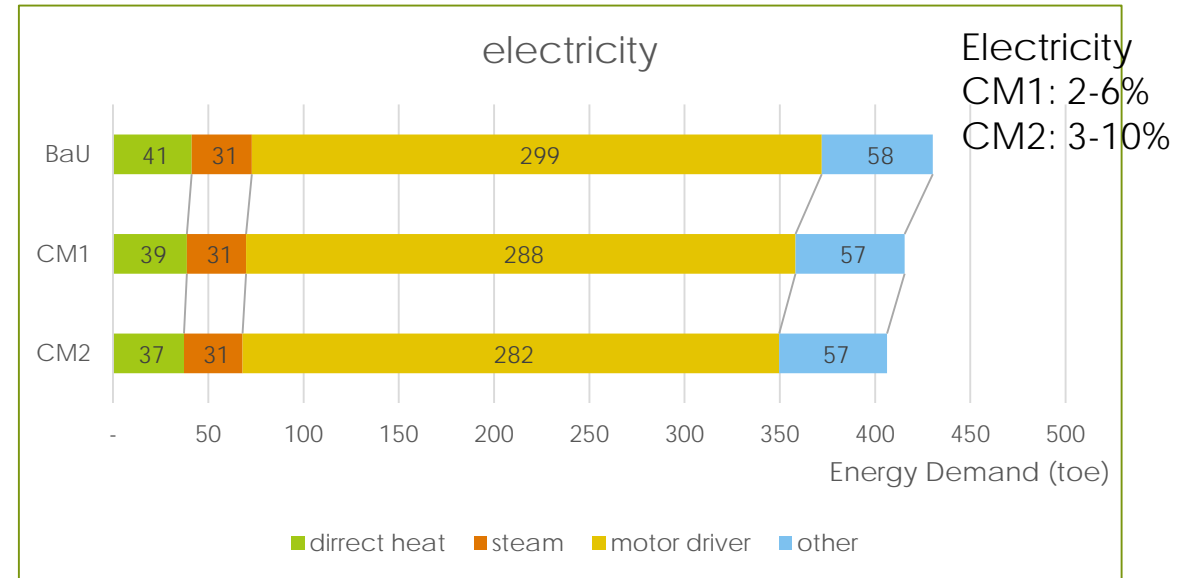
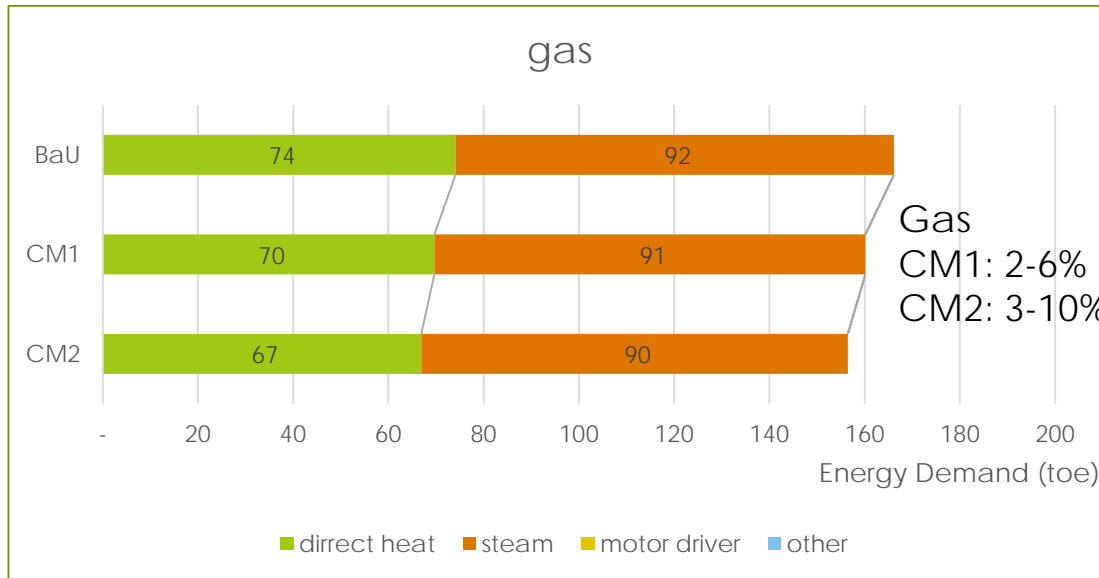
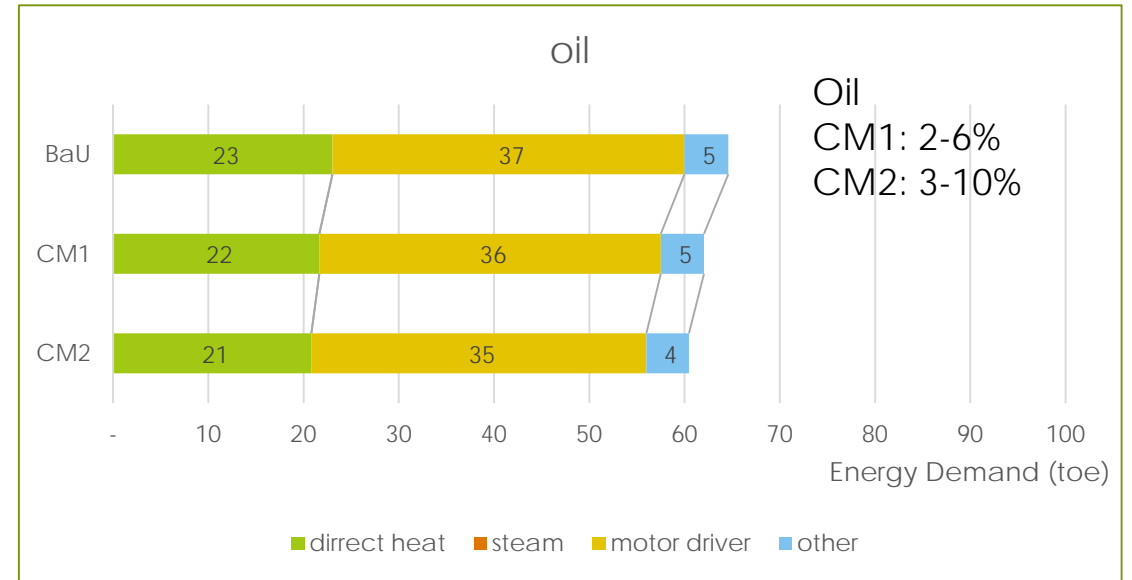
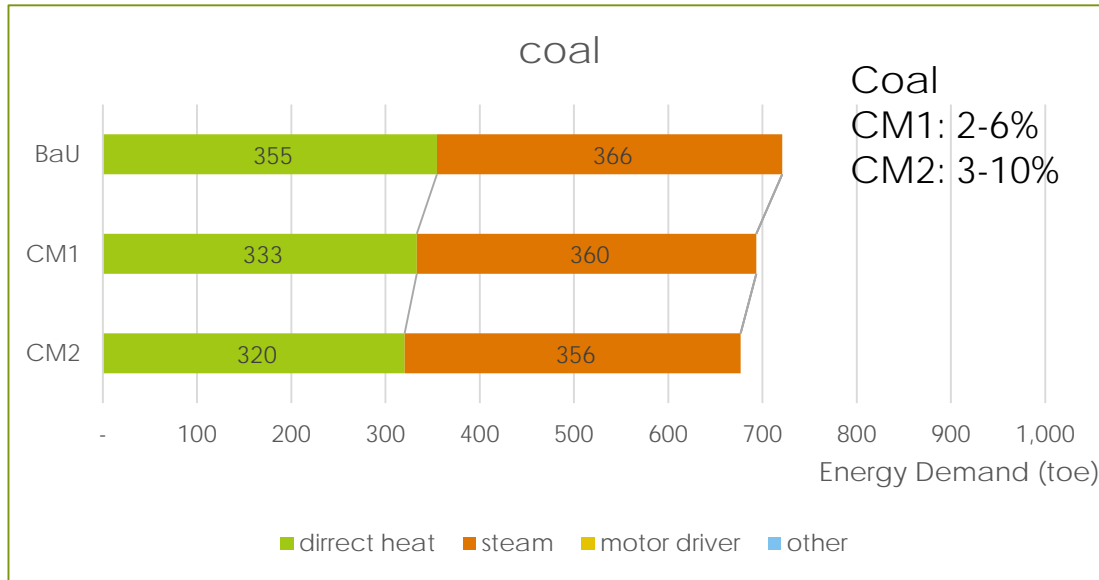
Textile vs Industry - projection



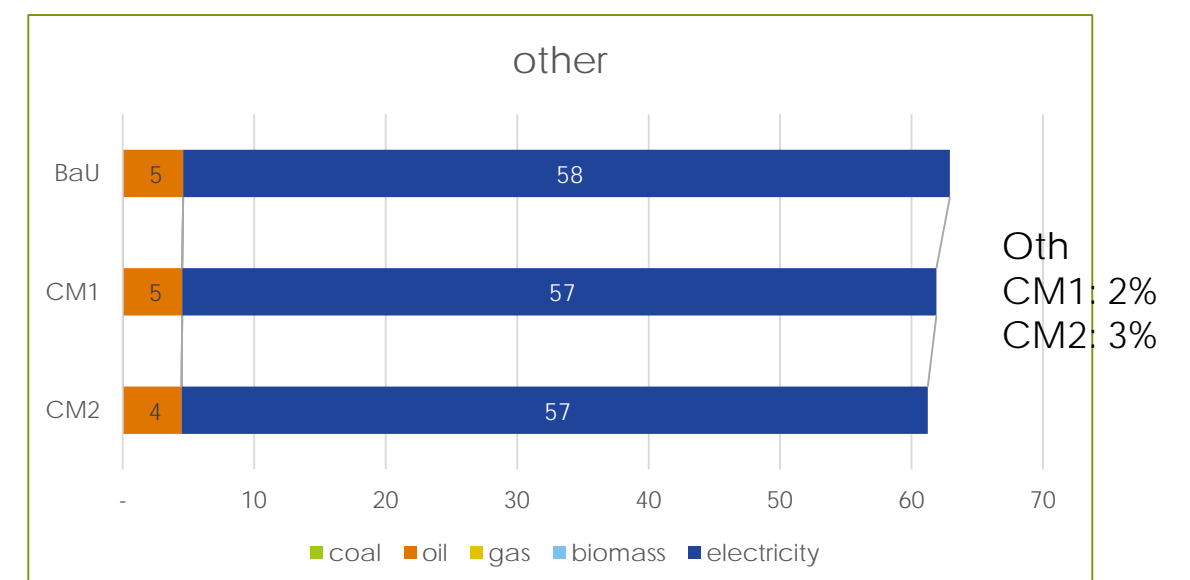
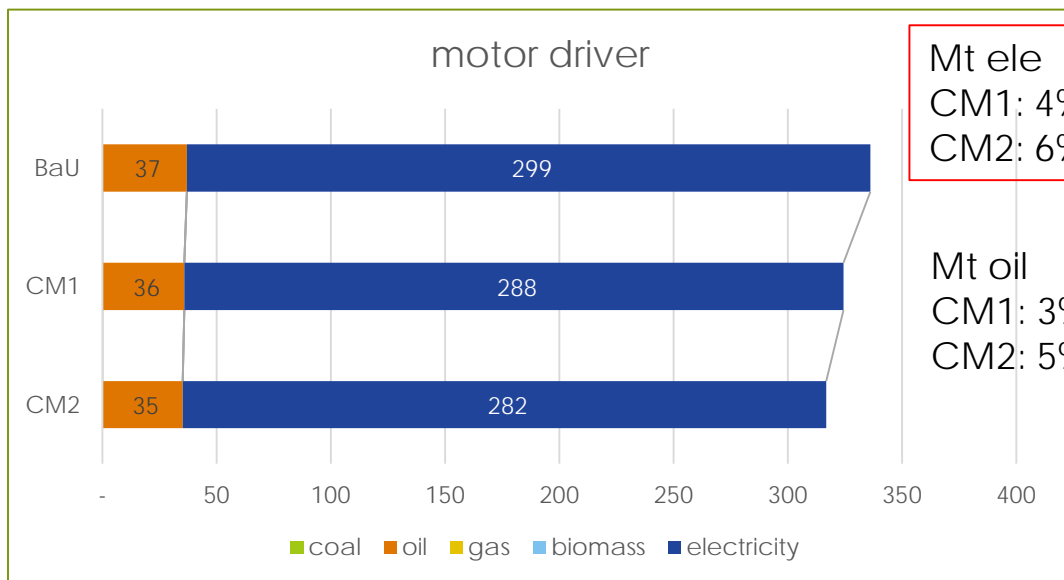
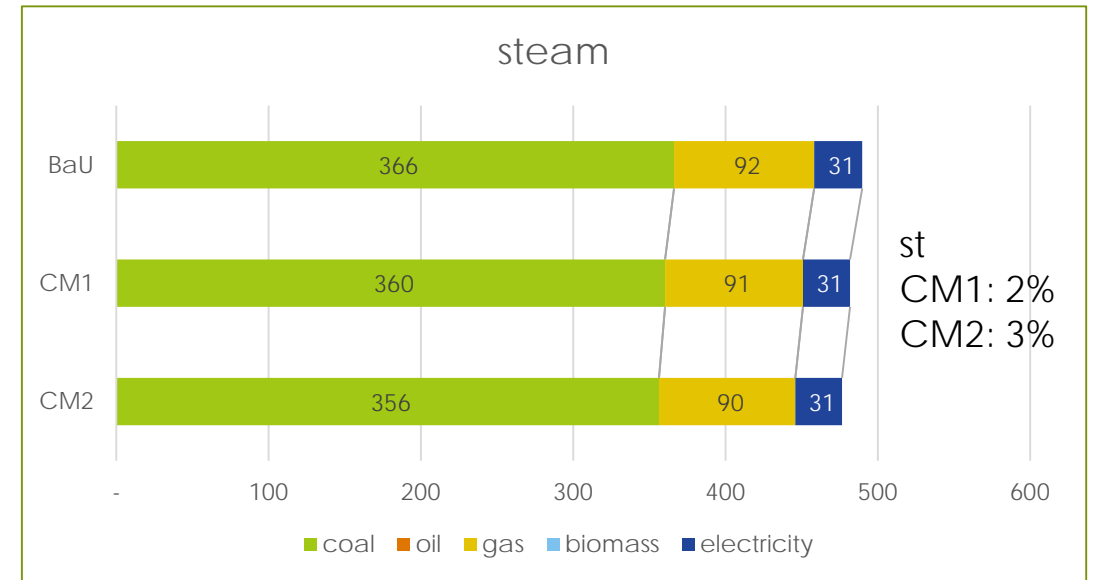
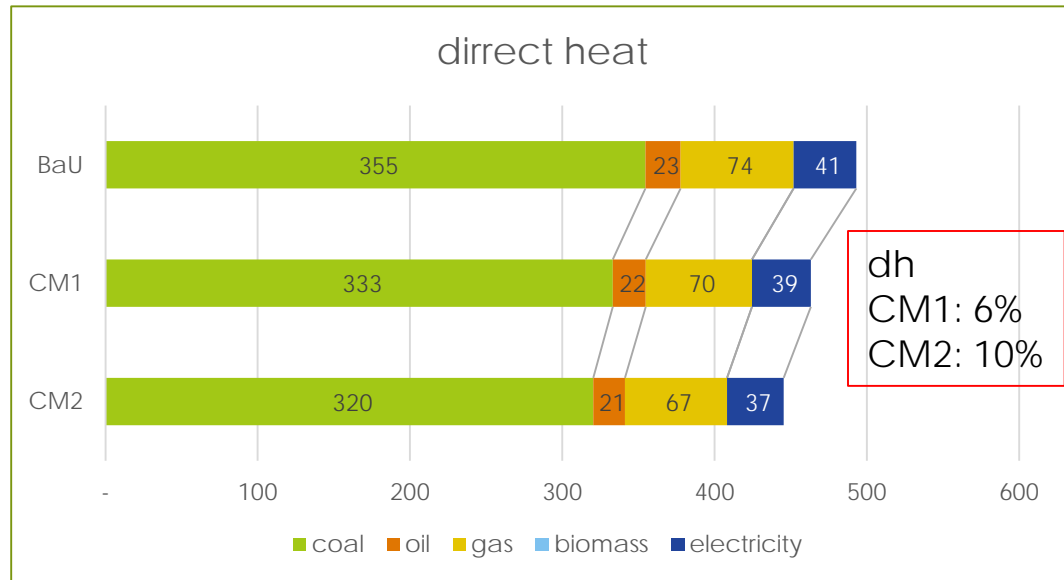
BaU: increase ~3.3 times
 CM1: 3.7%
 CM2: 5.9%



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



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



Conclusion and Remarks

- Since textile 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 to 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.
- There are still rooms for improvement in energy efficiency in industry sector, particularly textile industries. JICA Study (2009) shows energy savings potential in textile industry can be up to 30%. In this study assumes BAT penetration at 15% (CM1) and 25% (CM2).
- From the ExSS results, efficient technology in direct heat is contributing the biggest GHG emission reduction followed efficient motor equipments.