GHGs emission in Iron and Steel Industry

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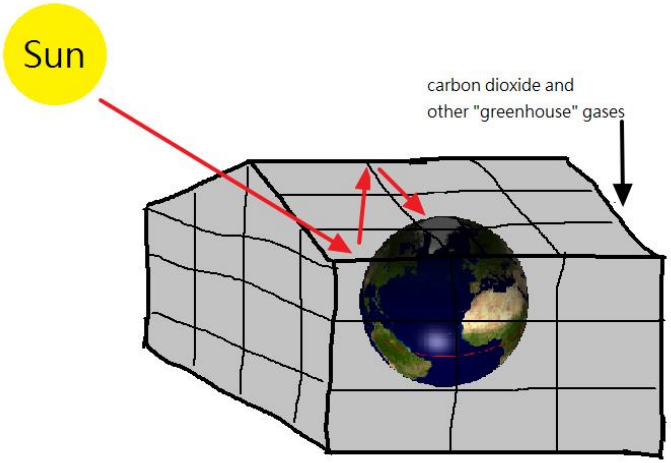
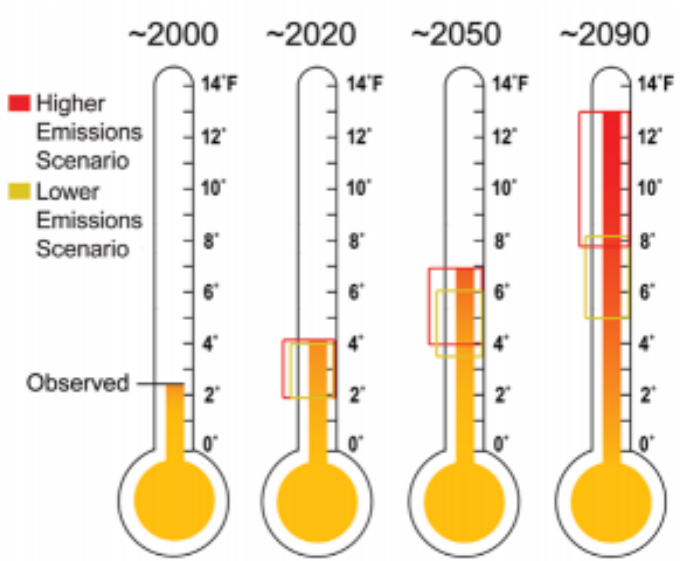
Contents

Climate change

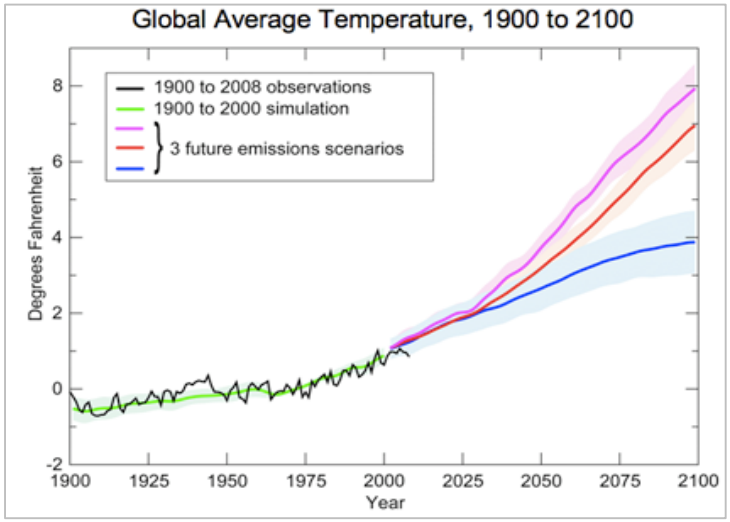
- Climate change is often called ‘Global warming’ – the effect of increases in global temperatures caused by an accumulation of greenhouse gases in the atmosphere.

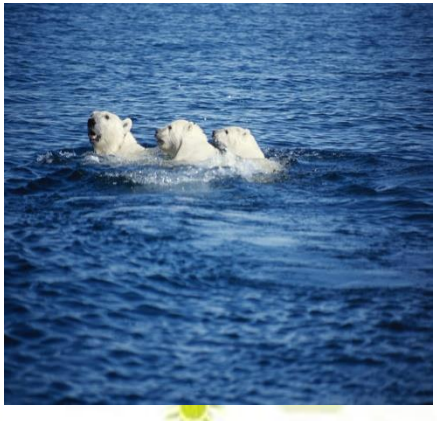




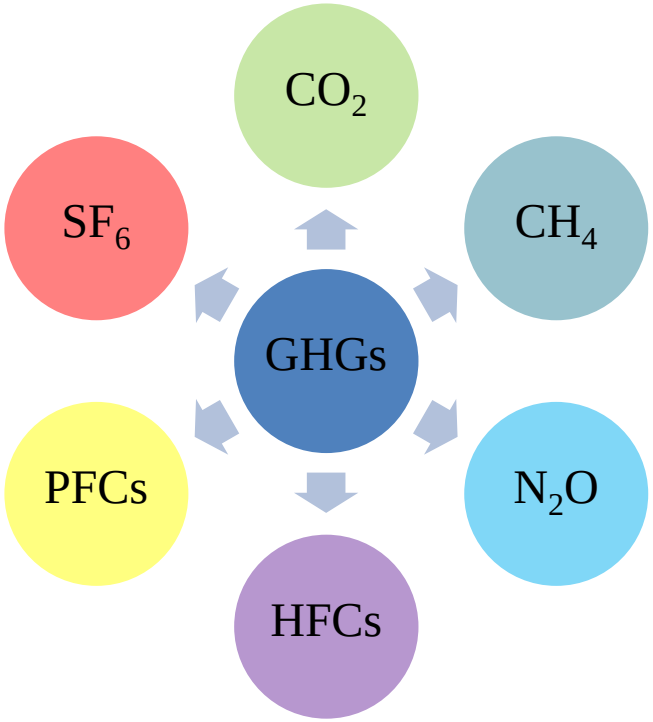
Impact on Climate change

- Temperature increase
- Damage from Disaster Frequency
- Decreases in snow cover and sea ice
- Rising Sea level
- Drought
- Human health



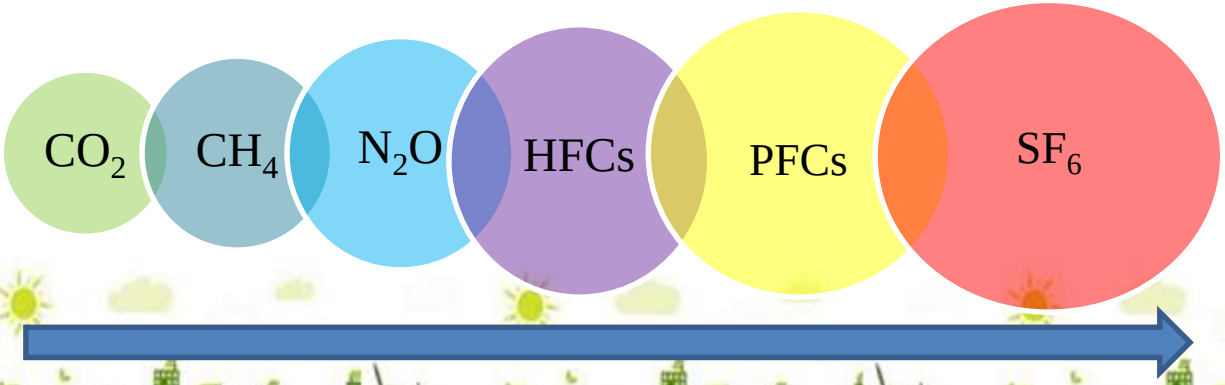


Greenhouse gases



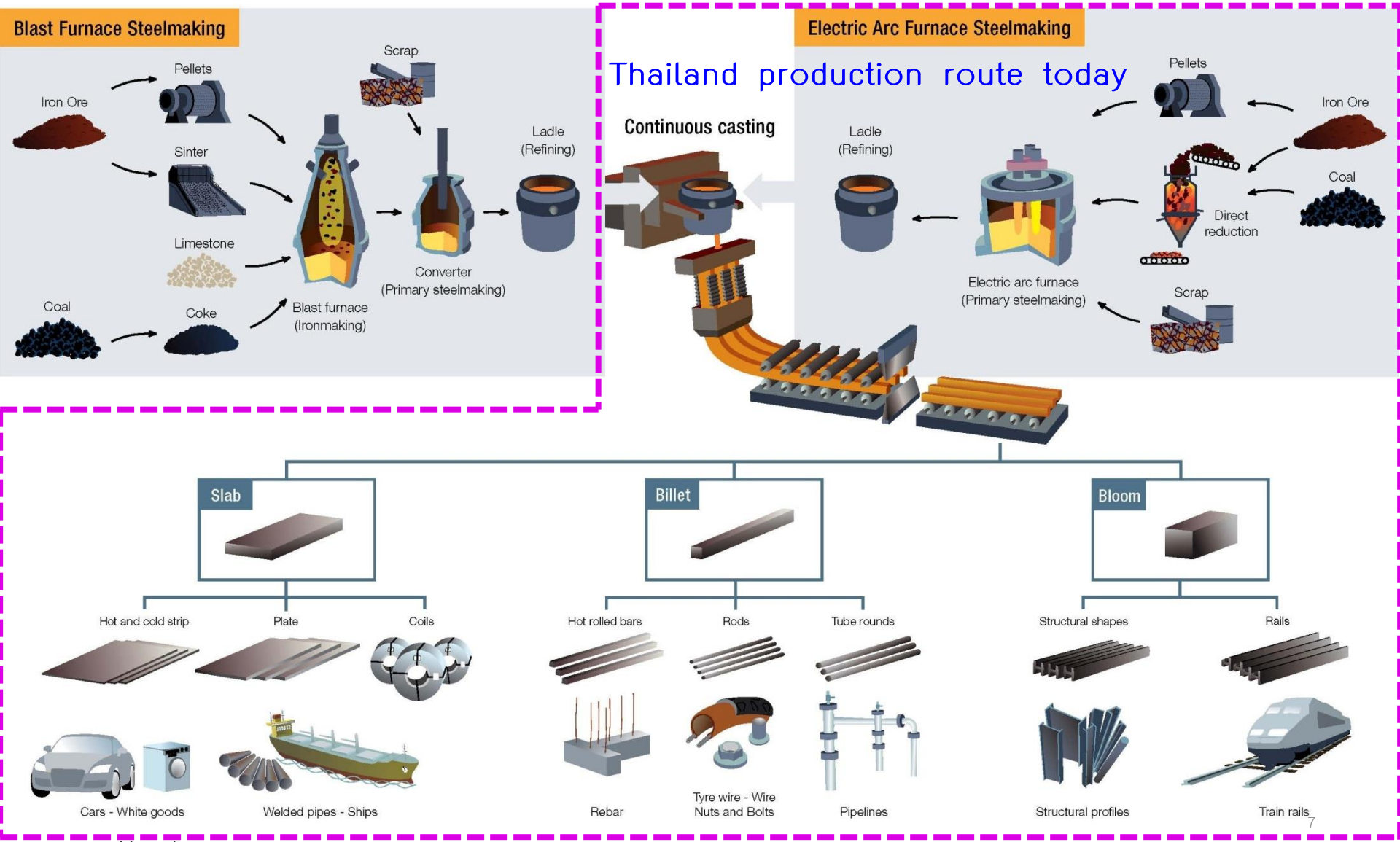
Global Warming Potential of Primary Greenhouse Gases

Greenhouse Gas	Chemical formula	Global Warming Potential [Time Horizon] 20 years	100 years
Carbon Dioxide	CO_2	1	1
Methane	CH_4	42-70	16-26
Nitrous Oxide	N_2O	280	310
Hydrofluorocarbons	HFCs	460 - 9,100	140-11,700
Perfluorocarbon	PFCs	4,400-6,200	6,500-23,900
Sulphur Hexafluoride	SF_6	16,300	23,900



Global benchmark of each steel product:

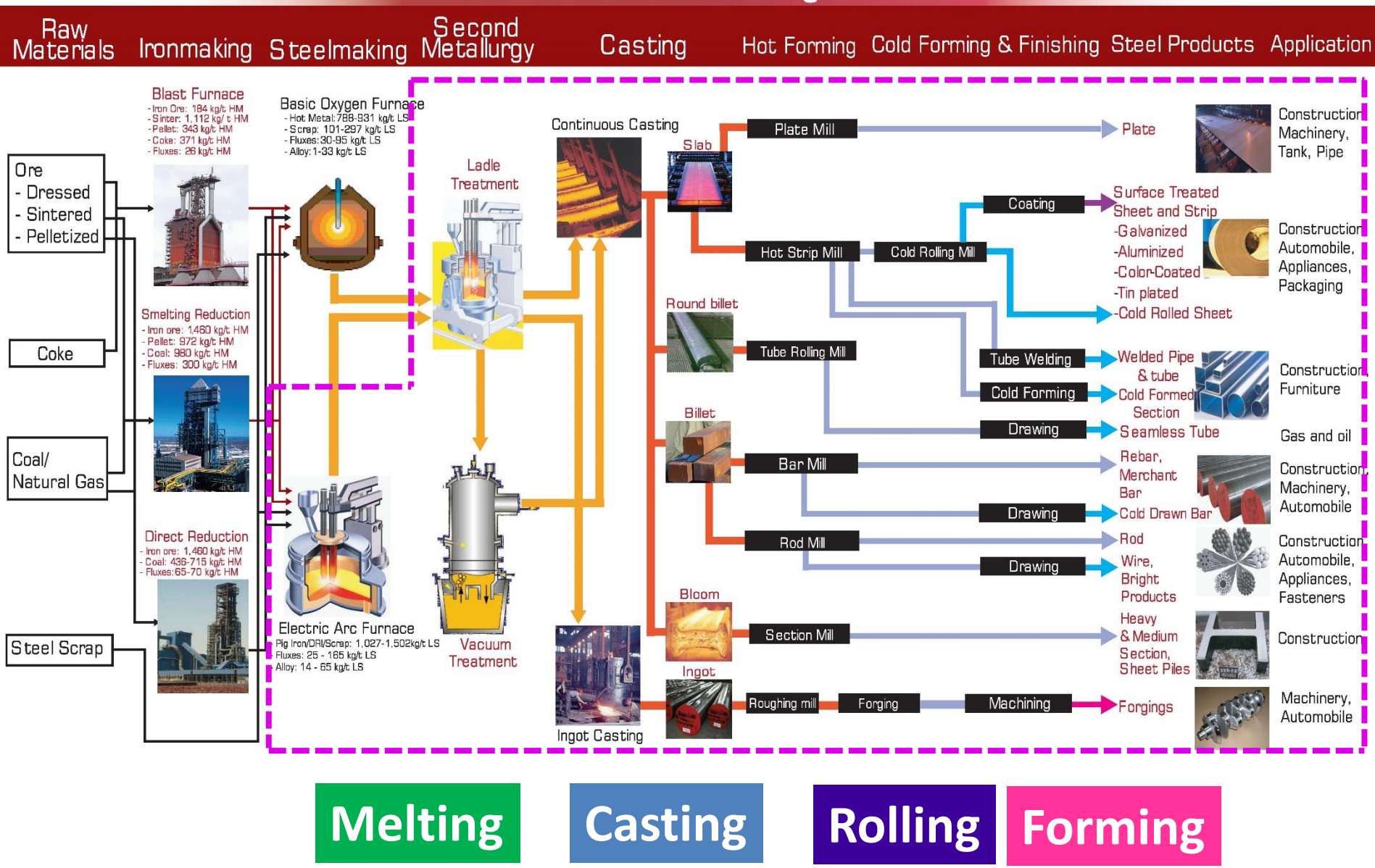
Iron and Steel industry



Source : World Steel Association

The process shown above is illustrative only and is not designed to show the steelmaking process in detail. Not all steel plants produce all of the products shown in this diagram.

Iron and Steelmaking Process



Melting **Casting** **Rolling** **Forming**

GHGs emission factor of Iron and Steel industry by process

Process	GHGs emission (ton CO_2 eq/ton product)				
	Non-energy			Energy	
	ASEAN[a]	IPCC[b]	IISI[c]	ASEAN[a]	IISI[d]
Sinter	-	0.20	0.12	-	0.21
Coke oven	-	0.56	0.09	-	0.82
Iron production	1.98	1.35	1.29	0.87	1.28
Direct Reduced Induction	-	0.70	-	-	-
Pellet production	-	0.03	-	-	0.08
Basic oxygen furnace	-	1.46	-	-	-
Electric Arc Furnace	0.09	0.08	0.06	0.34	0.24
Open Heart Furnace	-	1.72	-	-	-
Hot Rolling (Long product)	-	-	-	0.20	0.13
Hot Rolling (Flat product)	-	-	-	0.18	0.13

Remarks:

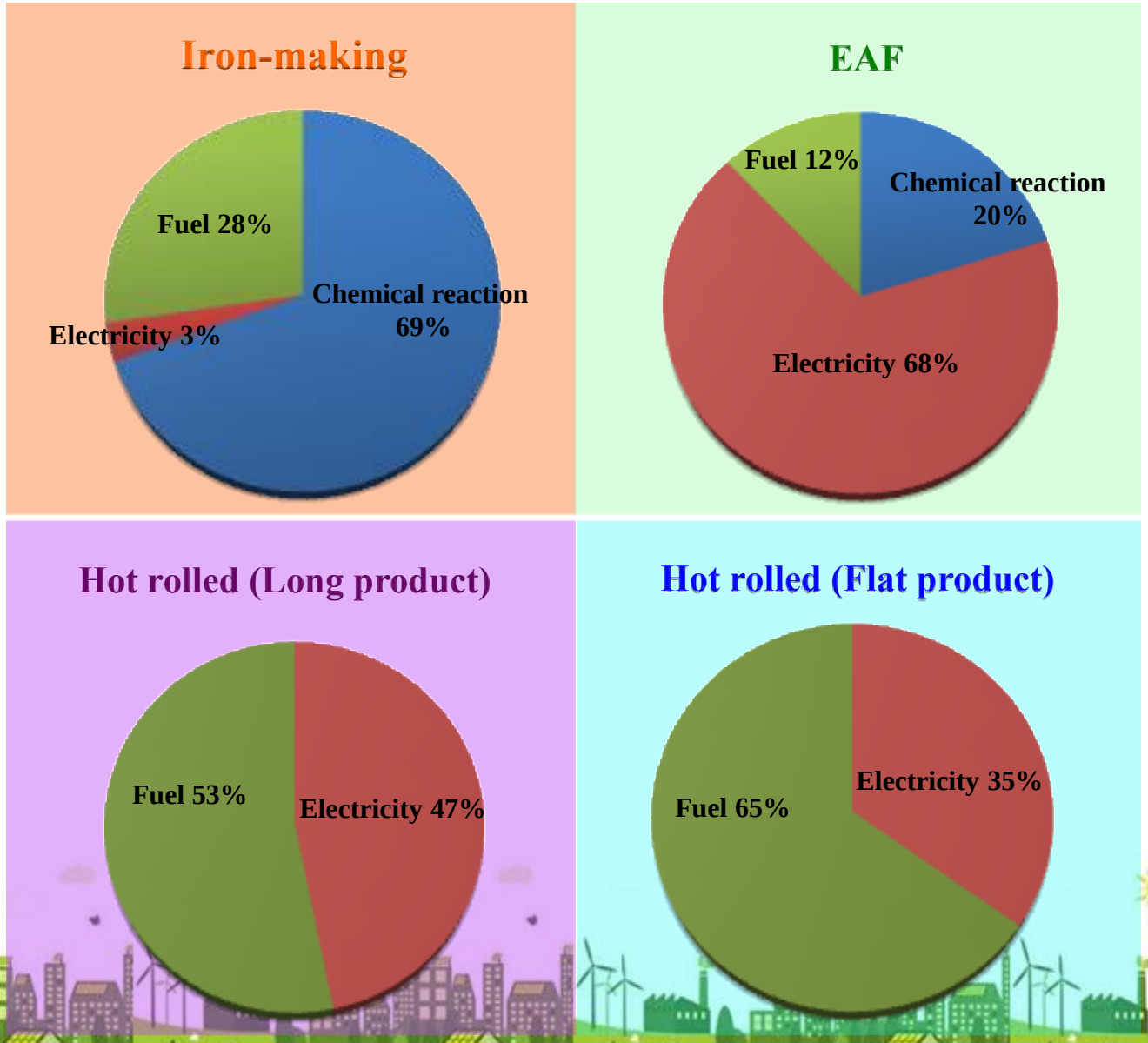
[a]ASEAN : Benchmarking of Energy & GHGs Intensity in the ASEAN Iron and Steel Industry, SEAISI (2015)

[b]IPCC : Intergovernmental Panel on Climate Change (IPCC), 2006

[c]IISI : Ecofys/Fraunhofer-ISI 2009, IISI 1998

[d]IISI, World Wide LCI database for steel industry products Technical report##2,1999

The ratio of GHGs emission by source

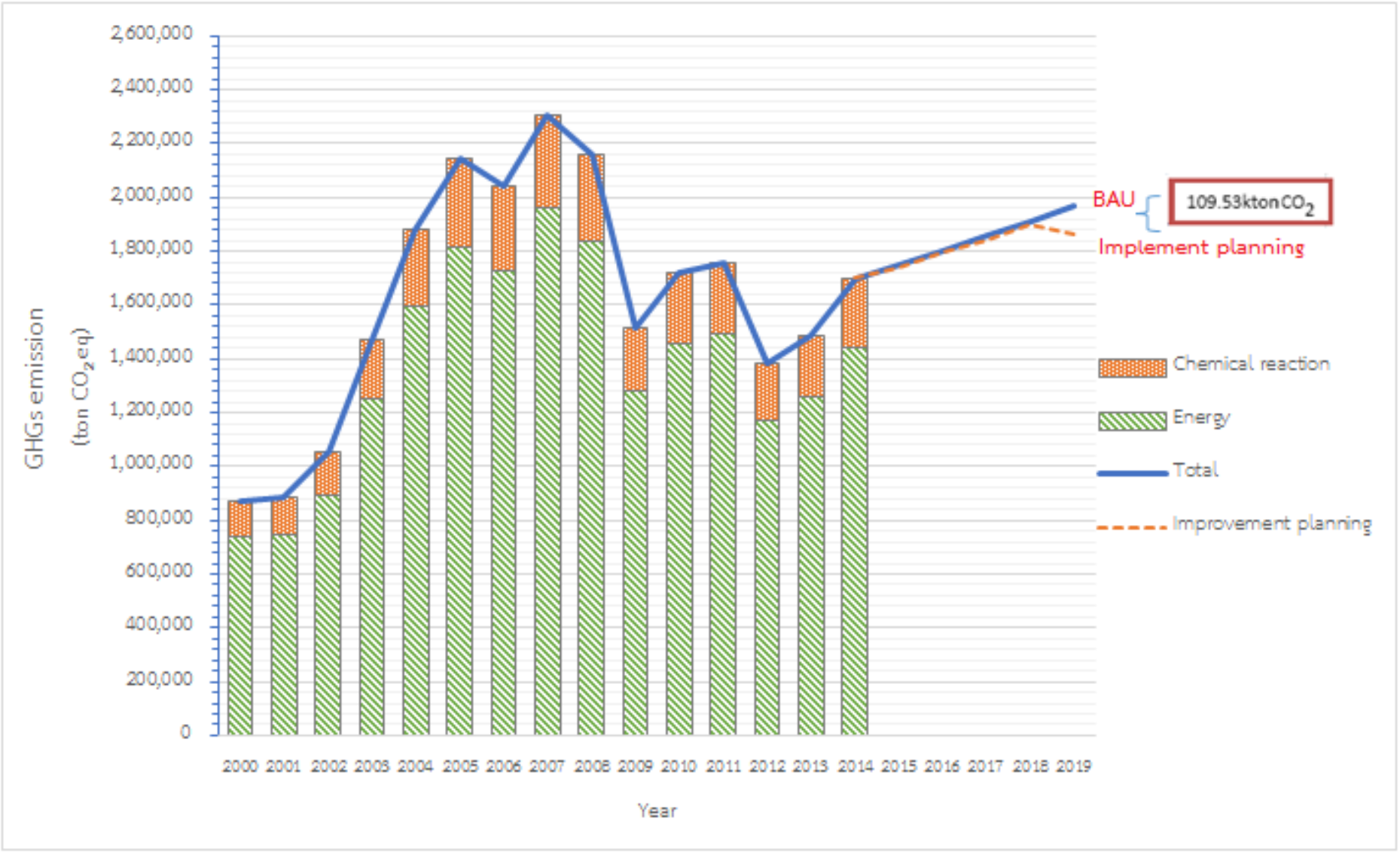


Main source of GHGs emission is related with energy consumption. Then, the mill should improve on energy utilization and select cleaner energy to reduce the SEC (Specific Energy Consumption) which in turn reduces the GHGs.

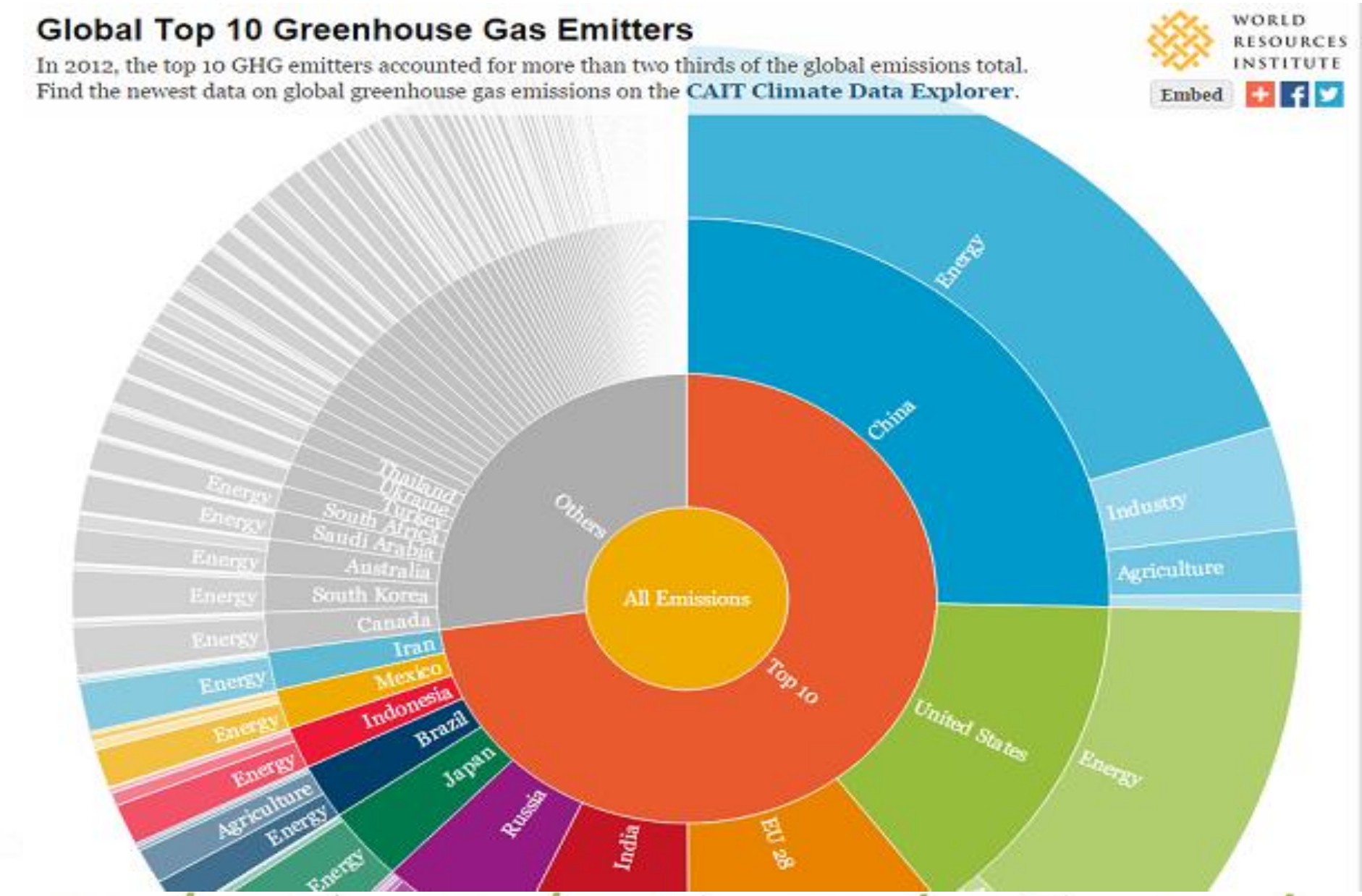
Although the GHGs emission from substances is lower than energy but the mill should consider the low-carbon content substances or recycle raw material to use in process.

Lastly, the trapping technology is a technology to trap CO_2 from chimneys to use in other applications for reducing direct GHGs.

Forecast of GHGs emission in EAF process (2015 – 2020)



Future trends and GHGs mitigation:

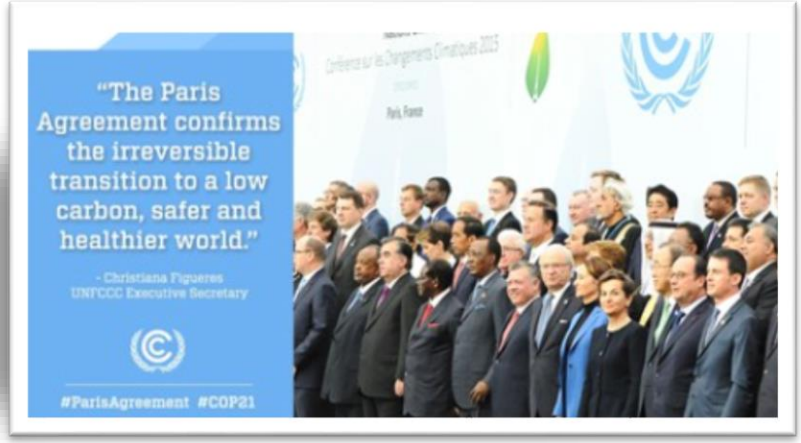


http://johannes-friedrich.com/circle/circle.htm

3 Key Ingredients for the COP21 Paris Agreement

Historic Paris Agreement on Climate Change

195 Nations Set Path to Keep Temperature Rise Well Below 2 Degrees Celsius



THE KEY ELEMENTS OF THE PARIS AGREEMENT

A text with universal scope, adopted by 195 countries

The aim: to keep the increase in global average temperature to well below 2°C and to 1.5°C if possible.

The objective: to level off greenhouse gas emissions as soon as possible.

The principal: to differentiate between developed and developing countries. Developed countries must lead the way for reduction of emissions and support developing countries in implementing this. Other countries with the ability to do so may also contribute their support on a voluntary basis to achieve this target.

The means: Countries must submit Intended Nationally Determined Contributions (INDCs) which are revised upwards every 5 years. The 1st report is due in 2023. North-South technology transfer.

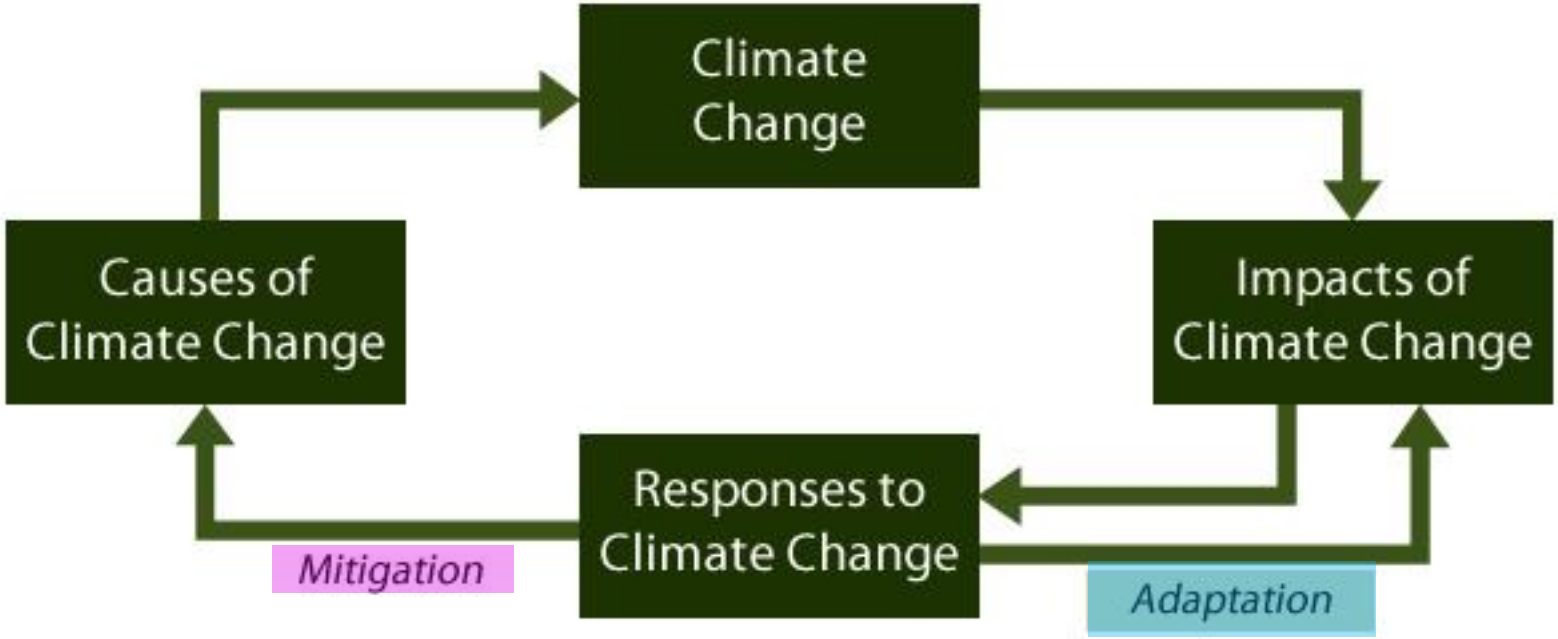
The financing: from 2020, rich countries must contribute at least $100 billion per year. This amount will be reviewed in 2025.

The new mechanism: loss and damage. Measures must be taken to avert, minimize and address the concrete effects of climate change, in order to help the most vulnerable countries.

Entry into force: 2020 if the Agreement is ratified by 55 countries accounting for 55% of global greenhouse gas emissions.

Theme

- Adaptation & mitigation



United Nations
Climate Change Secretariat

UNFCCC Country Brief 2014: Thailand

A. Key Country Indicators

	Global Rank	Global share	
CO2 emissions from fuel combustion[1] (2012)	23	0.81%	256.7 Mt CO2 Eq.
Population[2] (2013)	20	0.94%	67.01 Million
CO2 emissions / Pop.[1] (2012)	71		3.84 tCO2 per capita
GDP Size[2] (2013)	21	0.95%	Based on PPP
GDP Size[2] (2013)	29	0.52%	Based on exchange rates
UNDP human development index[3] (2012)	103		
GDP Structure[2], % (2013)	Agriculture: 12, Industry: 43, Services: 45		
Share of GDP[2], % (2011)	Imports: 70, Exports: 74		

This Country Brief was generated on: 01/10/2015

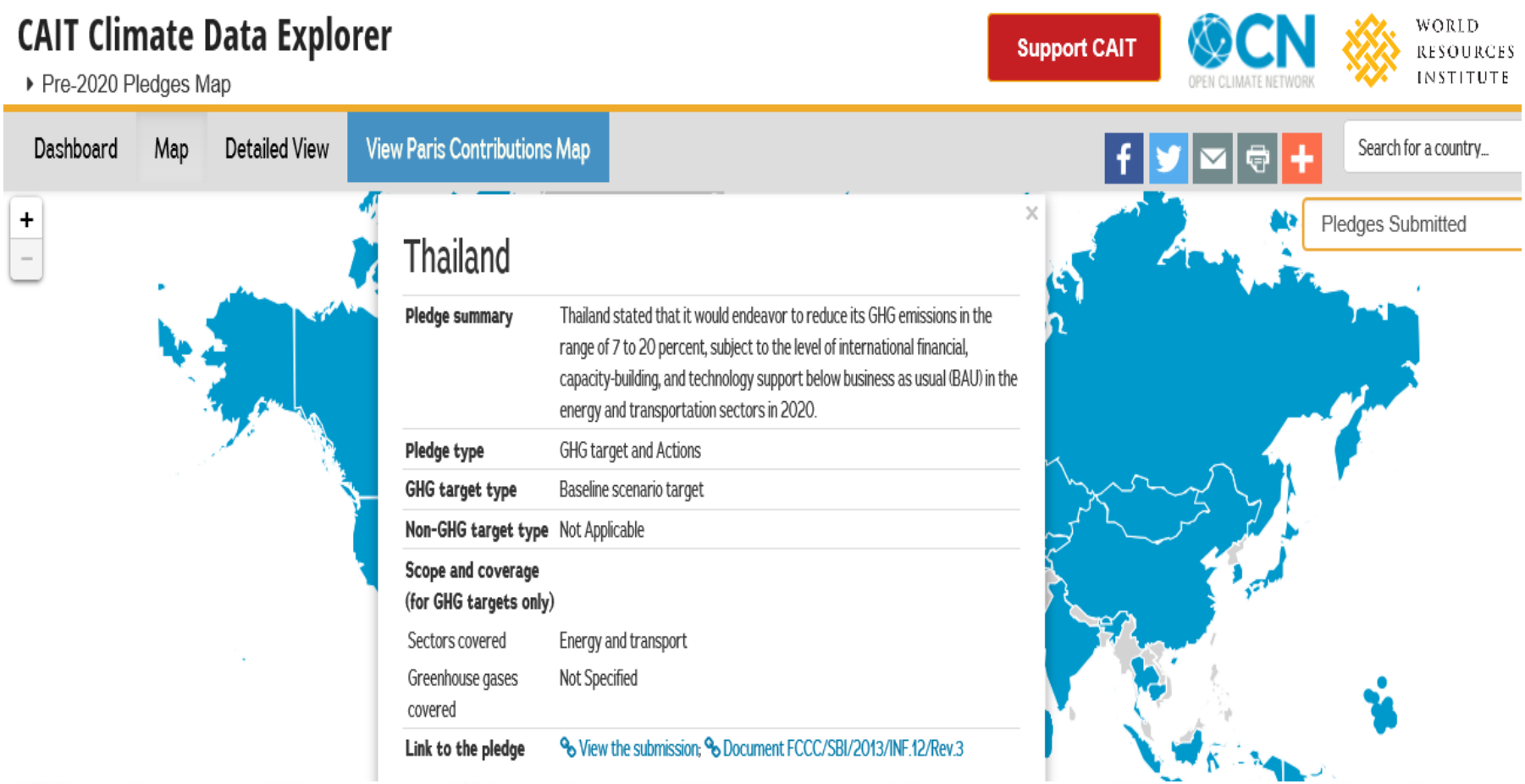
Thailand's mitigation action

- As non-annex I country on UNFCCC which has not obligate to any GHGs emission reduction target.

- Presently Thailand's NAMAs pledge aim to reduce GHGs emissions in 7% by 2020 in comparison with business-as-usual.

- Thailand intends to reduce its greenhouse gas emissions by 20 percent from the projected business-as-usual (BAU) level by 2030 (approx. 555 $MtCO_2$ eq).

Thailand's NAMAs pledge



NAMAs Pledge content

- Thailand will endeavour, on a voluntary basis, to reduce its greenhouse gas emissions by 7–20 per cent below the 'business as usual' scenario in the energy and transport sectors by 2020, subject to the level of international support received in the form of technology development and transfer, finance and capacity-building for the preparation and implementation of NAMAs.

These NAMAs will include the following measures:

- Development of renewable and alternative energy sources;
- Energy efficiency improvement in industries, buildings, transportation and power generation;
- Bio-fuels in transportation; and
- Environmentally sustainable transportation system.

Intended Nationally Determined Contribution (INDC)

Submission by Thailand

Intended Nationally Determined Contribution and Relevant Information

As a developing country highly vulnerable to the impacts of climate change, Thailand attaches great importance to the global efforts to address this common and pressing challenge. Pursuant to decisions 1/CP.19 and 1/CP.20, Thailand hereby communicates its intended nationally determined

Thailand intends to reduce its greenhouse gas emissions approx. 555 $MtCO_2$ eq.

projected business-as-usual (BAU) level by 2030.

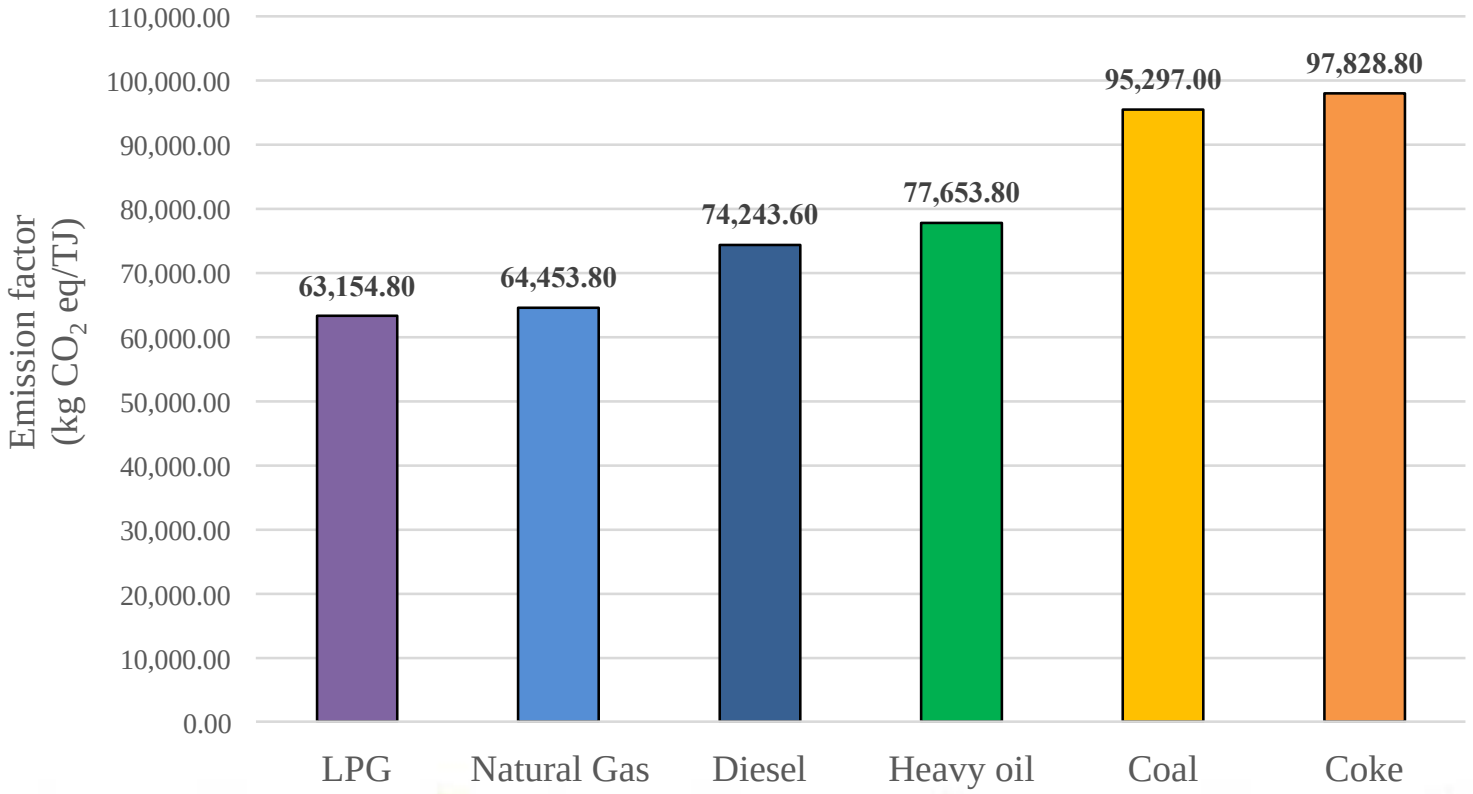
The level of contribution could increase up to 25 percent, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support through a balanced and ambitious global agreement under the United Nations Framework Convention on Climate Change (UNFCCC).

Thailand's INDC based on the following :

- National Economic and Social Development Plans
- Climate Change Master Plan B.E. 2558–2593 (2015-2050)
- Power Development Plan B.E. 2558–2579 (2015-2036)
- Thailand Smart Grid Development Master Plan B.E. 2558-2579 (2015-2036)
- Energy Efficiency Plan B.E. 2558–2579 (2015-2036)
- Alternative Energy Development Plan B.E. 2558–2579 (2015-2036)
- Environmentally Sustainable Transport System Plan B.E.2556–2573 (2013-2030)
- National Industrial Development Master Plan B.E. 2555–2574 (2012-2031)
- Waste Management Roadmap

Energy: **Fuel**

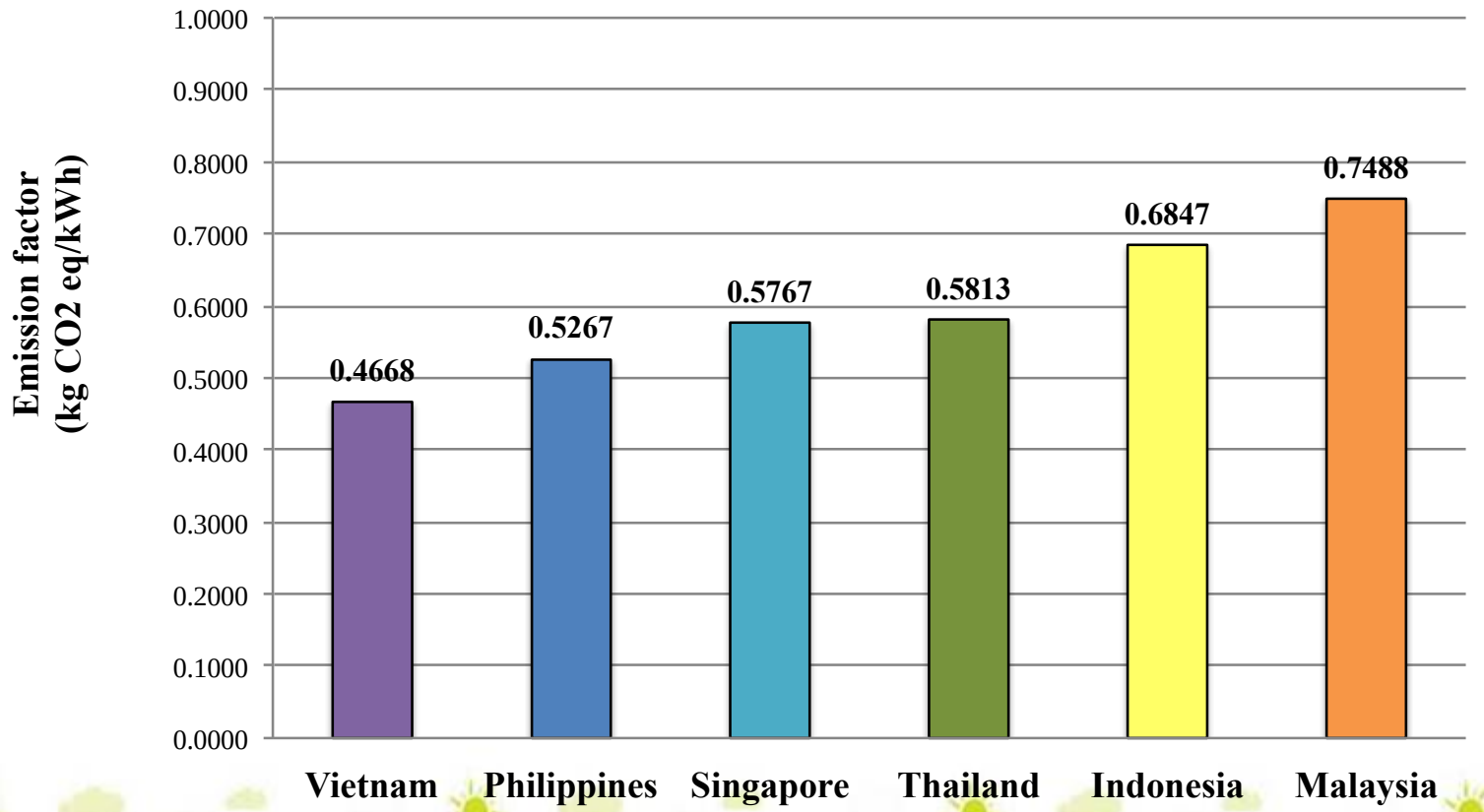
$$CO_2 emission_{(fuel)} = Activity \times EF_{(fuel)}$$



Source: 2006 IPCC Guideline, Chapter 2 Stationary Combustion
Thailand Greenhouse Gas Management Organization. 2014.

Energy: **Electricity**

$$CO_2\ emission_{(electricity)} = Activity \times EF_{(electricity)}$$



Source: [a]The Ecometrica (UK)
[b]Thailand Greenhouse Gas Management Organization. 2014.

Industry target of mitigation

- Mineral
- Chemical
- Metal industry

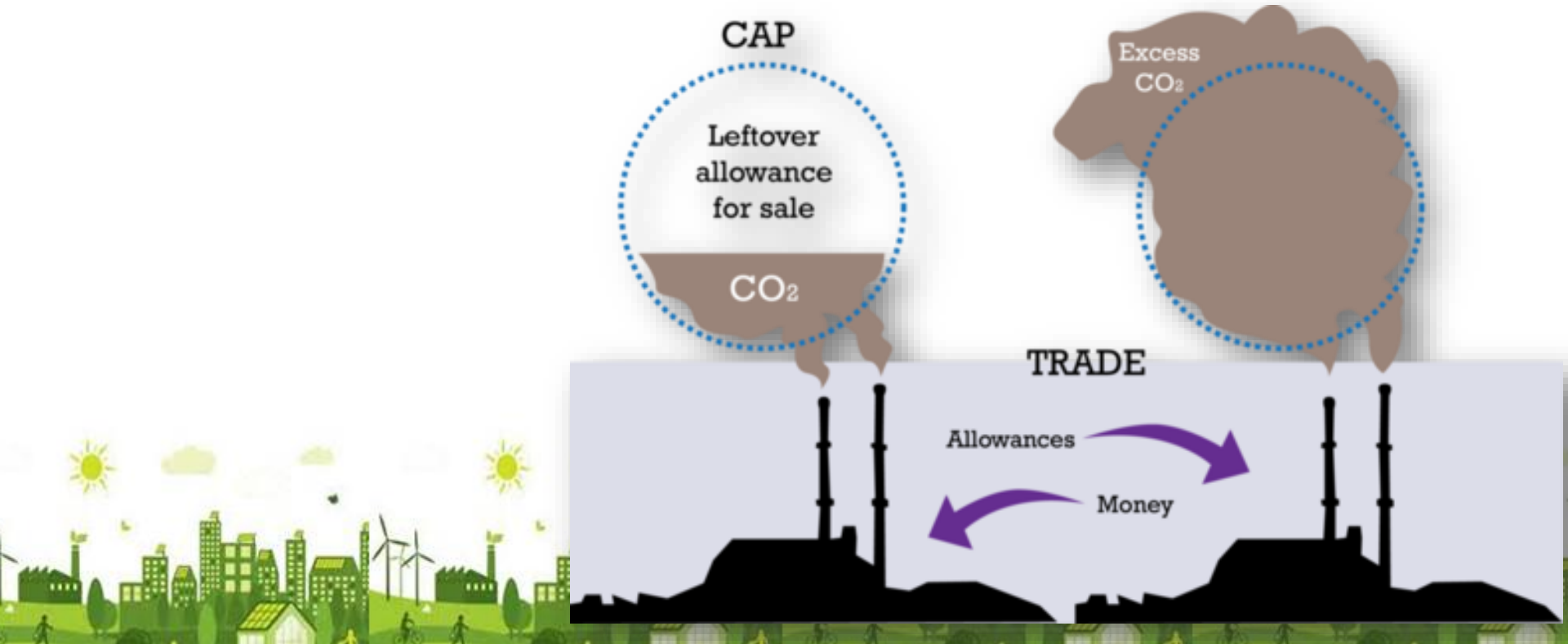
Table 2-1 National greenhouse gas inventory of Thailand for 2000 (thousand tons or gigagrams)

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4	N_2O	NO_x	CO	NMVOCs	SO_x
Total national emissions and removals	210,231.2	-52,374.0	2,801.5	40.0	907.0	5,624.4	759.5	618.8
1. Energy	149,914.6	0.0	413.9	2.5	873.3	4,773.0	668.1	605.7
A. Fuel combustion (sectoral approach)	149,914.6		164.8	2.5	873.3	4,773.0	668.1	605.7
1. Energy Industries	64,241.0		97.4	0.5	181.3	703.7	168.1	52.2
2. Manufacturing industries and construction	30,305.8		7.5	1.0	105.6	684.7	13.0	514.4
3. Transport	44,438.7		6.6	0.4	450.4	2,071.1	393.0	6.2
4. Other sectors	10,929.0	0.0	53.3	0.6	136.0	1,313.6	93.9	32.9
B. Fugitive emissions from fuels	0.0		249.1		0.0	0.0	0.0	0.0
1. Solid fuels			32.0		0.0	0.0	0.0	0.0
2. Oil and natural gas			217.1		0.0	0.0	0.0	0.0
2. Industrial processes	16,059.3	0.0	6.4	0.6	1.2	6.3	91.4	13.1
A. Mineral products	16,052.6				0.0	0.0	5.5	7.7
B. Chemical industry	0.0		6.4	0.6	0.2	2.6	51.2	0.8
C. Metal production	6.6		0.0	0.0	0.1	0.0	0.0	0.1
D. Other production	0.0		0.0	0.0	1.0	3.7	34.7	4.6
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other	0.0		0.0	0.0	0.0	0.0	0.0	0.0
3. Solvent and other product use	0.0			0.0			0.0	

Cap-and-Trade system

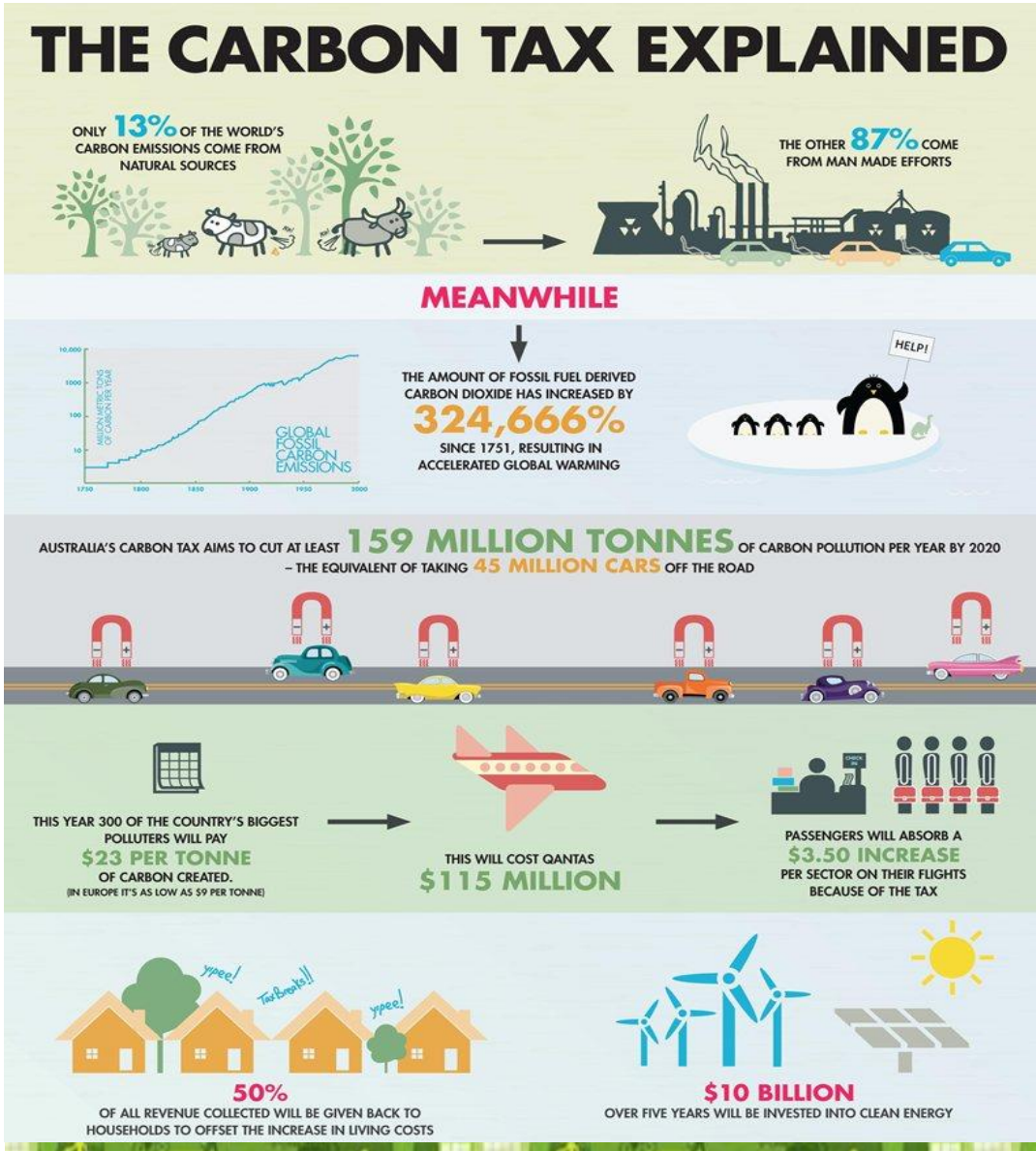
- curbs emissions by limiting the quantity of a pollutant (e.g., carbon dioxide [CO_2]) that can be emitted and then allocating a corresponding number of tradable emissions permits to sources covered by the program.



Thailand Voluntary Emission Reduction Program (T-VER)

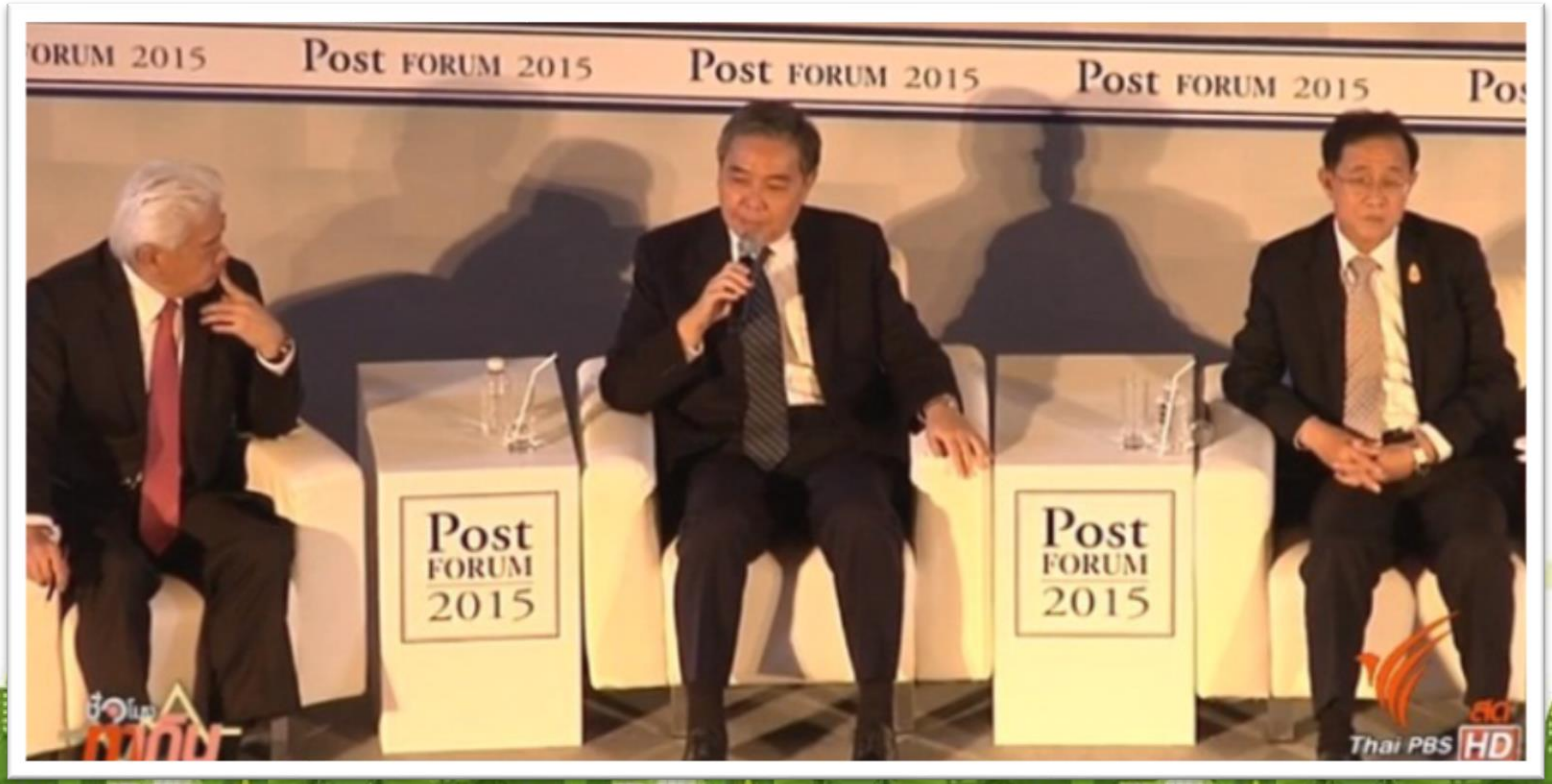
Carbon Tax

- curbs emissions by raising the price of fossil fuels based on their carbon content.



Thailand introducing new Eco-Sticker and CO_2 based taxation scheme to promote fuel economy

- The CO2 ratings of new vehicles will be used on 1 January 2016. The revised tax scheme is expected to encourage consumers to buy more efficient vehicles.



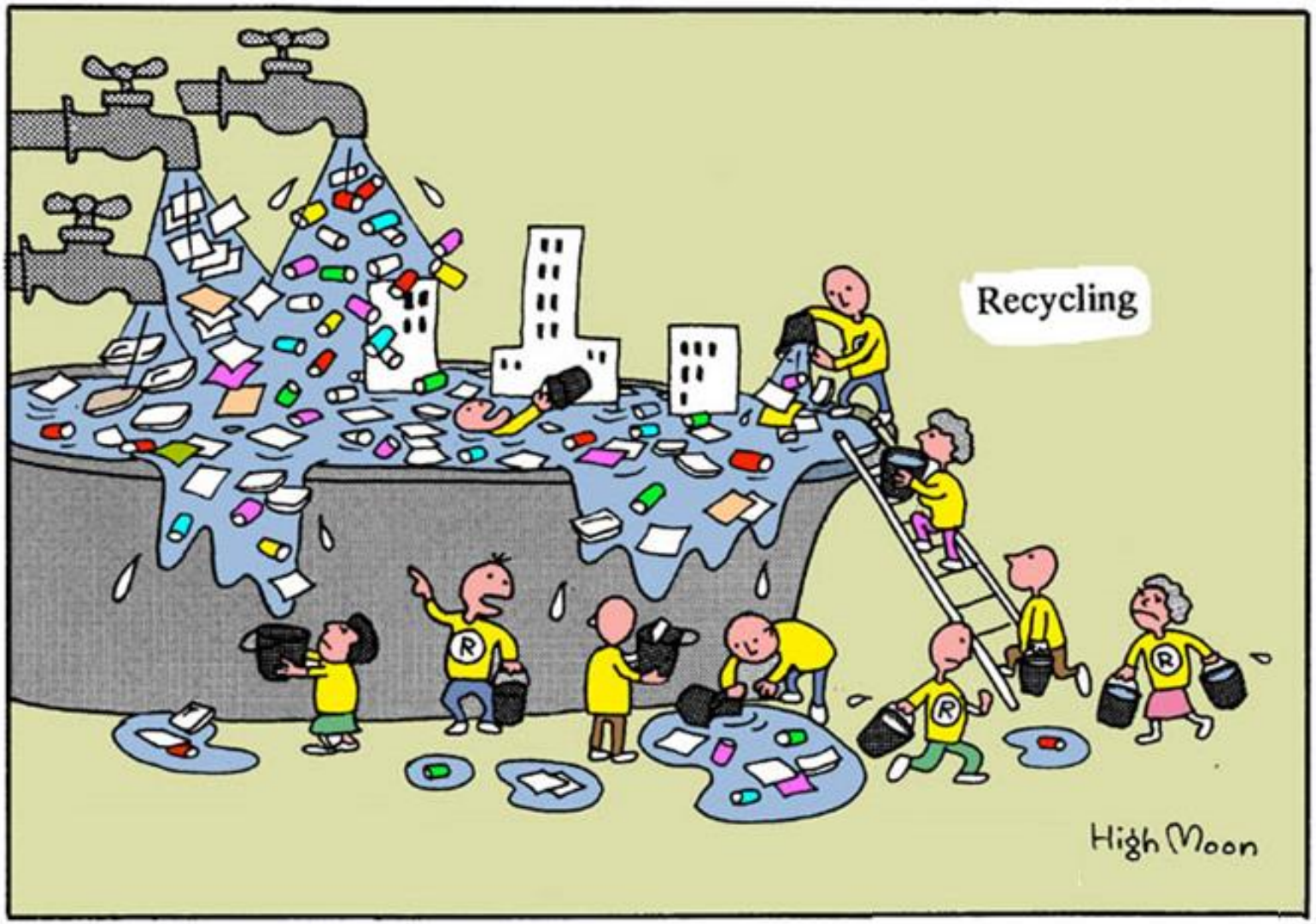
Comparison of Current Structure VS New Structure

Categories Of Vehicle	Tax Structure in Present				Tax Structure in Future			
	Engine Capacity (Horse Power)	Tax Rate (%)			CO_2	Tax Rate (%)		
		E10	E20	E85		E10/E20	E85/NGV	Hybrid
Passenger Vehicles								
-Passenger Vehicles and, Vans less than 10 seats	≤2,000 CC	30	25	22*	≤ 100 g/km	} 30*	} 25	10
	2,001-2,500 CC	35	30	27	101-150g/km			20
	2,501-3,000 CC	40	35	32	151-200 g/km	35	30	25
					>200 g/km	40	35	30
	>3,000 CC (เกิน 220 HP)	50	50	50	>3,000 CC	50	50	50
PPV / DC /Space Cab/Pick Up	≤3,250 CC	20/12/ - /3,18			≤ 200 g/km	25*/12/5/3,18		
					>200 g/km	30/15/7/5,18		
	>3,250 CC	50			>3,250 CC	50		
Eco Car (Benzine/Diesel) / E85	1,300/1,400 CC	17			≤100 g/km	14*/12		
					101-120 g/km	17/17		
Electric Vehicle /Fuel Cell/ Hybrid	≤ 3,000 CC	10				10		
		10				**		
	>3,000 CC	50			>3,000 CC	50		
NGV-OEM	≤ 3,000 CC	20				**		
	>3,000 CC	50			>3,000 CC	50		

Remarks * : Assign safety standard for Active Safety (ABS+ESC) for Passenger Vehicles and, Vans less than 10 seats must obtain CO_2 ≤150 g/km / PPV must obtain CO_2 ≤200 g/km / Eco Car must obtain CO_2 ≤100 g/km

** Depend on CO_2 emission

* less than 1,780 CC but not over 2,000 CC



Thank you for your attention