Emission Inventory in Jabodetabek

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Activity Summaries

Emission Inventory

- Sectors included: Transport, Industry, Power Plant, residential & Commercial, waste sector and construction
- Baseline Emission Inventory for All Sector
- Baseline Emission Inventory for Transport Sector
- Evaluating Key levers for Transport Sector
- Evaluating key levers ion for Transport, Industry, and Power Sector
- Source Contribution of Each Area in JABODETABEK

- **Spatial Distribution**
- **conclusion**

Methodology

General Equation to calculate the emission load

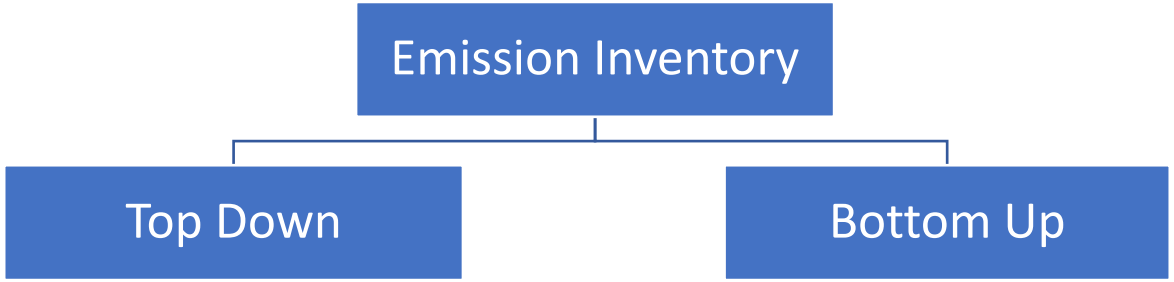
$$Emission = \sum_{abcd} (EF_{abcd}(1-\eta_{abcd})X_{abcd}) * Activities_{abcd})$$

Emission	:	Total emission
EF	:	Emission Factor (Mass per unit activities in g/km, g/L or g/joule
Activities	:	Average Activities (fuel/energy consumption)
η	:	Removal efficiency of emission control technology
x	:	Penetration of the control technology

This study is using emission factor from *Greenhouse Gas - Air Pollution Interactions and Synergies* (GAINS model)

Methodology

Emission Inventory Approaches



Based on energy used/ **energy consumption**

Activity Data includes:

- Overall energy consumption (from Residential, Commercial, Industry, Power Plant, Construction, and transport sector)

Sources: Pertamina, MEMR, or other private company (PLN), KLH

Based on several **Activity Data** (for transport sector) such as:

- Vehicle population
- Fuel economy
- Vehicle kilometer travel

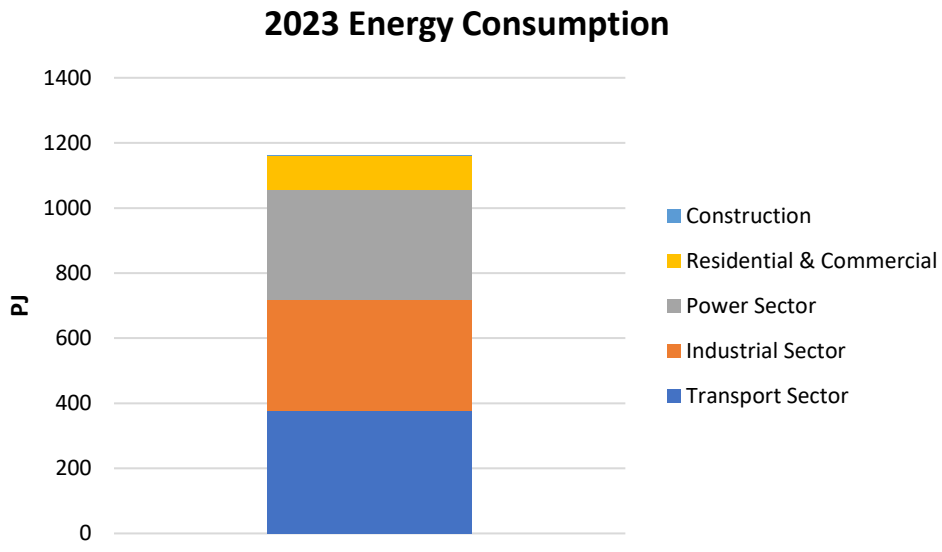
Sources: BPS, survey, and calculation. Korlantas

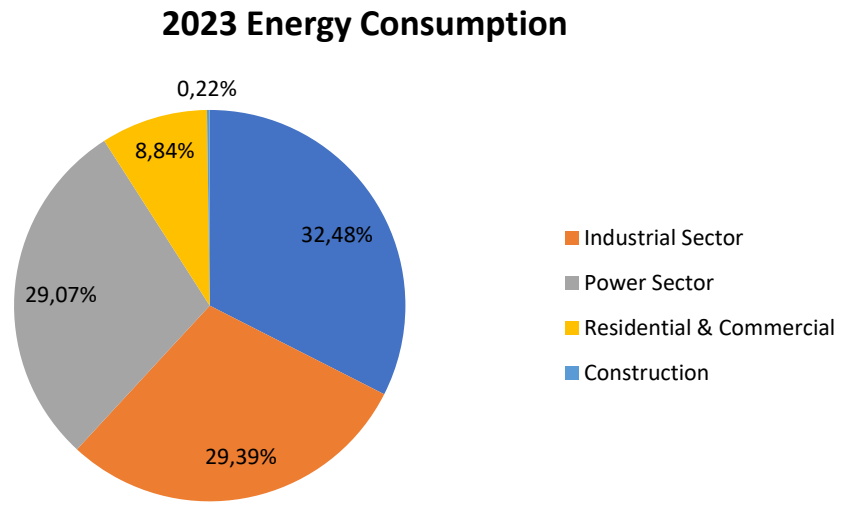
Activity Data

Sector	Activity Data	2023	Unit	Data Source
Industrial	Diesel	28.81	PJ	
	Kerosene	0.10	PJ	Ministry of Environment and Forestry, Dinas Lingkungan Hidup Provinsi DKI Jakarta
	Gasoline	27.73	PJ	
	Natural Gas	40.45	PJ	
	Hard Coal	264.93	PJ	
Power Generation	Middle Fuel Oil	0.18	PJ	
	Diesel	0.16	PJ	Ministry of Environment and Forestry, PLN Indonesia Power & PLN Nusantara Power
	Natural Gas	187.57	PJ	
	Coal	193.21	PJ	
Residential	LPG	60.74	PJ	BPH Migas & Pertamina
Commercial	Natural Gas	41.68	PJ	BPH Migas
Waste Management			Mt waste	
	Waste Generation	7.15		Central Bureau of Statistics, SIPSN by Ministry of Environment (Mt)
	Waste to Landfill	7.06	M waste	
	%Open Burning	1.20%		Riskesdas by Ministry of Health
	Open Burning	0.09	M waste	(Mt)
Waste Composition				
	Paper	17.2%		Central Bureau of Statistics
	Glass	1.5%		
	Metal	1.1%		
	Textile	0.9%		
	Food	49.9%		
	Wood	3.2%		
	Others	3.3%		
	Plastic	23.0%		
Construction	Total area of activity	0.38	M m2	Dinas Bina Marga Provinsi DKI Jakarta & Dinas Cipta Karya, Tata Ruang Dan Pertanahan DKI Jakarta
	Construction			Greenhouse Gas - Air Pollution Interactions and Synergies

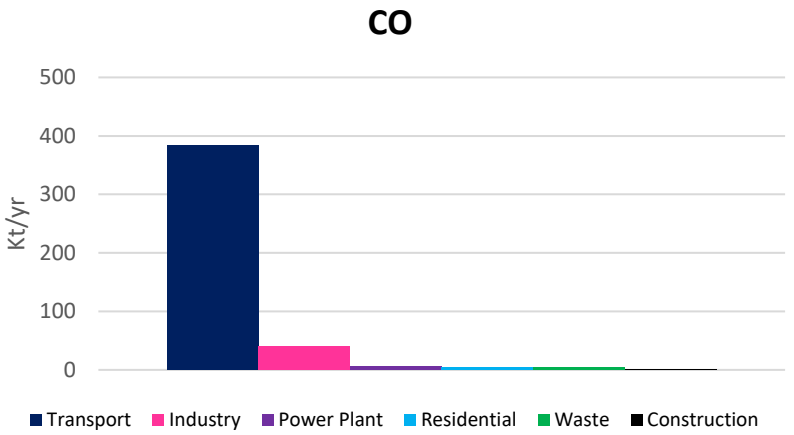
EMISSION INVENTORY JABODETABEK IN 2023 FOR ALL SECTOR

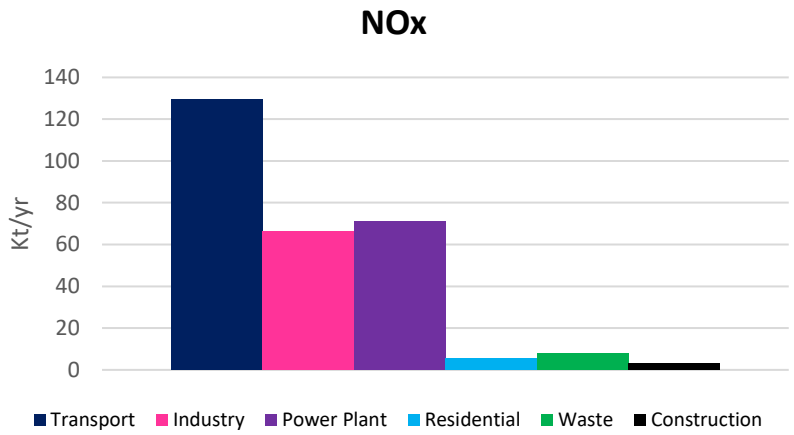
Energy Consumption Jabodetabek 2023

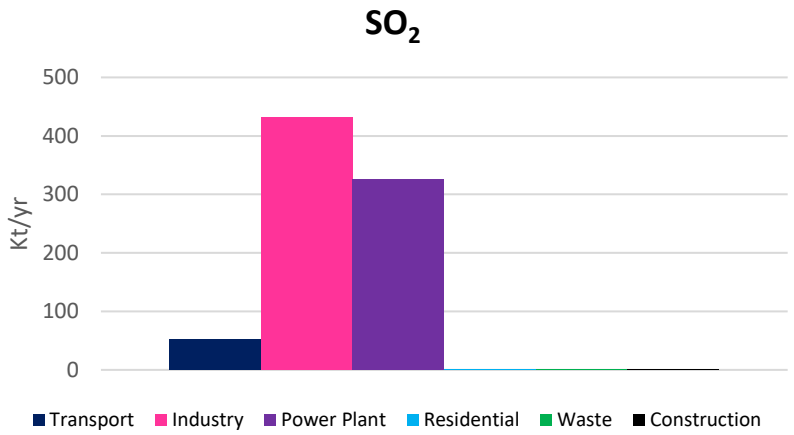


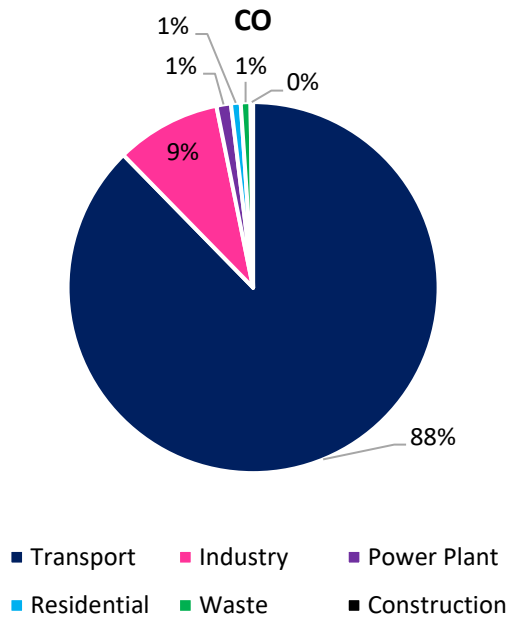


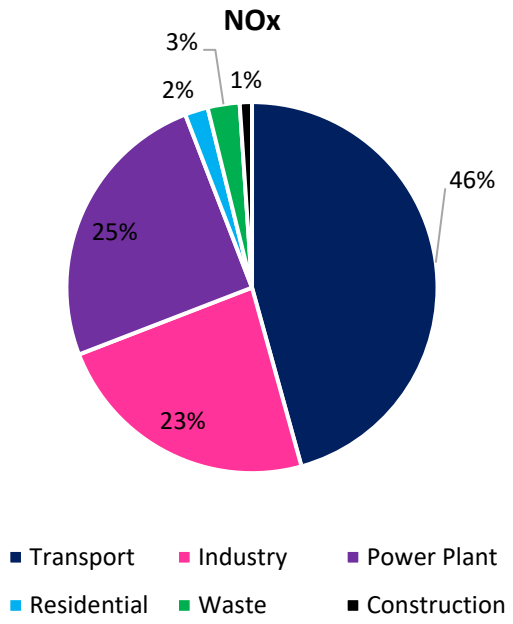
Emission Inventory 2023 All Sector

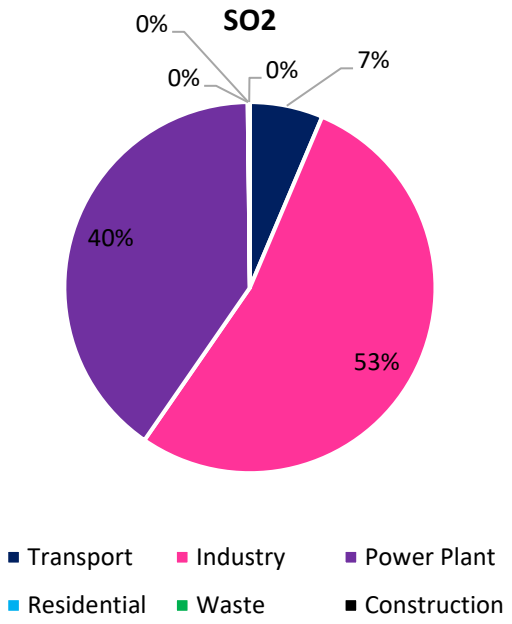




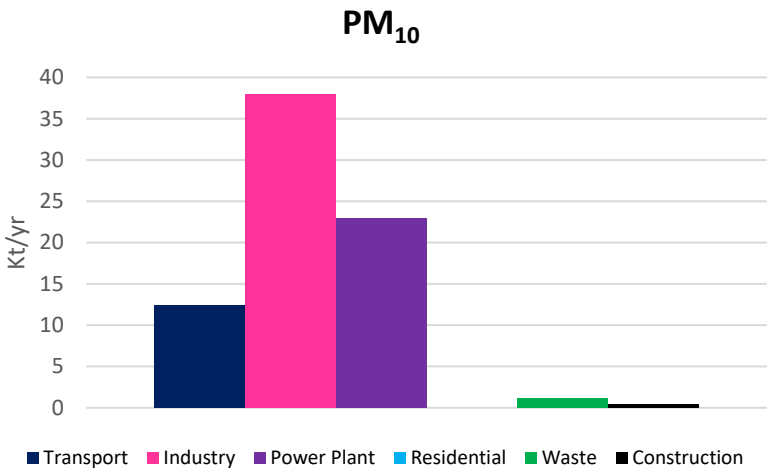


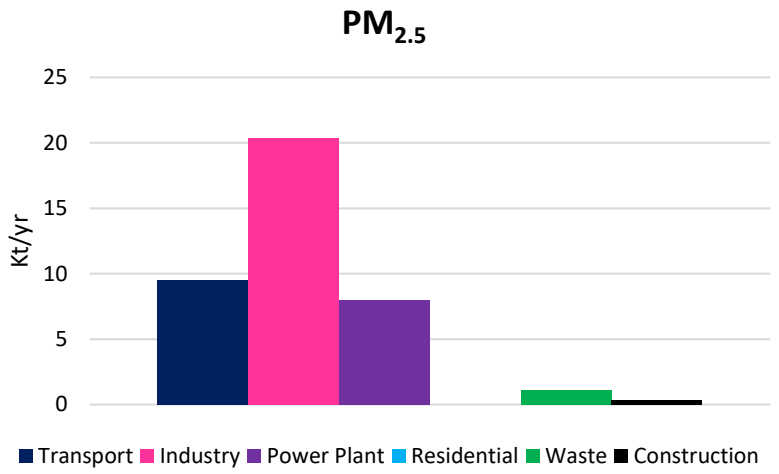


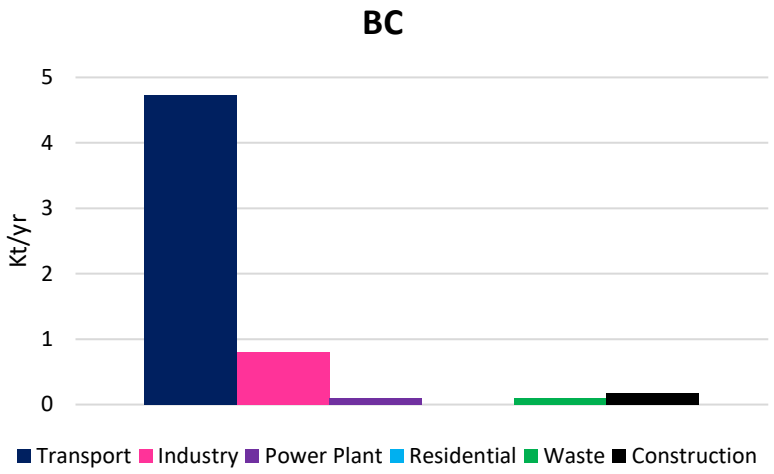


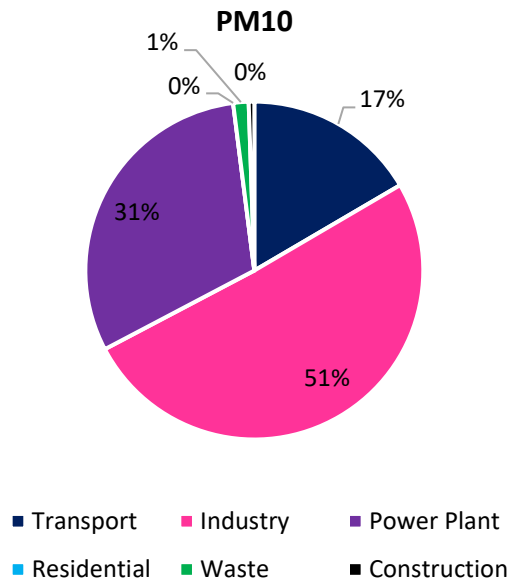


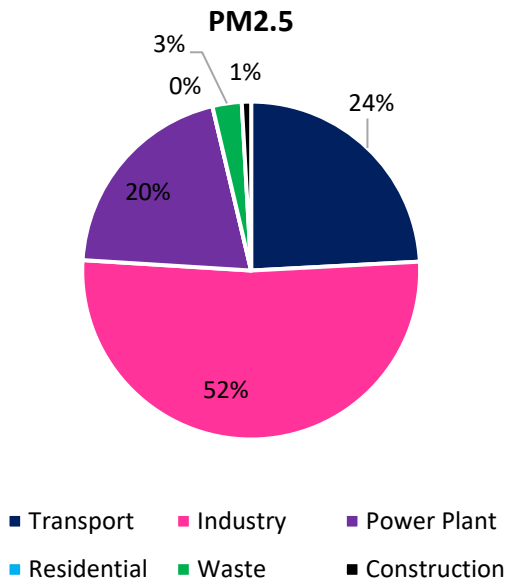
Emission Inventory 2023 All Sector

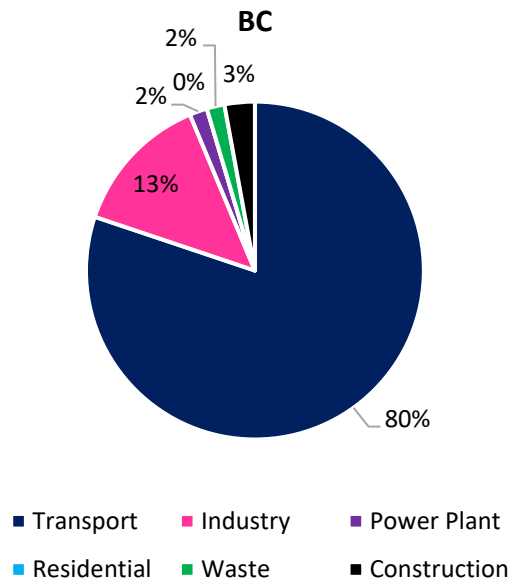




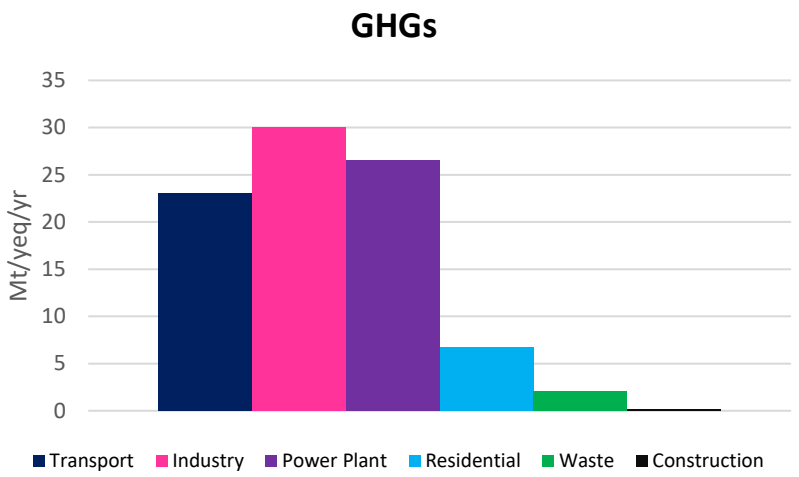


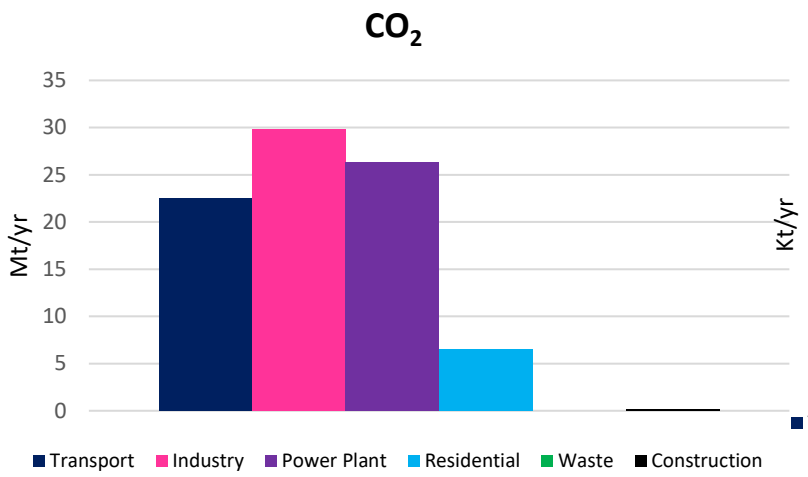


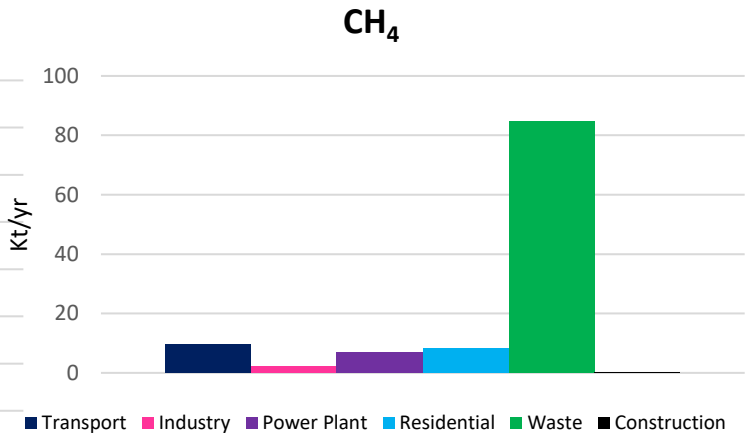


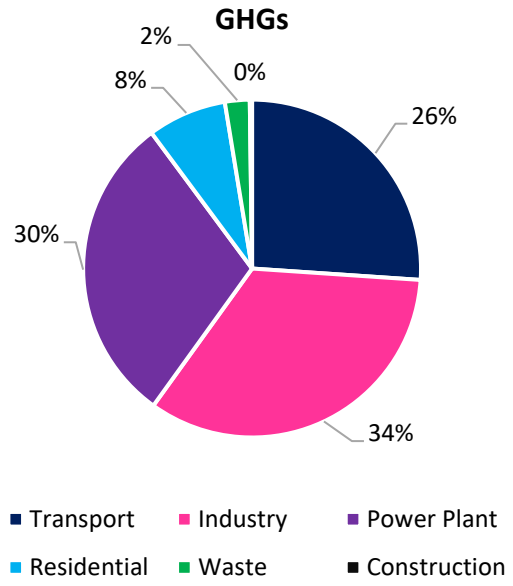


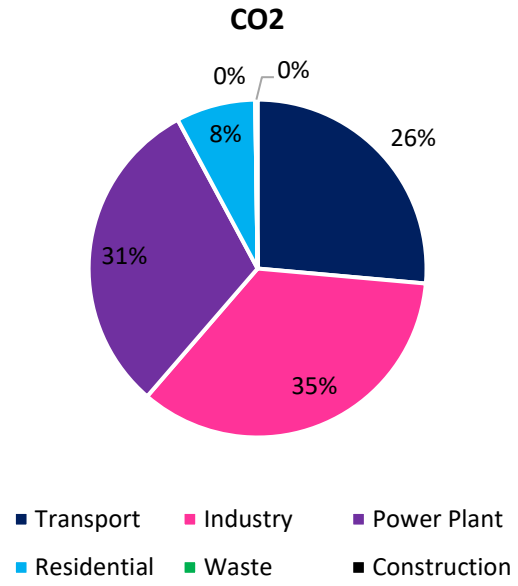
Emission Inventory 2023 All Sector

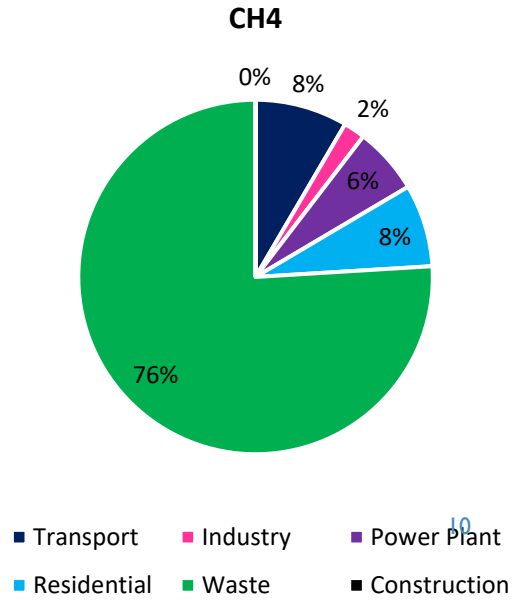




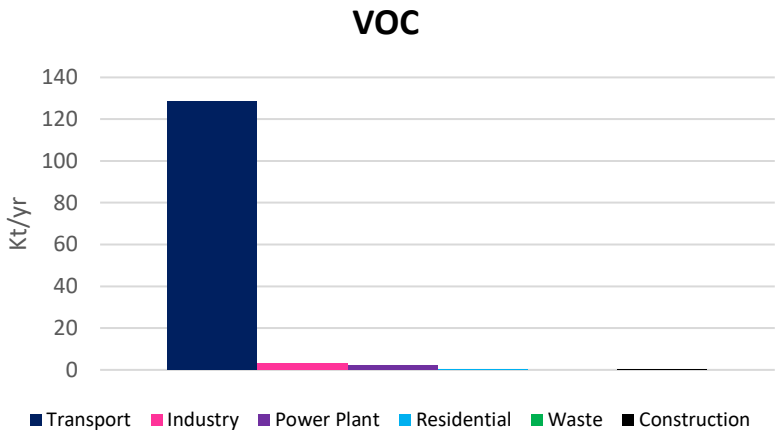


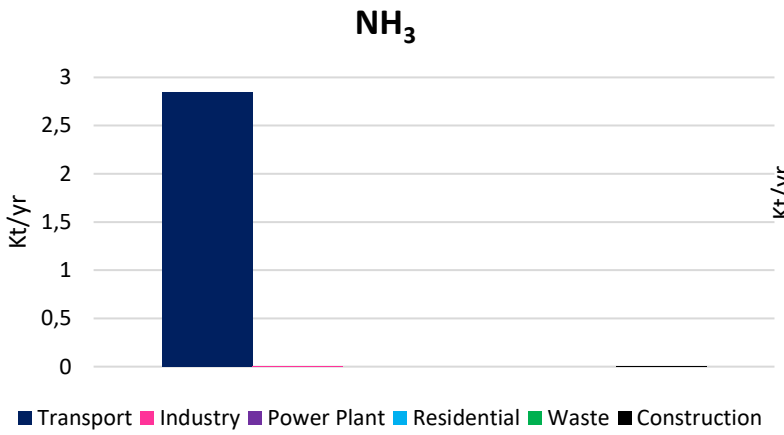


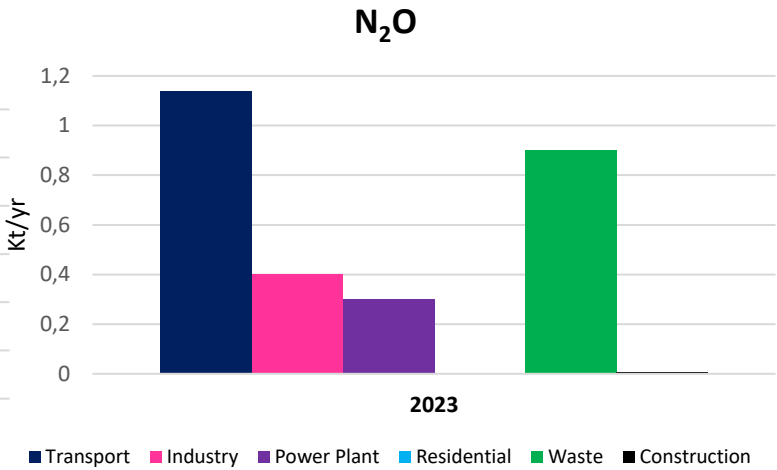


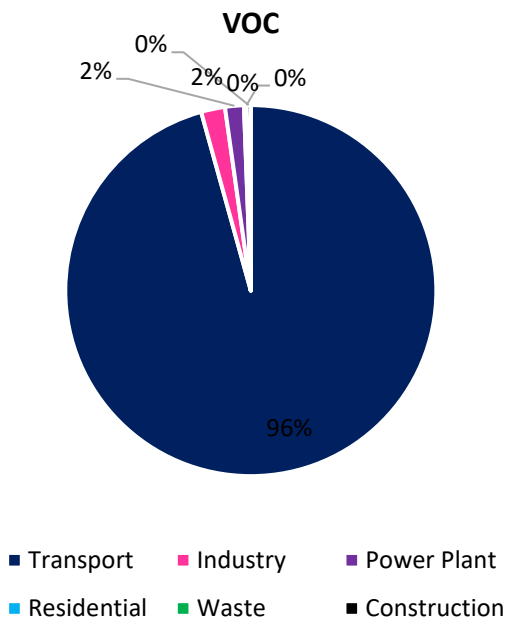


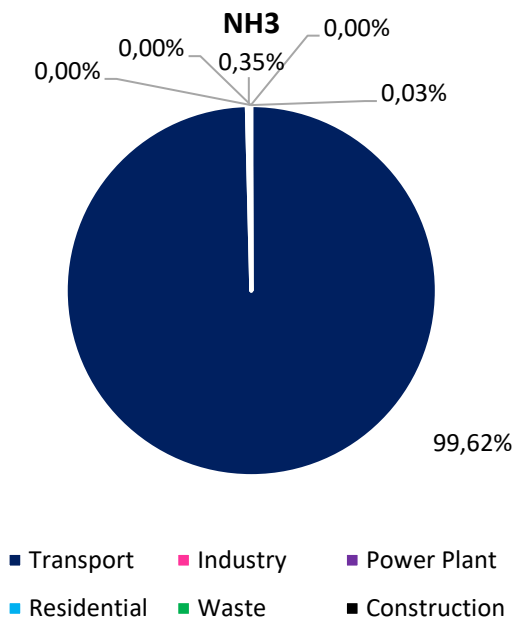
Air Pollutants Emission In 2023 All Sector

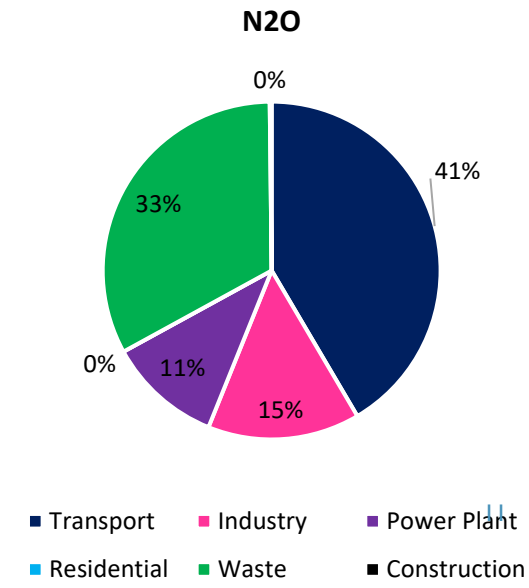






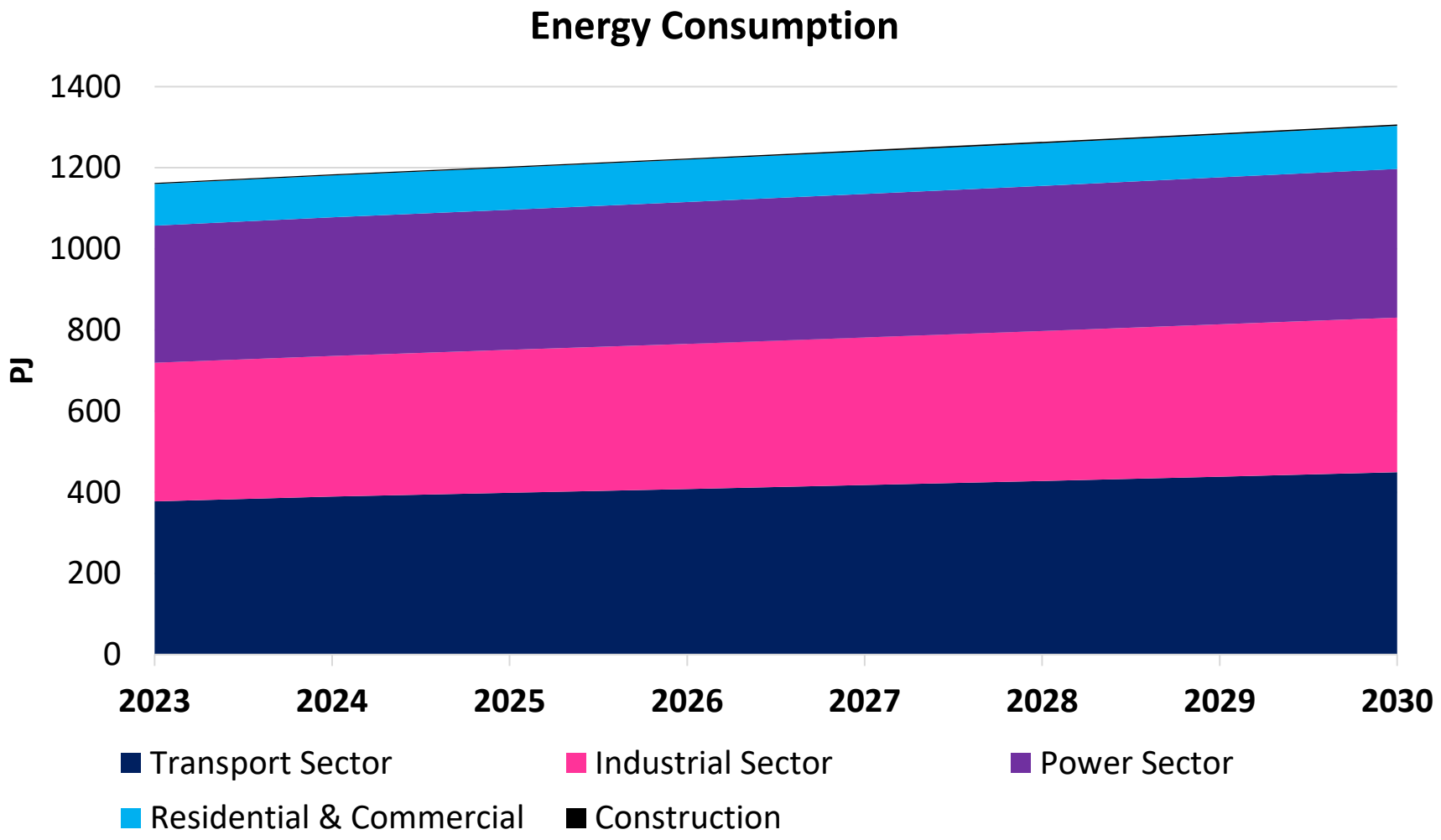




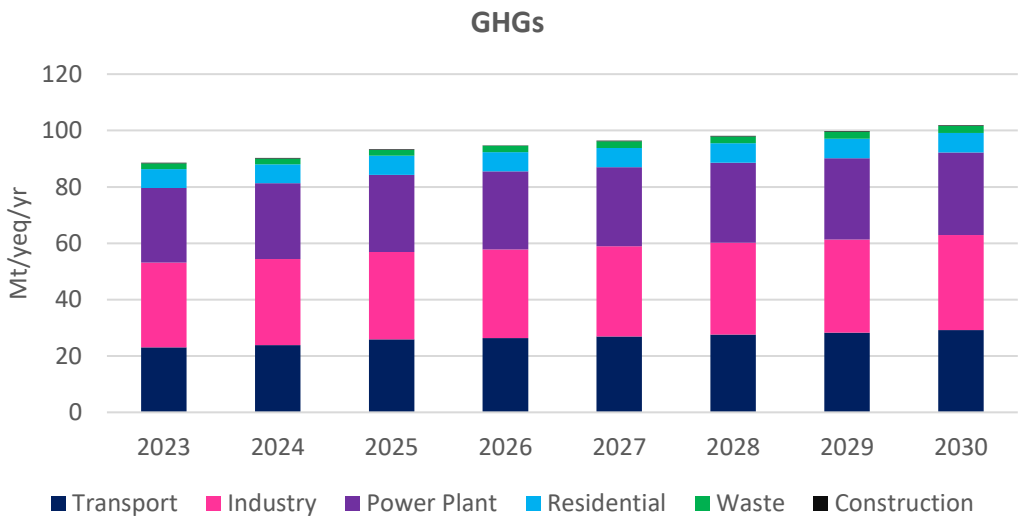


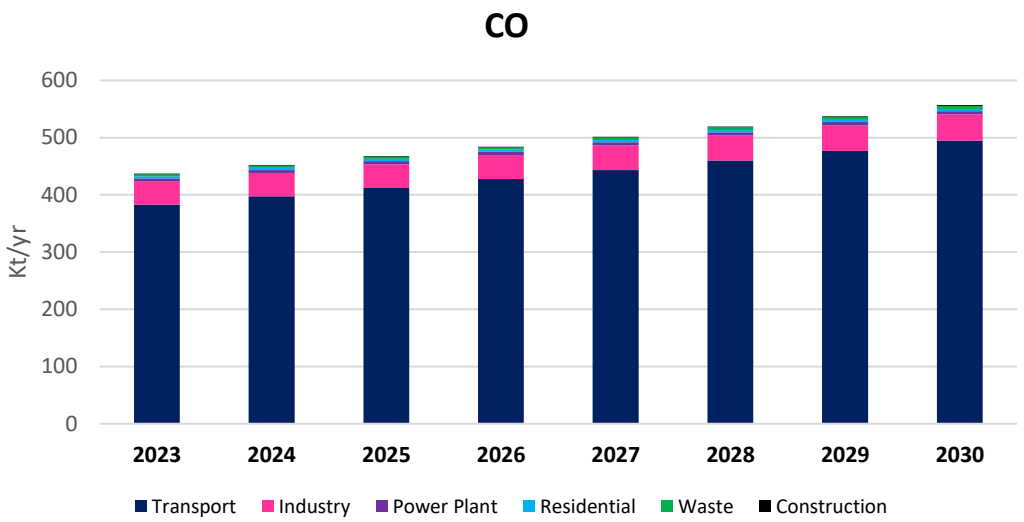
BASELINE ESTIMATED EMISSION UP TO 2030 FOR ALL SECTOR

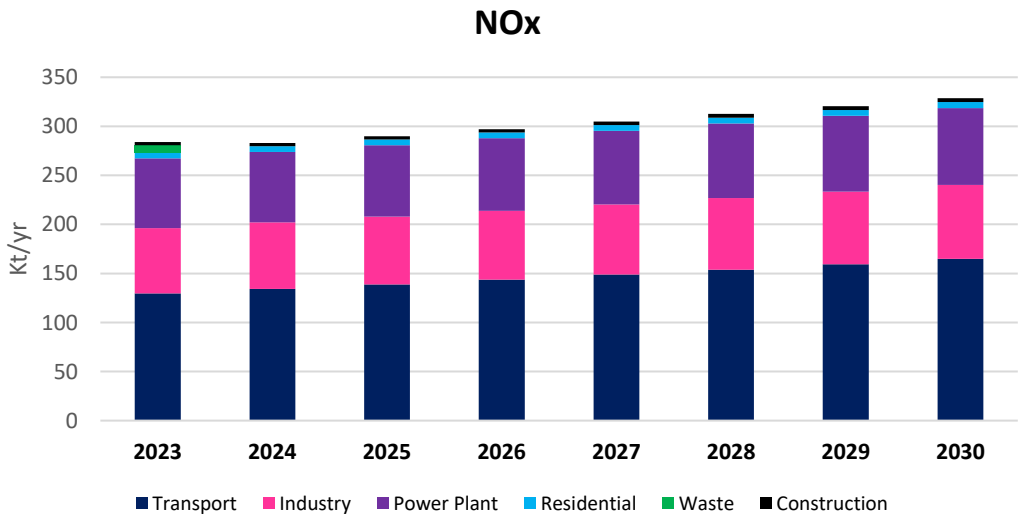
Energy Consumption 2023-2030

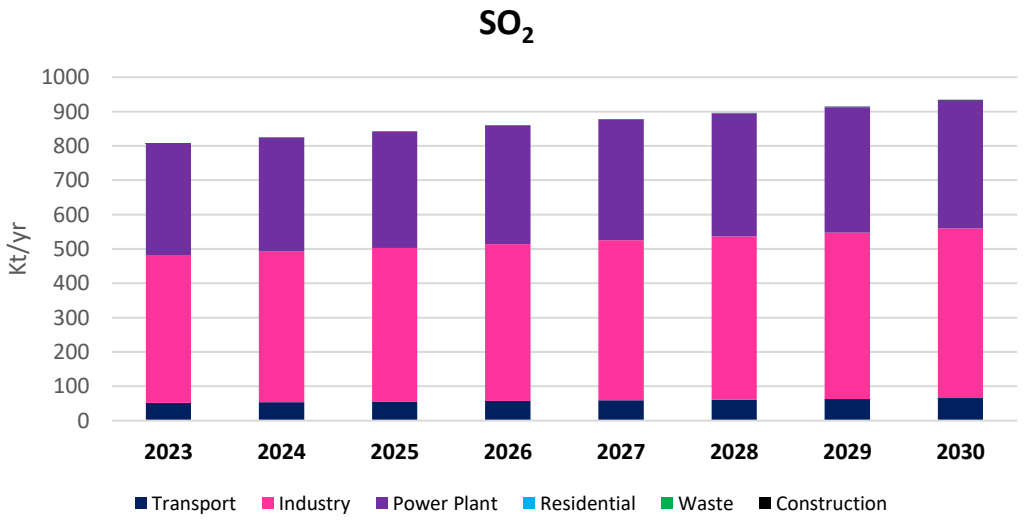


Estimated Emission (BAU) Up to 2030 for All Sector

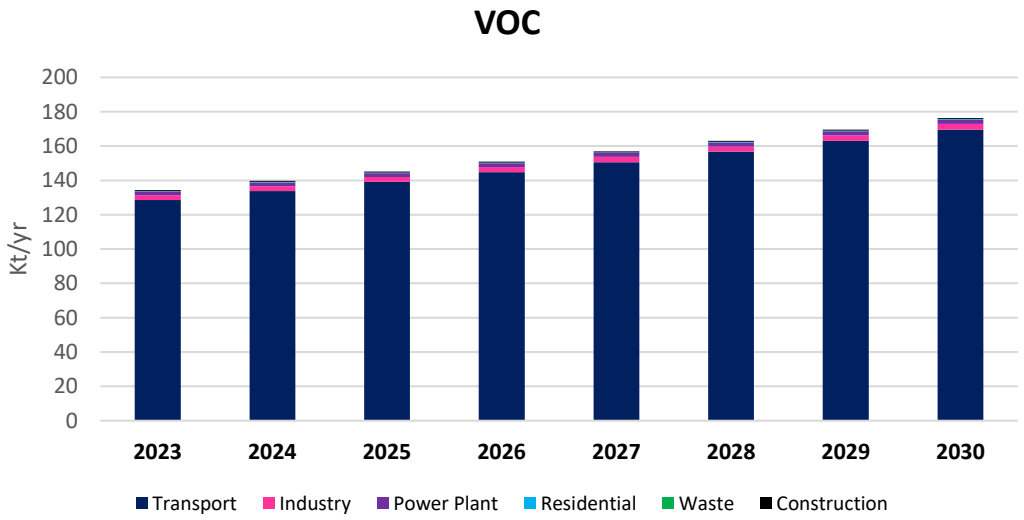


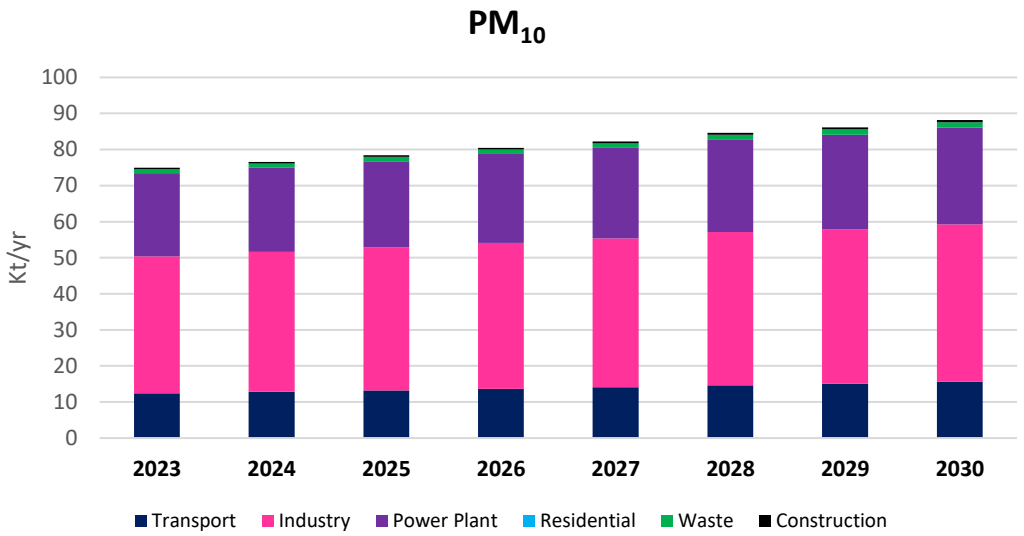


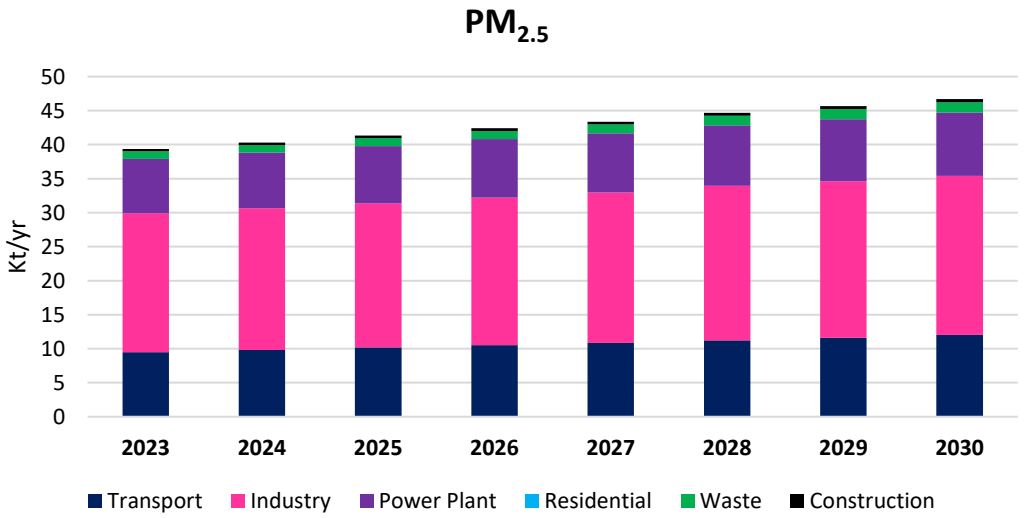


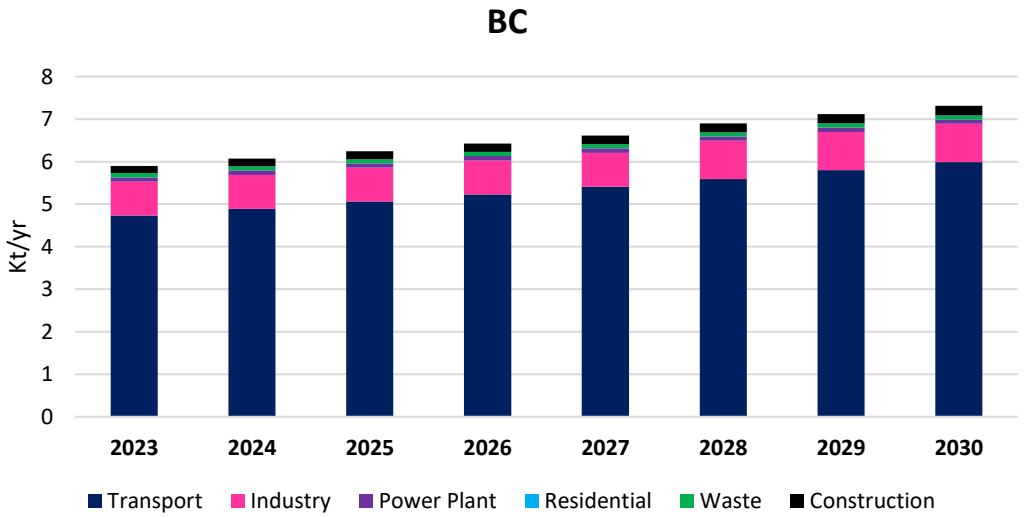


Estimated Emission (BAU) Up to 2030 for All Sector

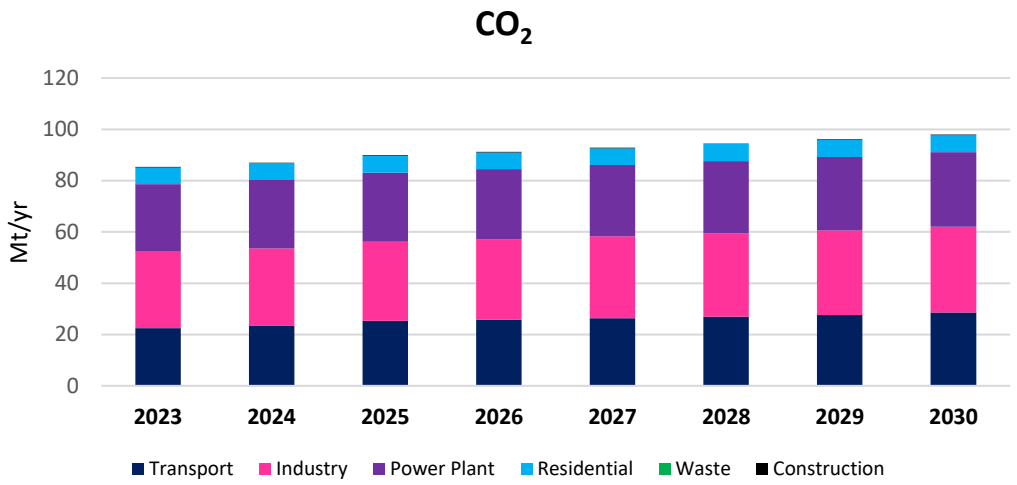


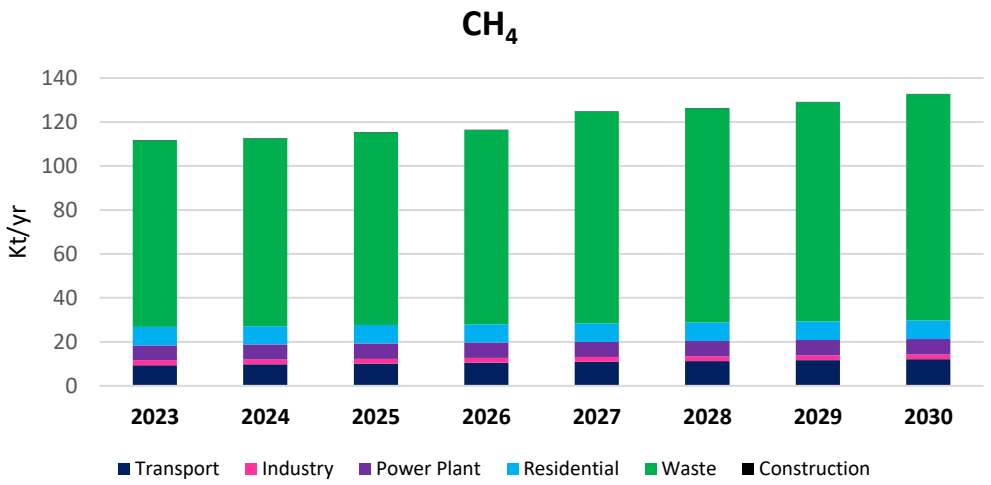


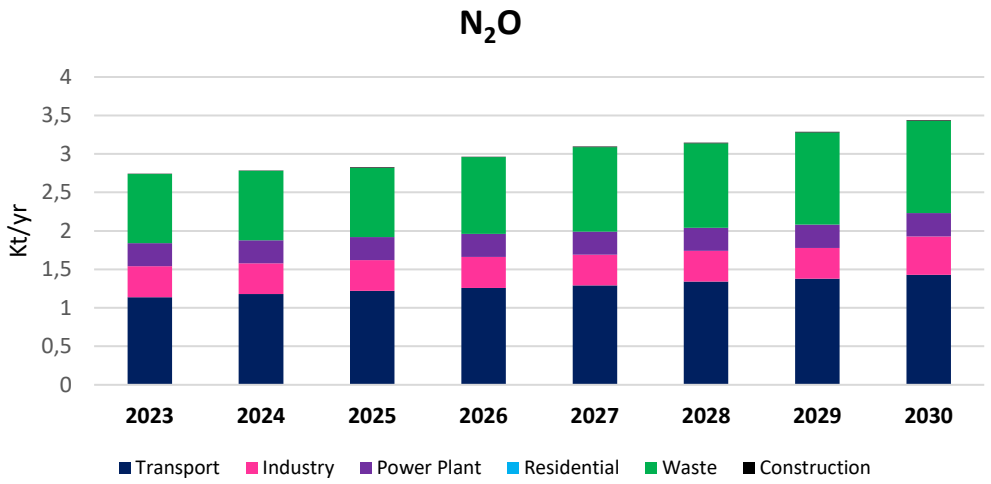


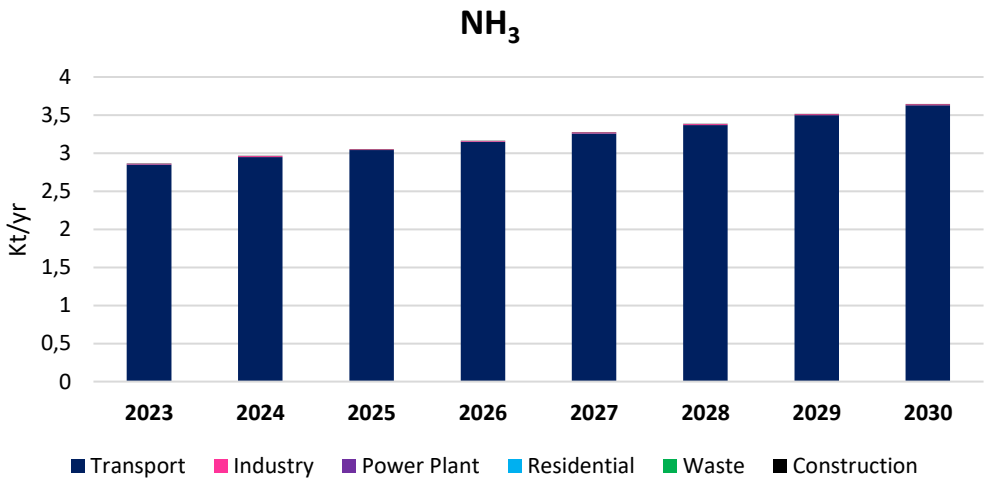


Estimated Emission (BAU) Up to 2030 for All Sector

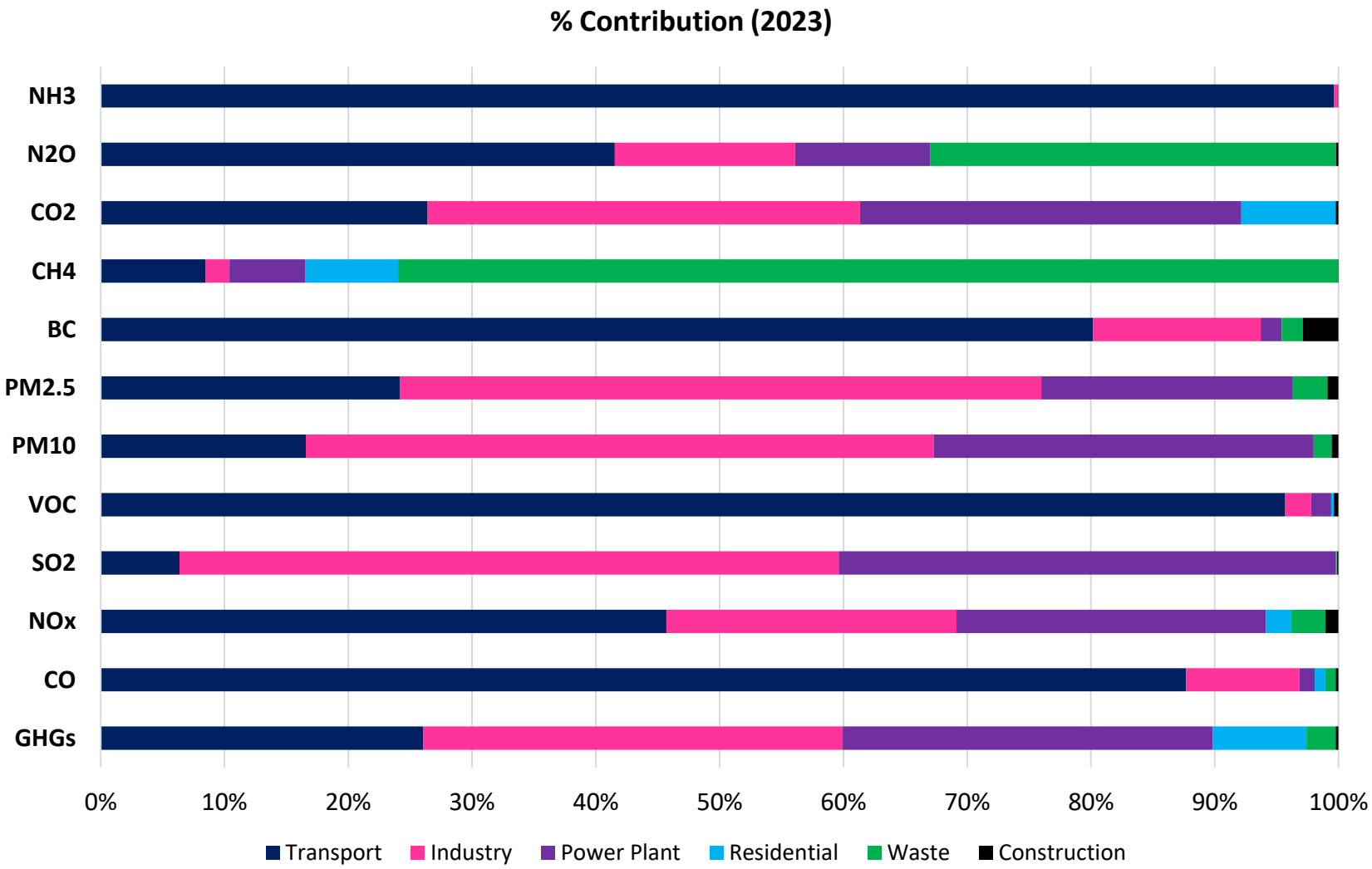






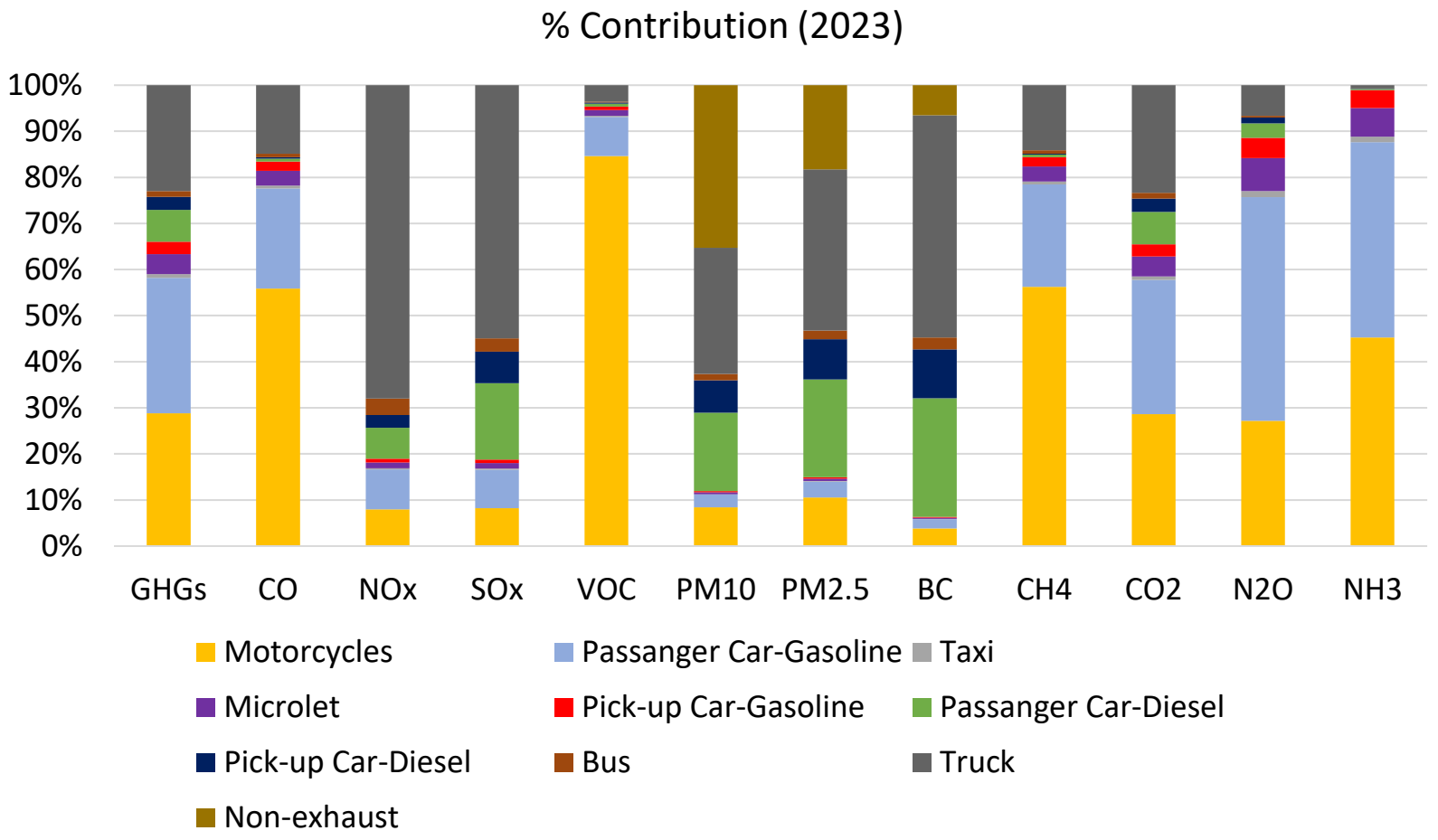


All Sectors 2023 Source Contribution

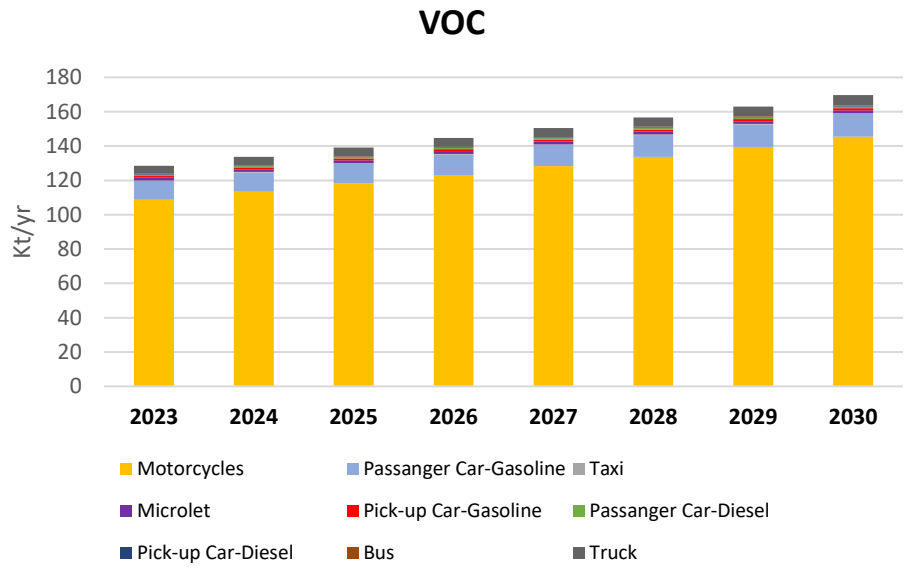


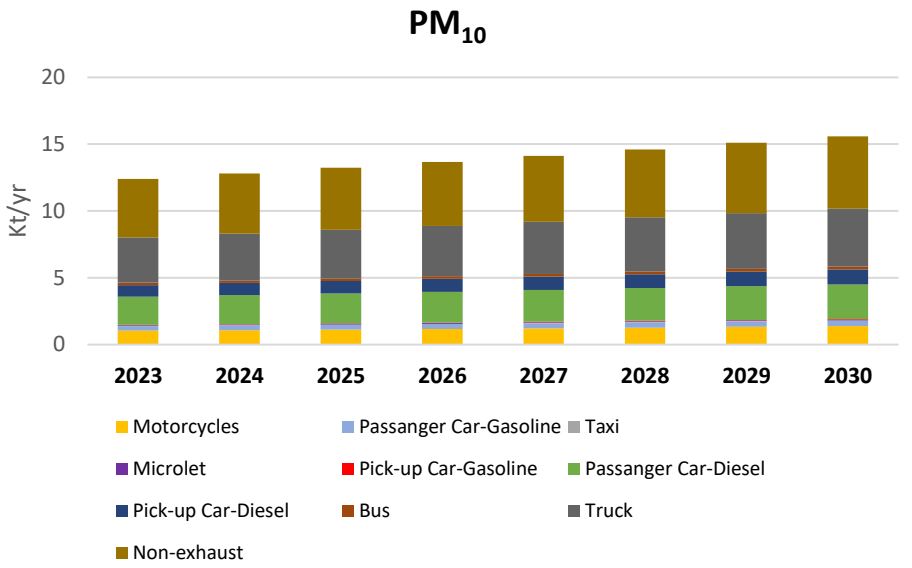
ESTIMATED EMISSION UP TO 2030 FOR TRANSPORT SECTOR

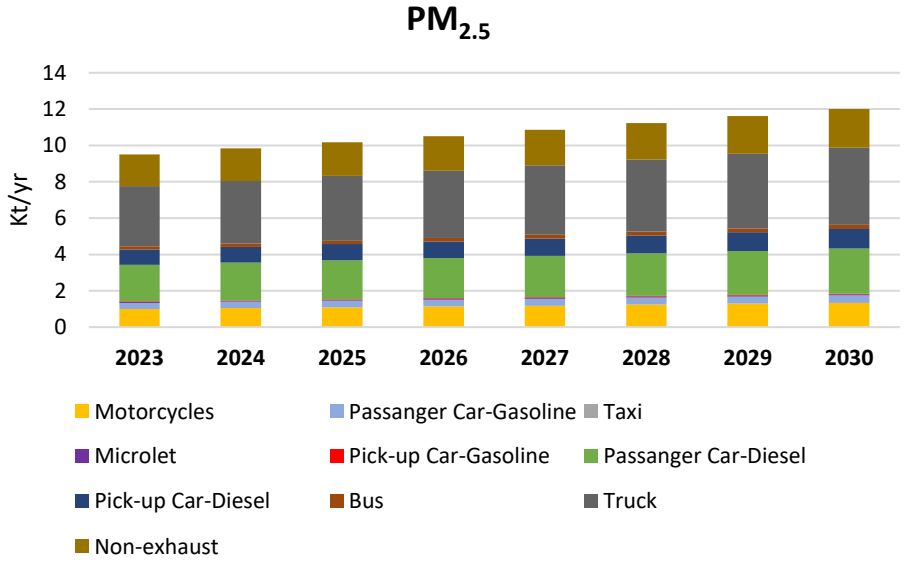
Contribution of each vehicle type in 2023 emission (%)

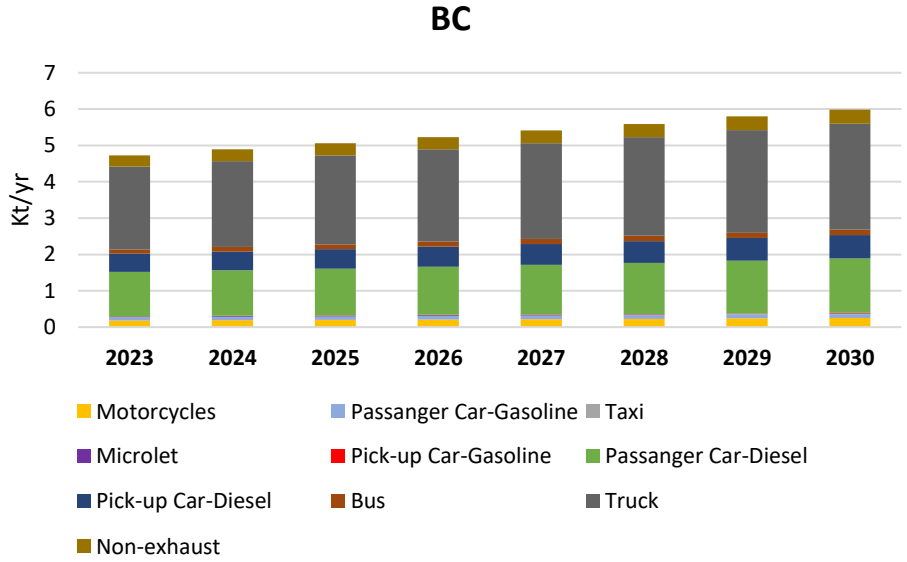


Estimated Emission Up to 2030 Transport Sector

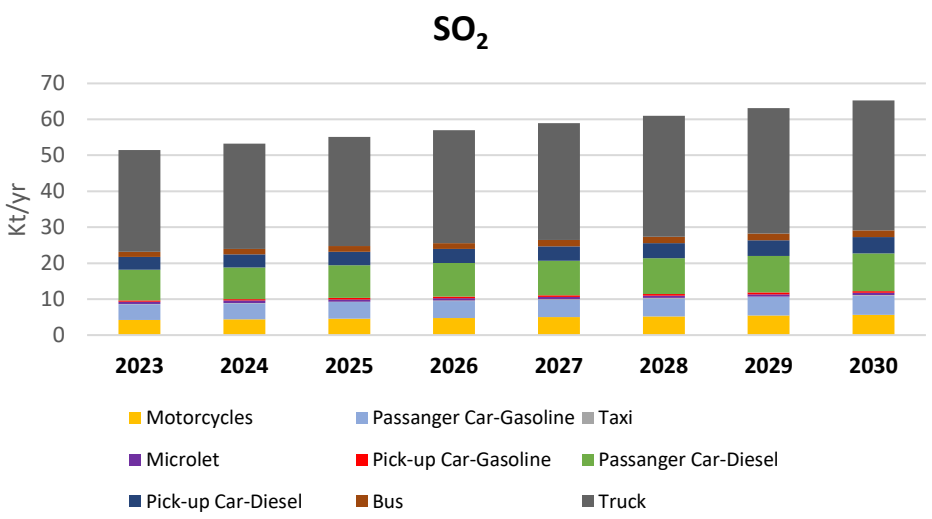


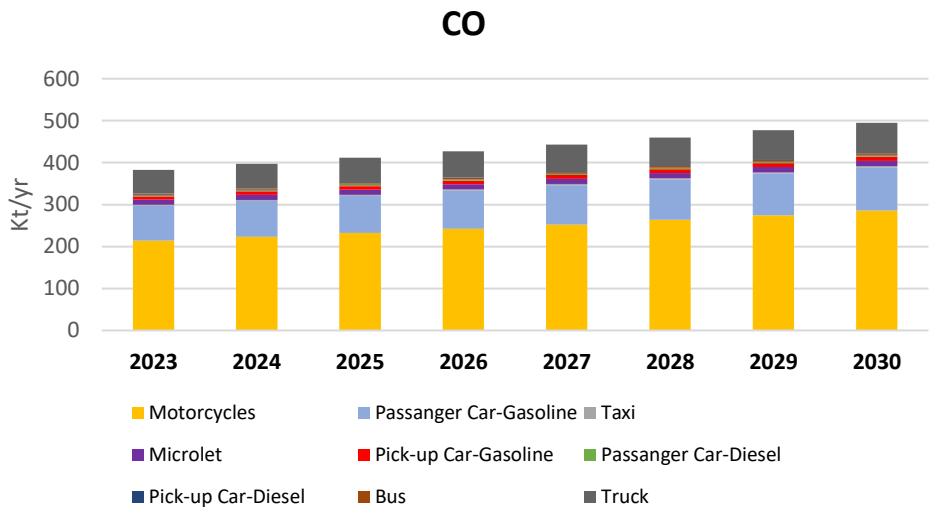


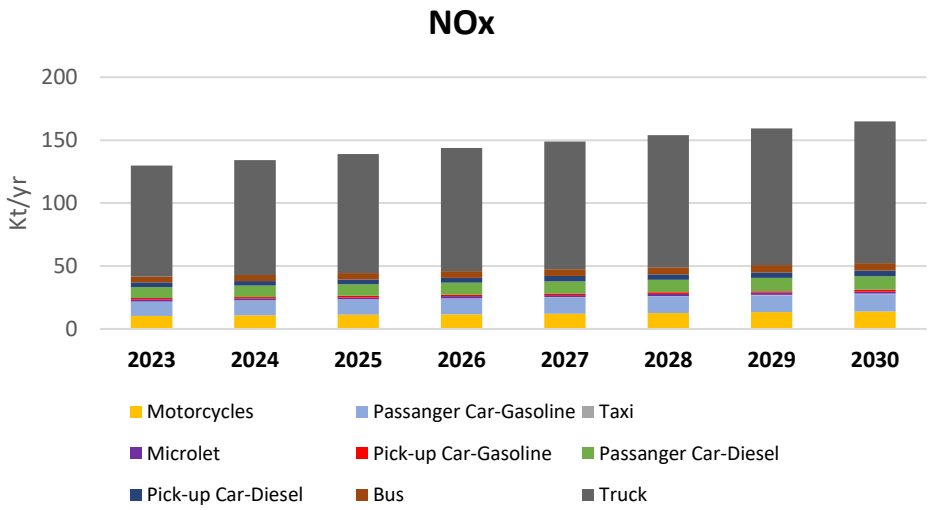


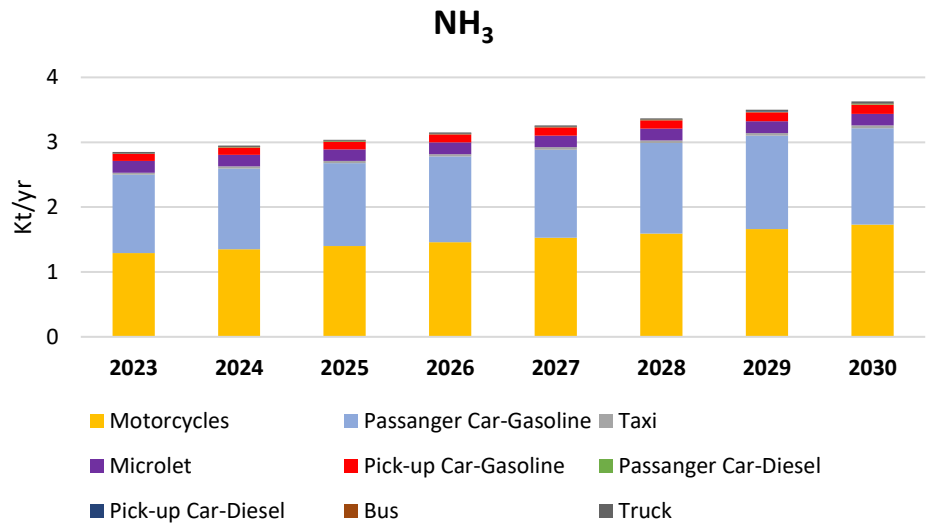


Estimated emission Up to 2030 Transport Sector

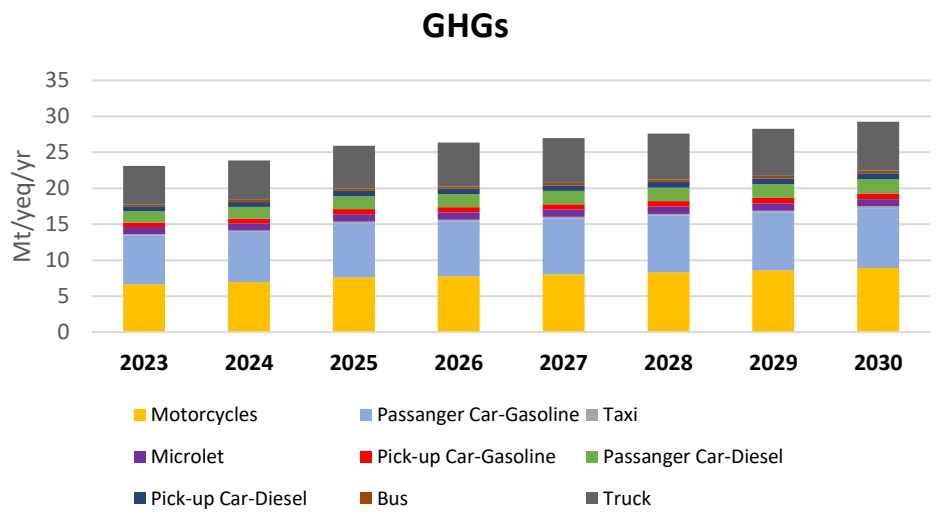


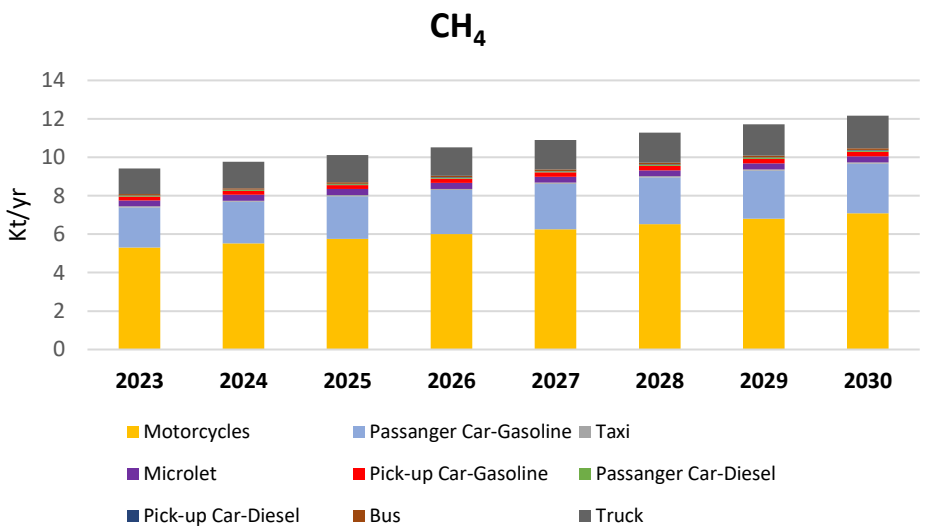


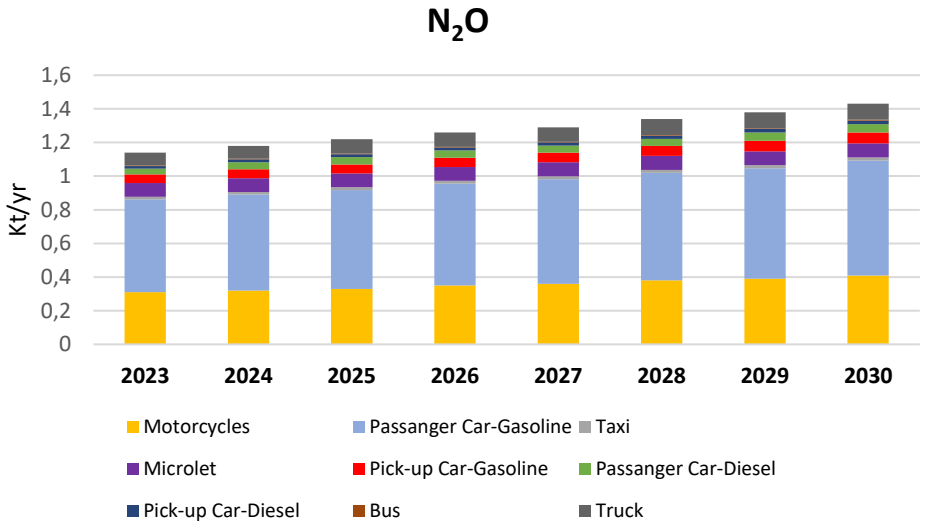


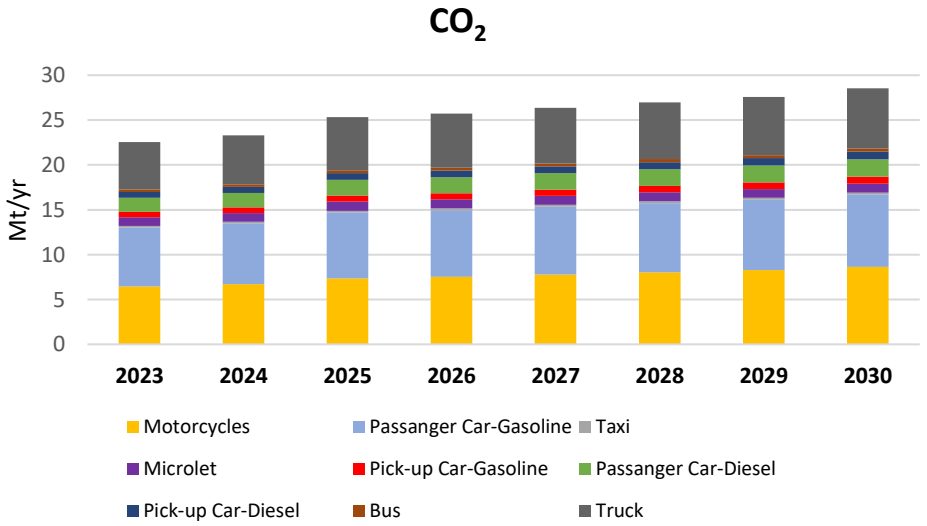


Estimated emission Up to 2030 Transport Sector







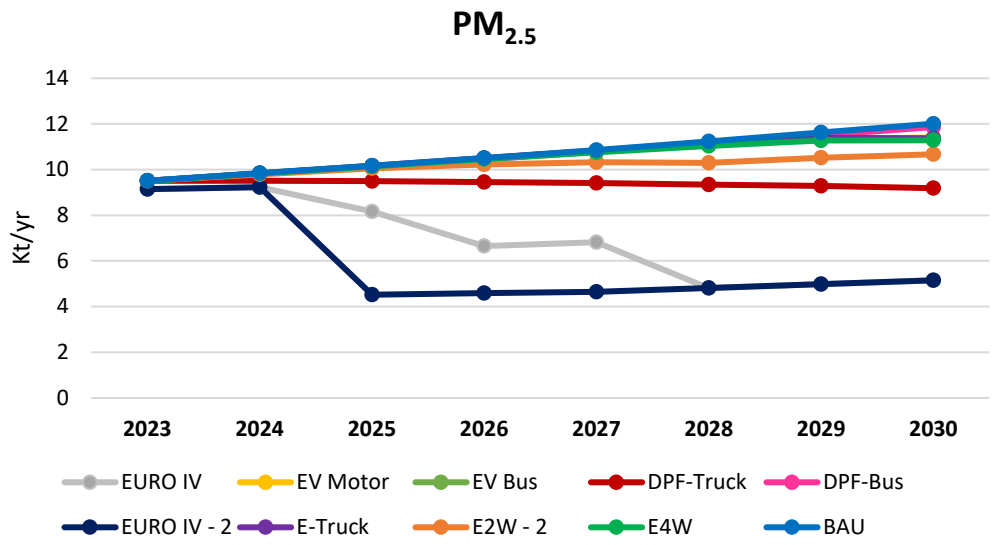


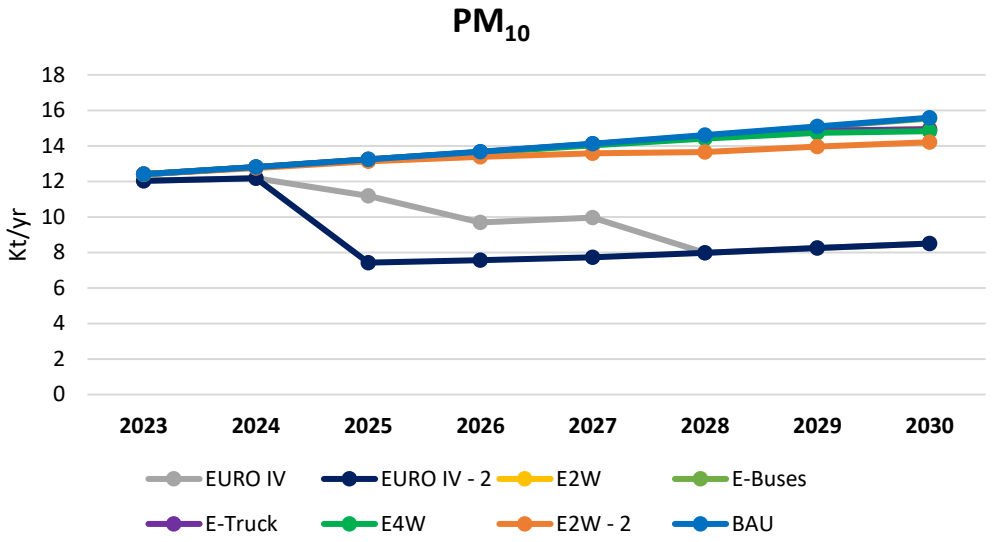
EMISSION REDUCTION WITH PROPOSED KEY LEVERS FOR TRANSPORT SECTOR

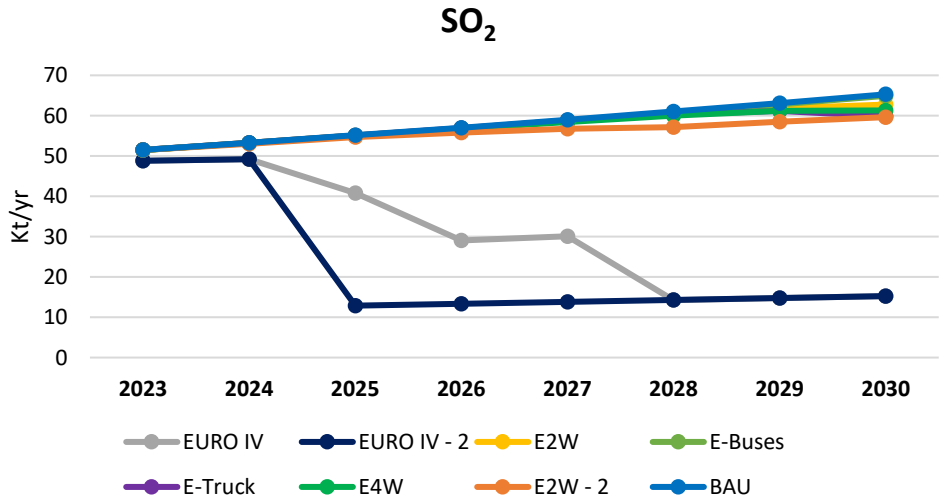
Jabodetabek Key Levers for Transport Sector

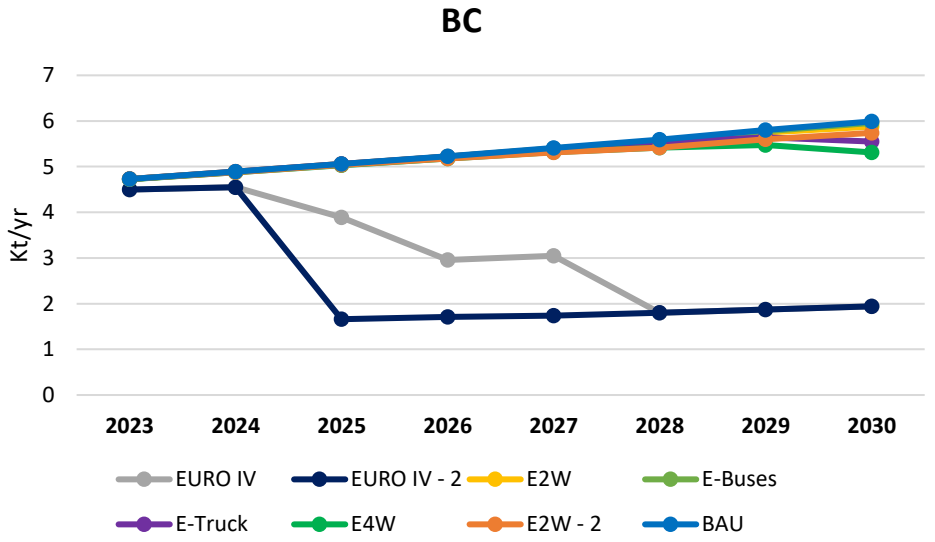
Levers	Percentage of Implementation							
	2023	2024	2025	2026	2027	2028	2029	2030
EUIV-I								
Gasoline	2%	24%	41%	66%	84%	100%	100%	100%
Diesel	7%	10%	34%	64%	64%	100%	100%	100%
EUIV-II								
Gasoline	2%	24%	41%	66%	100%	100%	100%	100%
Diesel	7%	10%	100%	100%	100%	100%	100%	100%
E-Buses	2.73%	3.80%	5.04%	8.99%	11.94%	14.71%	16.51%	20%
E-Trucks	0.02%	0.04%	0.11%	0.29%	0.78%	2.09%	5.59%	15%
E2W	0.41%	0.80%	1.57%	3.06%	5.98%	11.69%	22.86%	45%
E2W-2	0.41%	5%	10%	25%	45%	75%	85%	100%
E4W	0.27%	0.56%	1.08%	2.06%	3.72%	6.80%	12.38%	25%
DPF-Buses	-	10%	20%	30%	40%	50%	60%	70%
DPF-Trucks	-	10%	20%	30%	40%	50%	60%	70%

BAU vs Key Levers on Transport Sector

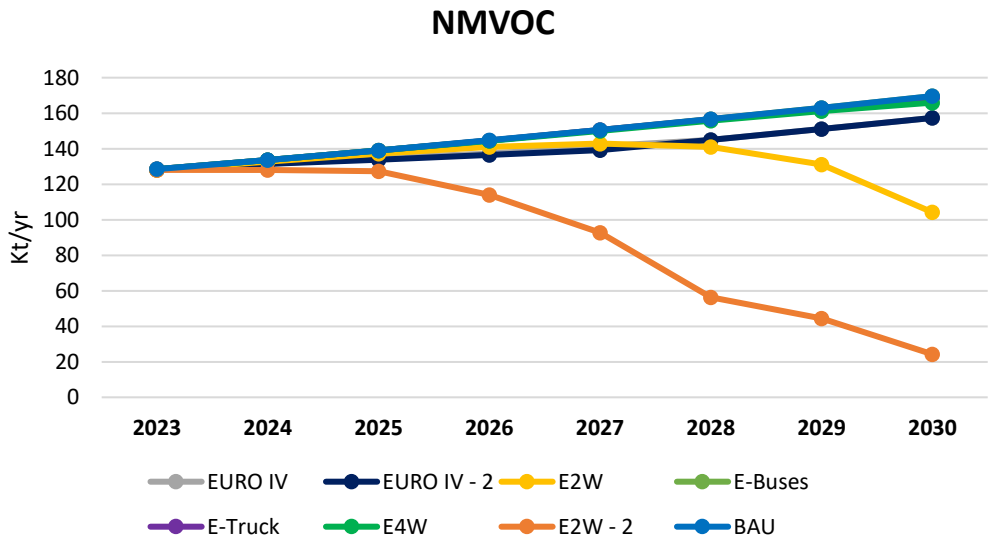


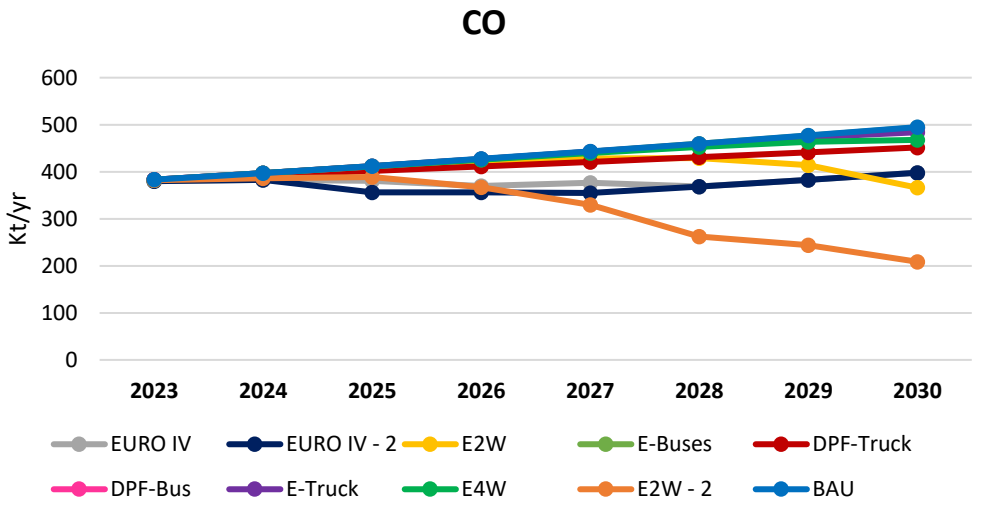


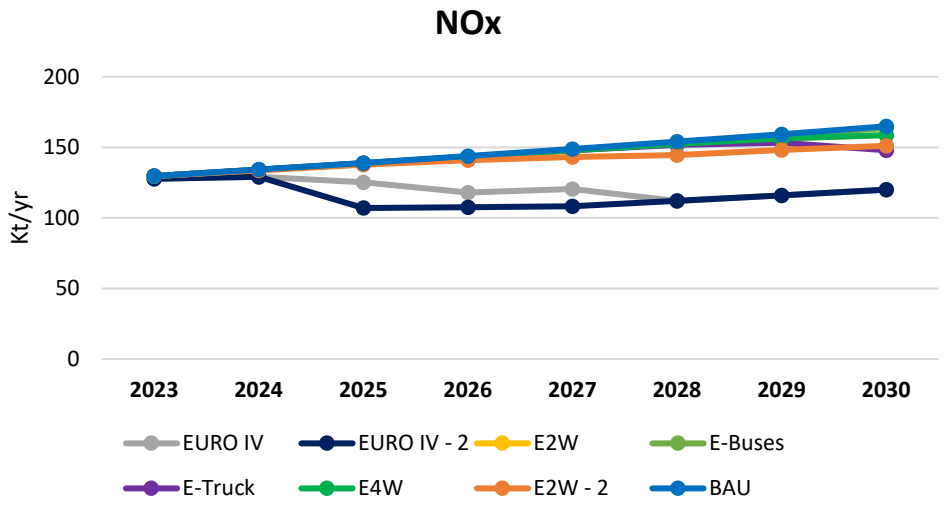


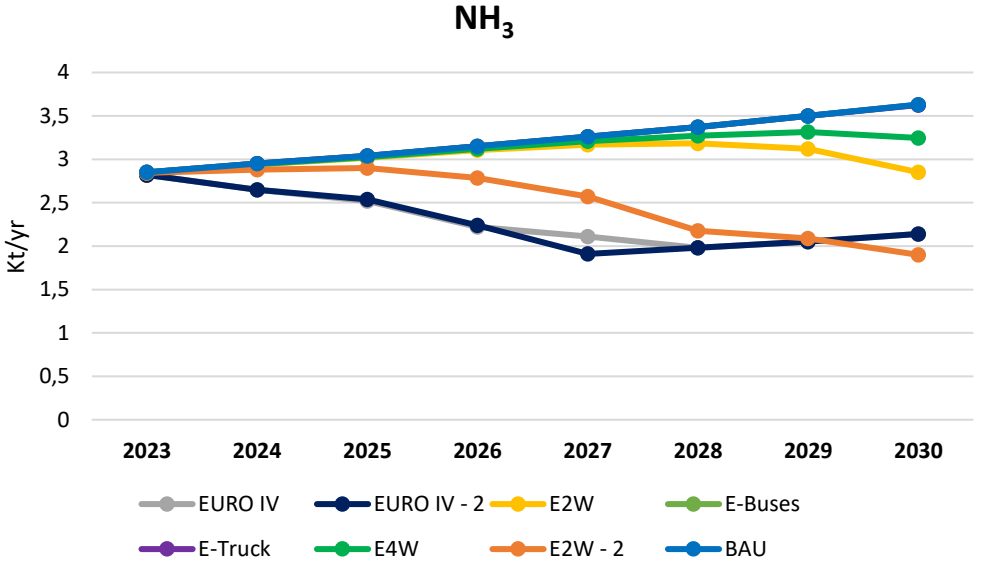


BAU vs Key Levers on Transport Sector

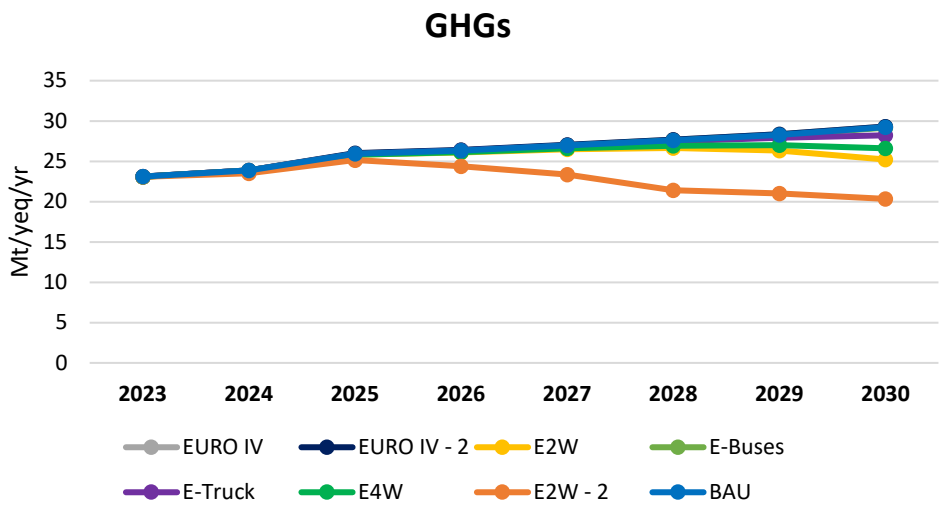


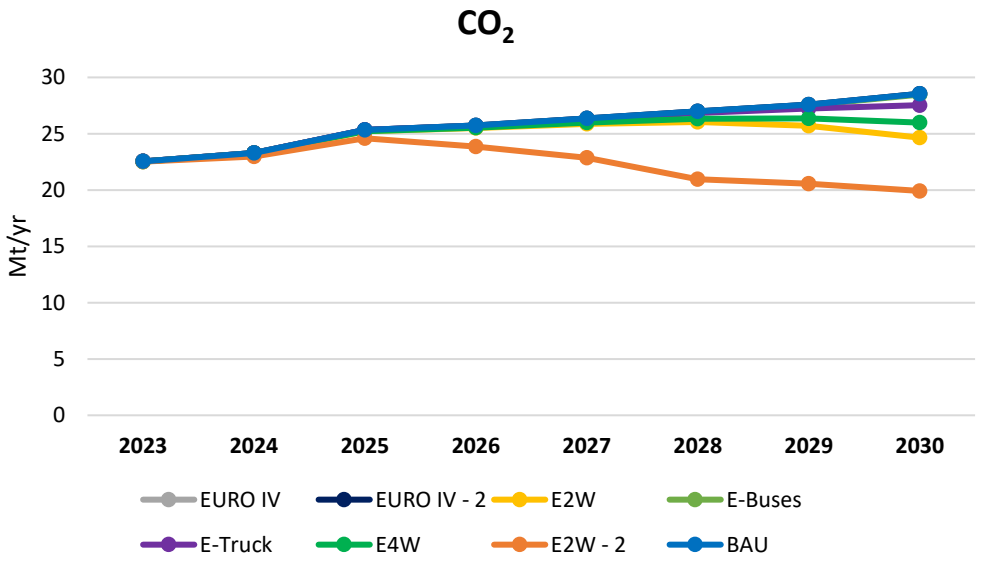


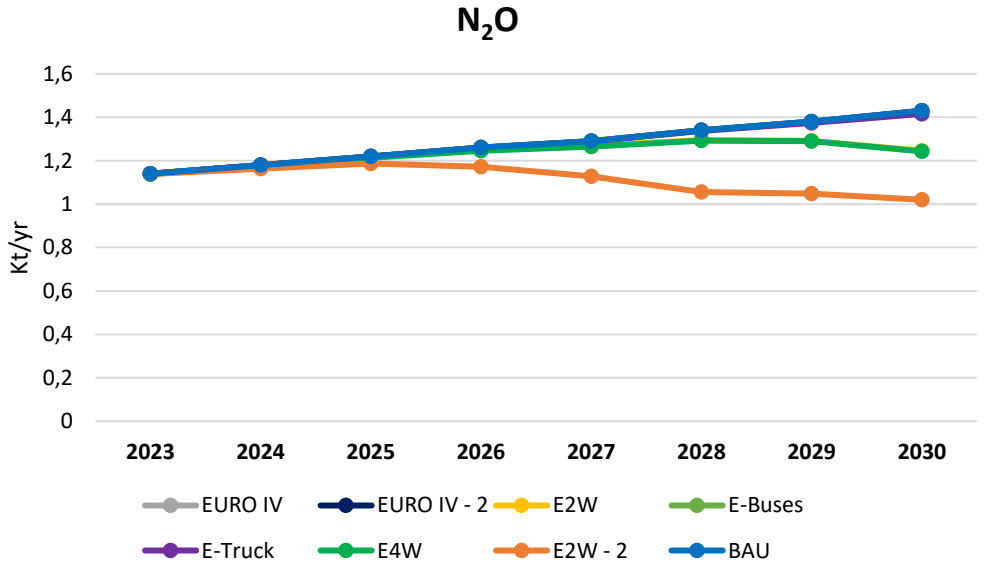


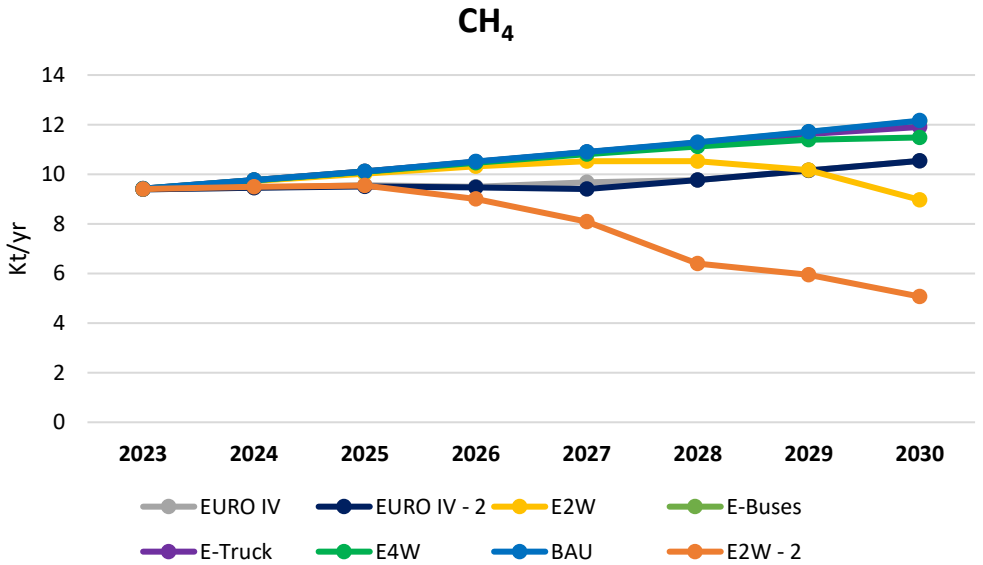


BAU vs Key Levers on Transport Sector







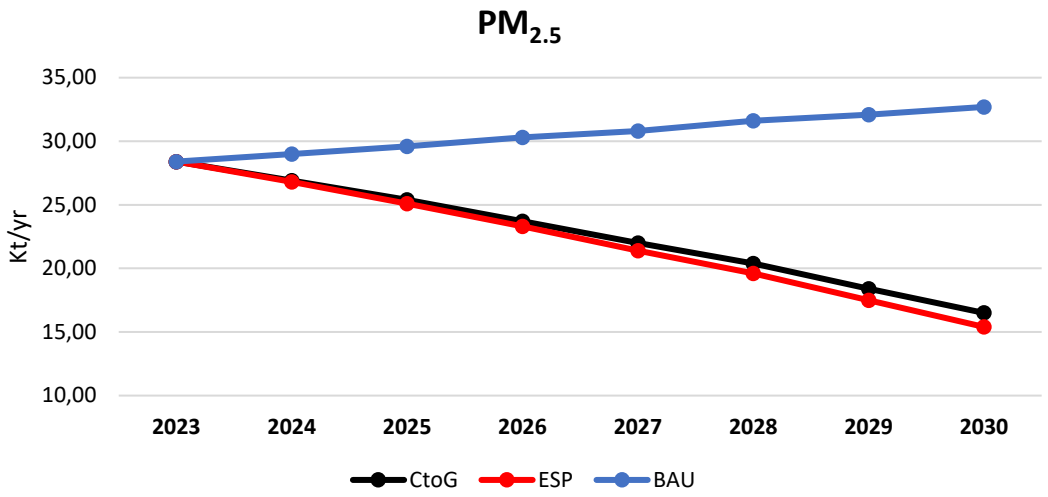


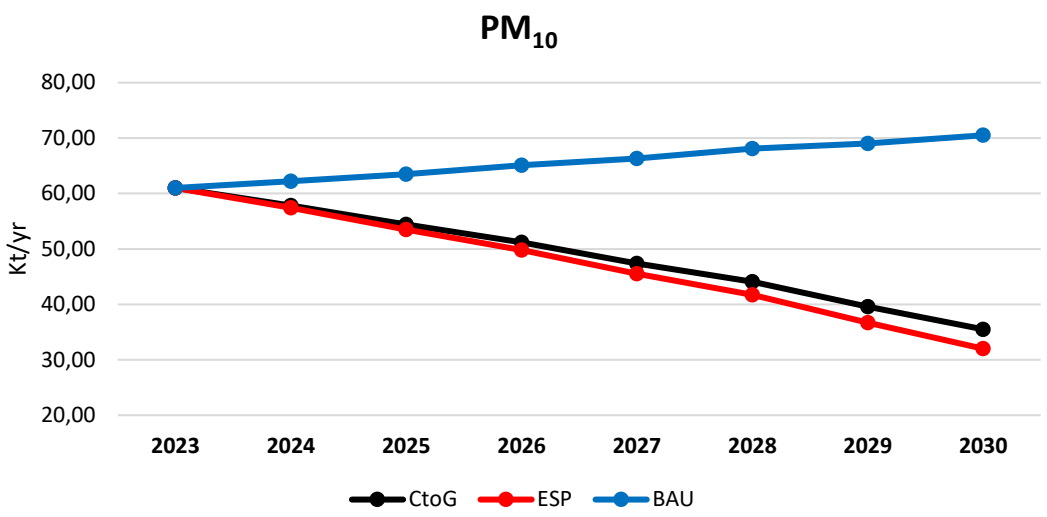
ESTIMATED EMISSION WITH PROPOSED KEY LEVERS FOR INDUSTRY AND POWER SECTOR

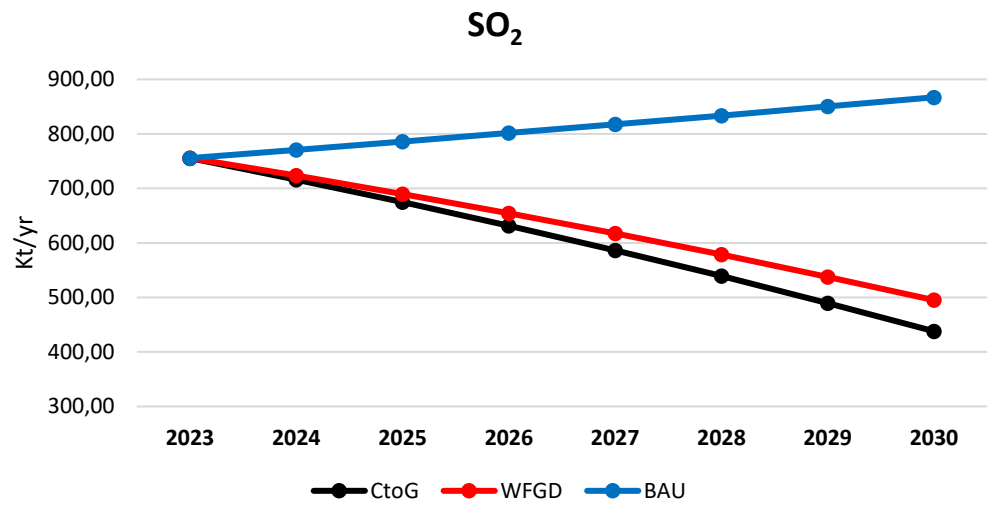
Jabodetabek Key Levers for Industrial and Power Sector (REV)

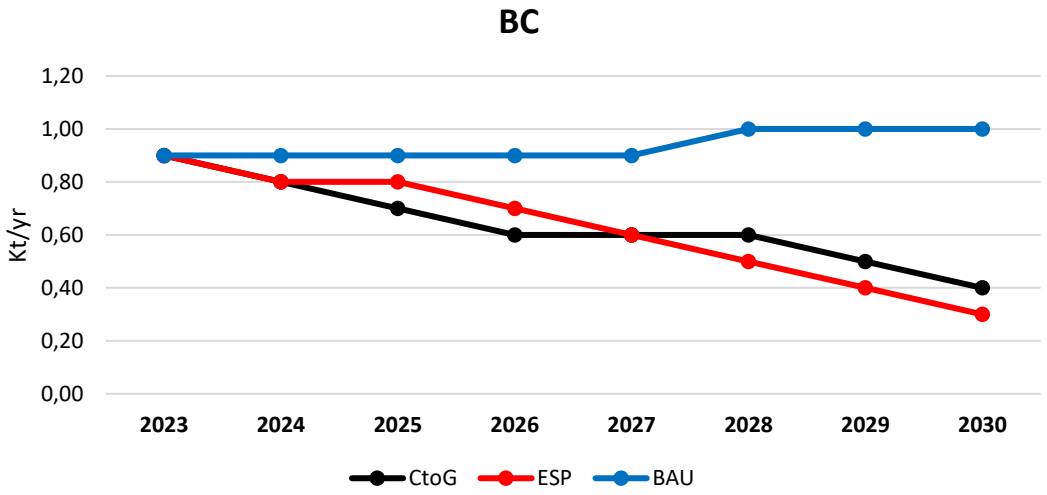
Scenarios	Sectors			Scenario Implementation	% Implementation							
					2023	2024	2025	2026	2027	2028	2029	2030
BAU	Industry	PM	IN_ESP1	Implementation of Electrostatic precipitator: 1 field - industrial combustion	35	35	35	35	35	35	35	35
	Industry	PM	IN_ESP2	Implementation of Electrostatic precipitator: 2 field - industrial combustion	22	22	22	22	22	22	22	22
	Industry	PM	IN_CYC	Implementation of Cyclone	27	27	27	27	27	27	27	27
	Industry	PM	WSCRB	Implementation of Wet Scrubber	16	16	16	16	16	16	16	16
	Industry	SO2	IWFGD	Implementation of Wet Flue Gas Desulphurisation	5	5	5	5	5	5	5	5
	Power Plant	NOx	PHCCM	Implementation of Modified Combustion (Gas)	30	30	30	30	30	30	30	30
	Power Plant	PM	ESP1	Implementation of Electrostatic precipitator: 1 field - power plants	80	80	80	80	80	80	80	80
	Power Plant	PM	ESP2	Implementation of Electrostatic precipitator: 2 field - power plants	20	20	20	20	20	20	20	20
ESP	Industry	PM	IN_ESP1	Implementation of Electrostatic precipitator: 1 field - industrial combustion	35	38	41	44	46	49	52	55
	Industry	PM	IN_ESP2	Implementation of Electrostatic precipitator: 2 fields - industrial combustion	22	23	24	25	27	28	29	30
	Industry	PM	IN_CYC	Implementation of Cyclone	27	24	20	17	14	11	7	4
	Industry	PM	WSCRB	Implementation of Wet Scrubber	16	15	15	14	13	12	12	11
	Power Plant	PM	ESP1	Implementation of Electrostatic precipitator: 1 fields - power plants	80	71	63	54	46	37	29	20
	Power Plant	PM	ESP2	Implementation of Electrostatic precipitator: 2 fields - power plants	20	29	37	46	54	63	71	80
SCR	Industry	NOx	IOGCSC and ISFCSC	Implementation of Selective Catalytic Reduction	-	4	9	13	17	21	26	30
	Power Plant	NOx	PHCCSC	Implementation of Selective Catalytic Reduction	-	7	14	21	29	36	43	50
WFGD	Industry	SO2	IWFGD	Implementation of Wet Flue Gas Desulphurisation	5	11	18	24	31	37	44	50
	Power Plant	SO2	PWFGD	Implementation of Wet Flue Gas Desulphurisation	-	7	14	21	29	36	43	50
Coal to Gas	Industry			Implementation of coal to gas conversion	-	7	14	21	29	36	43	50
	Power Plant			Implementation of coal to gas conversion	-	7	14	21	29	36	43	50

Implementation Levers on Industry and Power Sectors

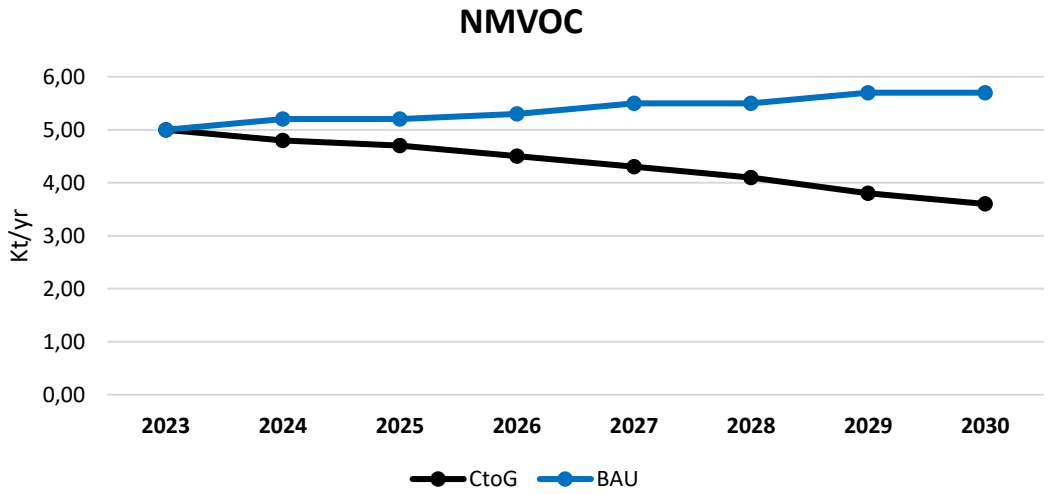


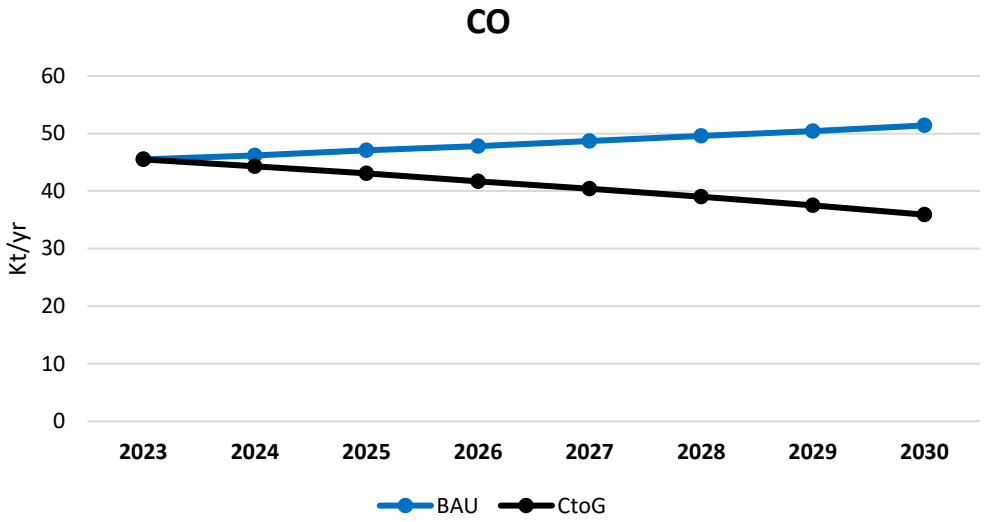


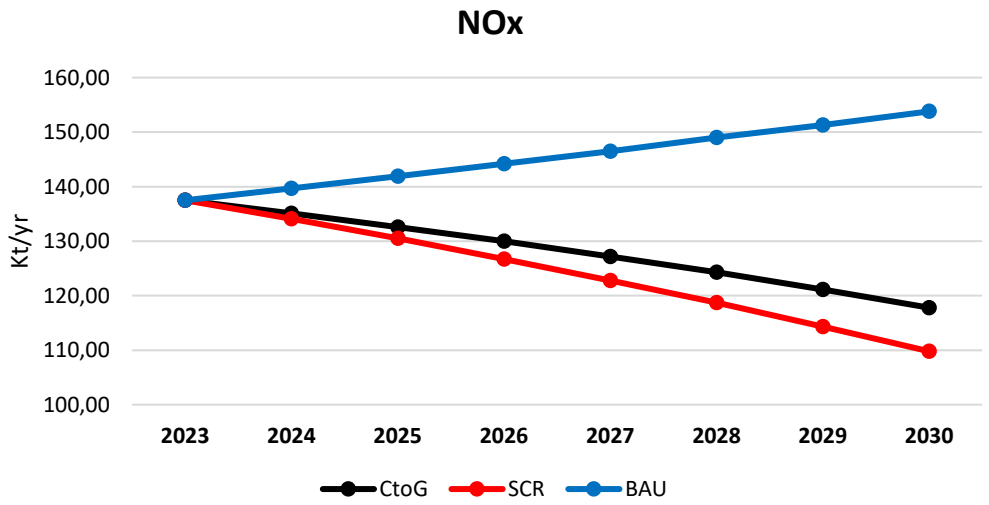


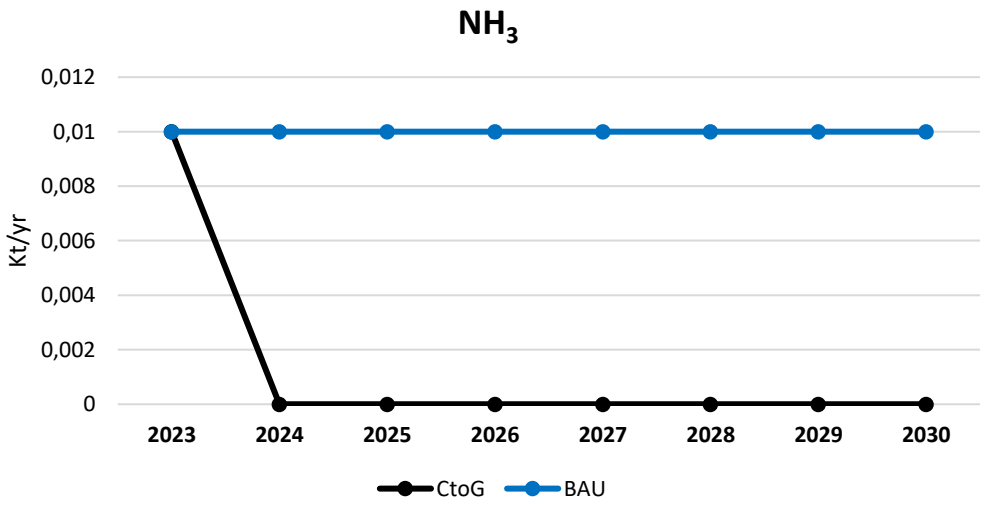


Implementation Levers (APC) on Industry and Power Sectors

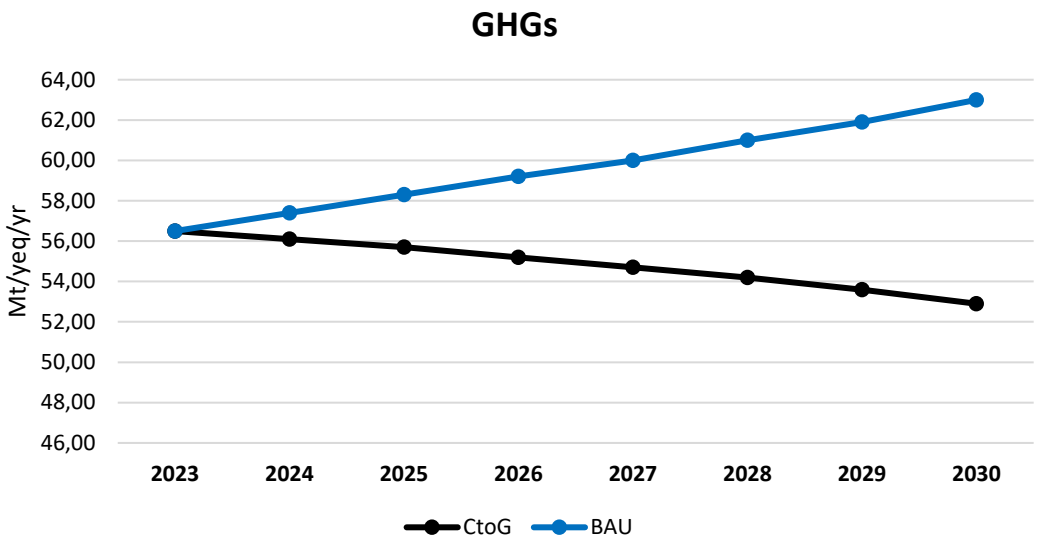


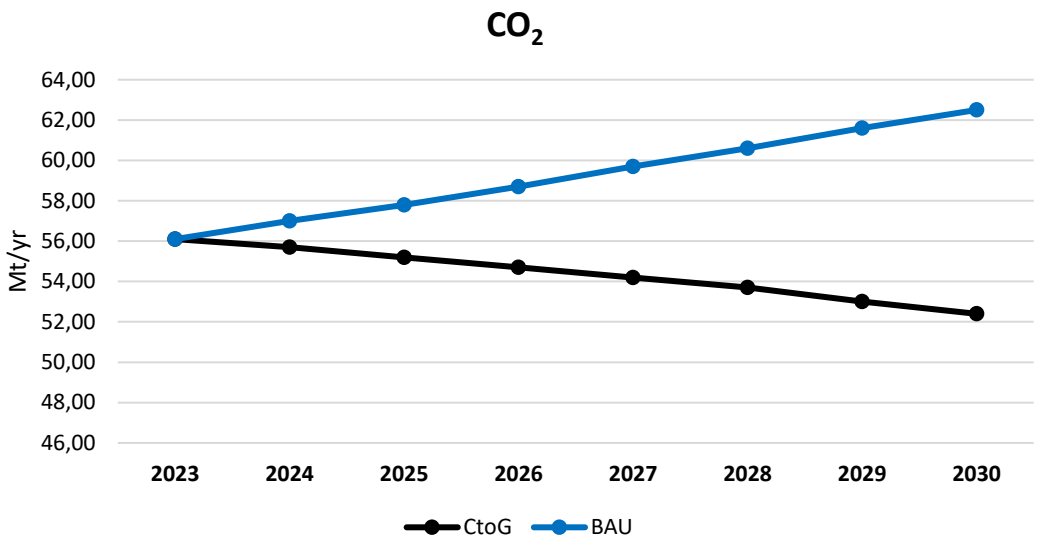


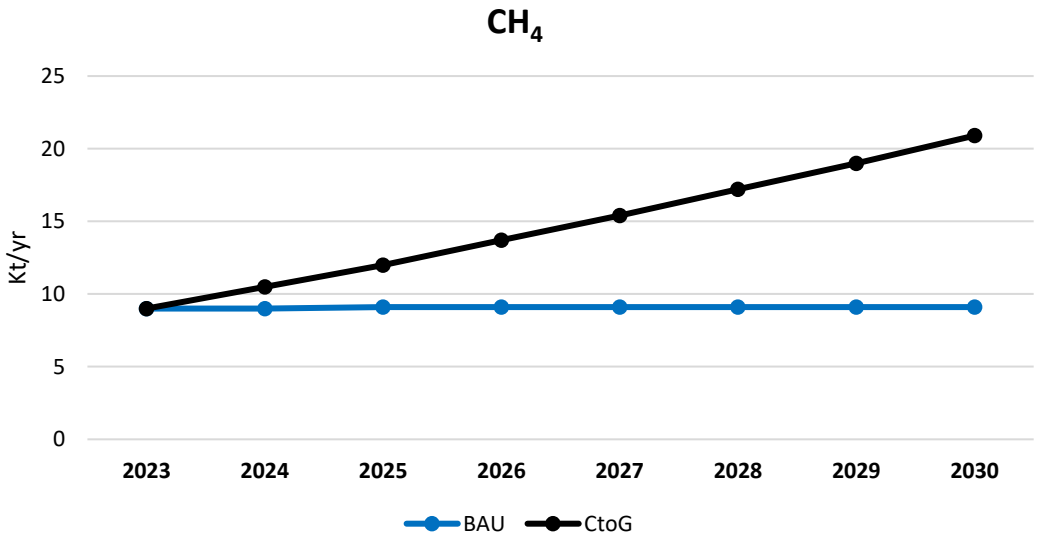


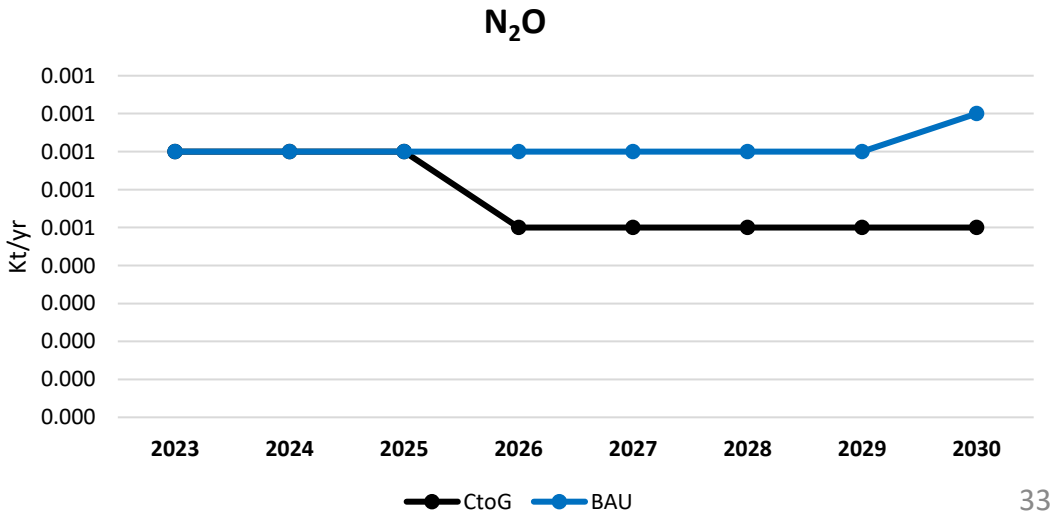


Implementation Levers (APC) on Industry and Power Sectors



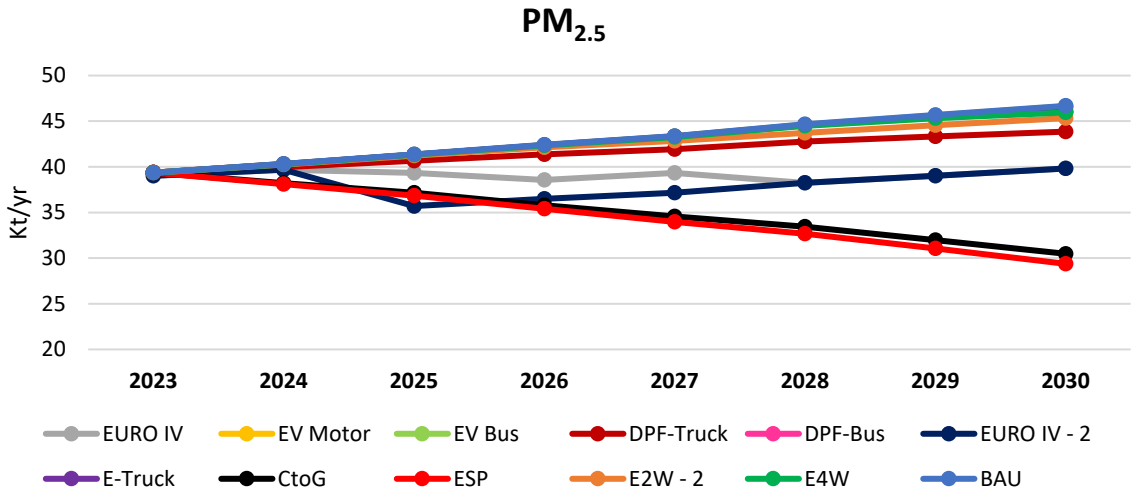


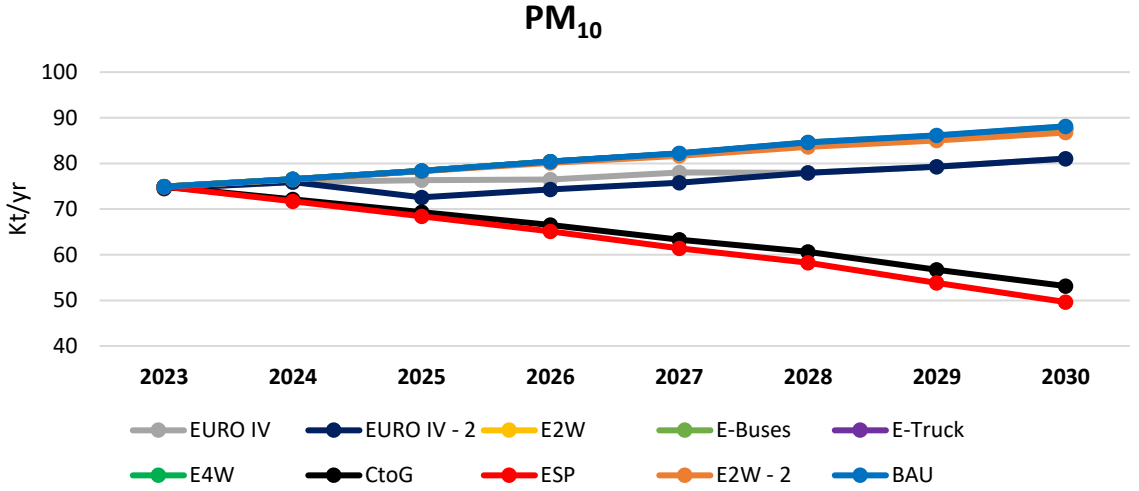


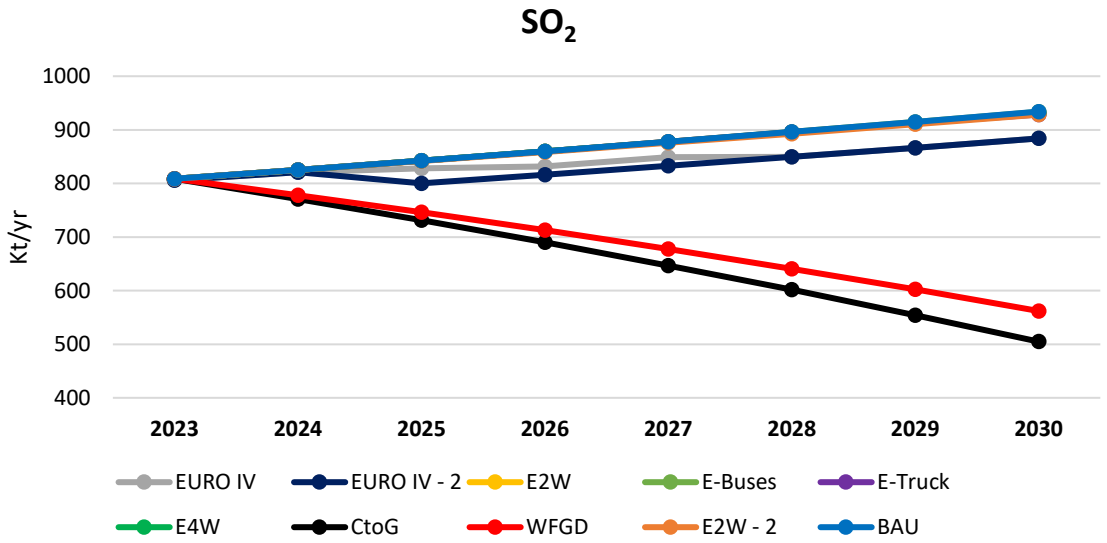


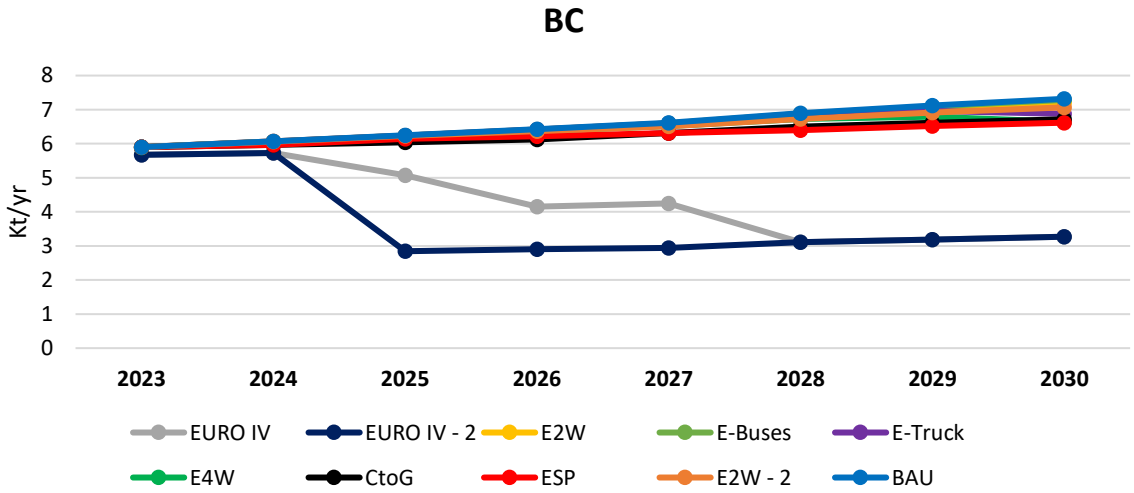
ESTIMATED EMISSION WITH PROPOSED KEY LEVERS FOR ALL SECTOR (COMBINE LEVERS)

BAU vs Key Levers on All Sector

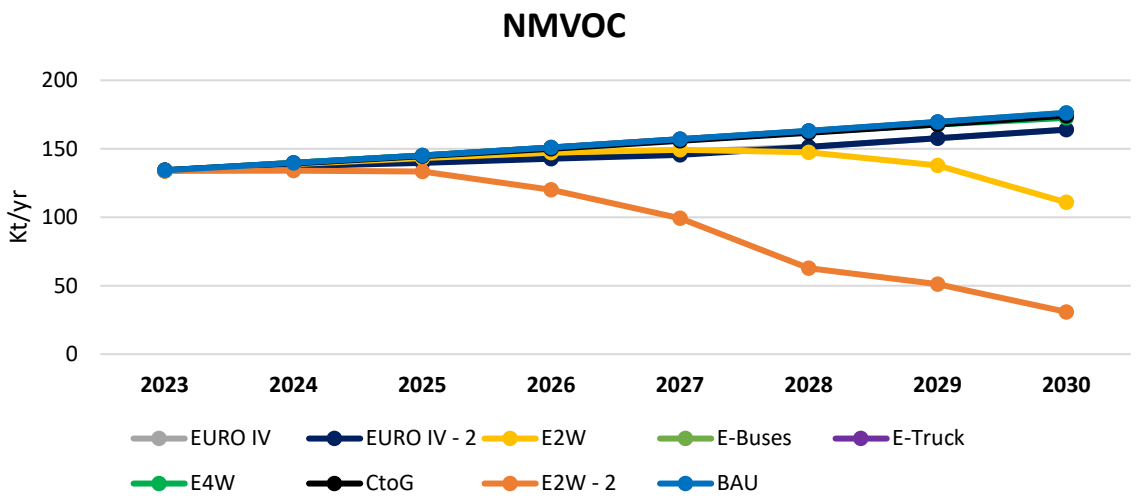


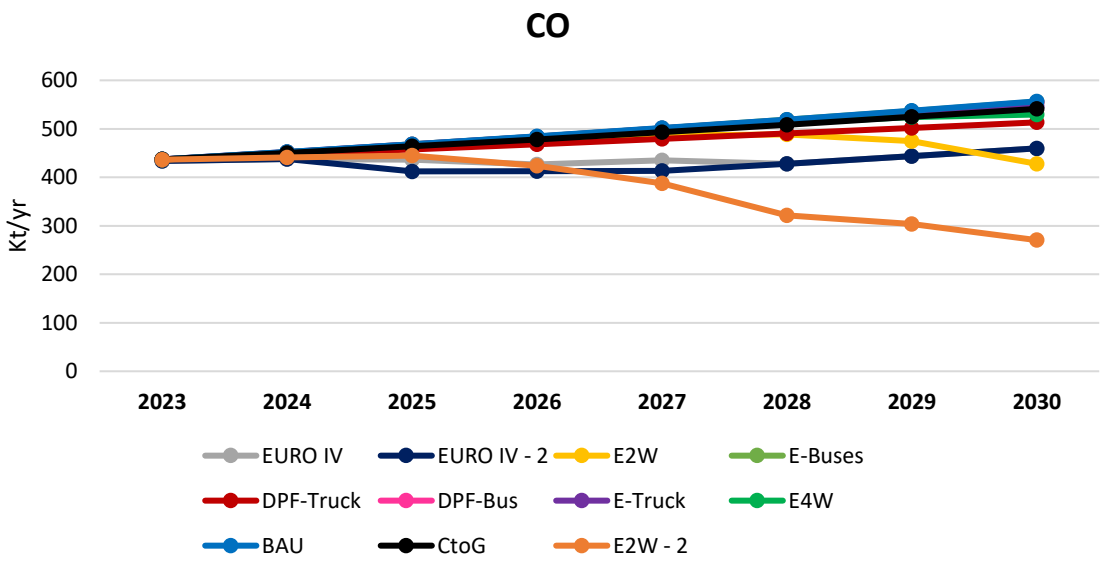


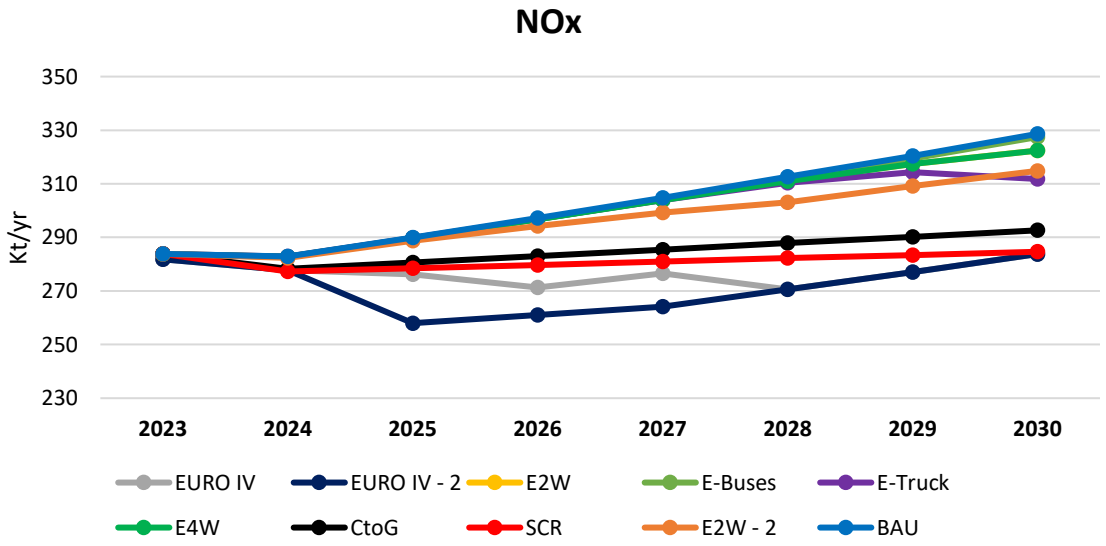


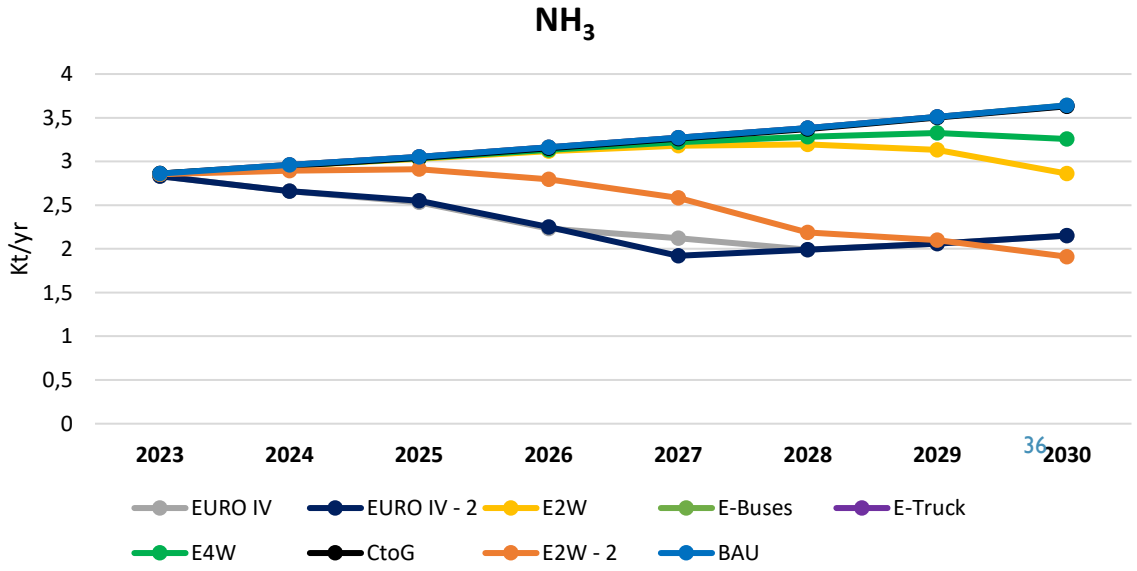


BAU vs Key Levers on All Sector

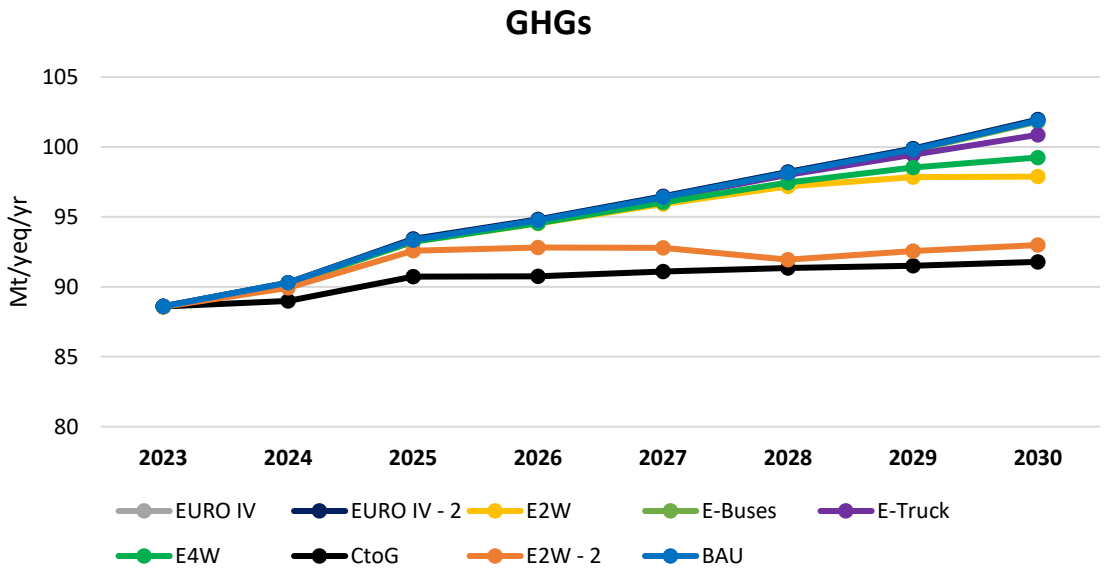


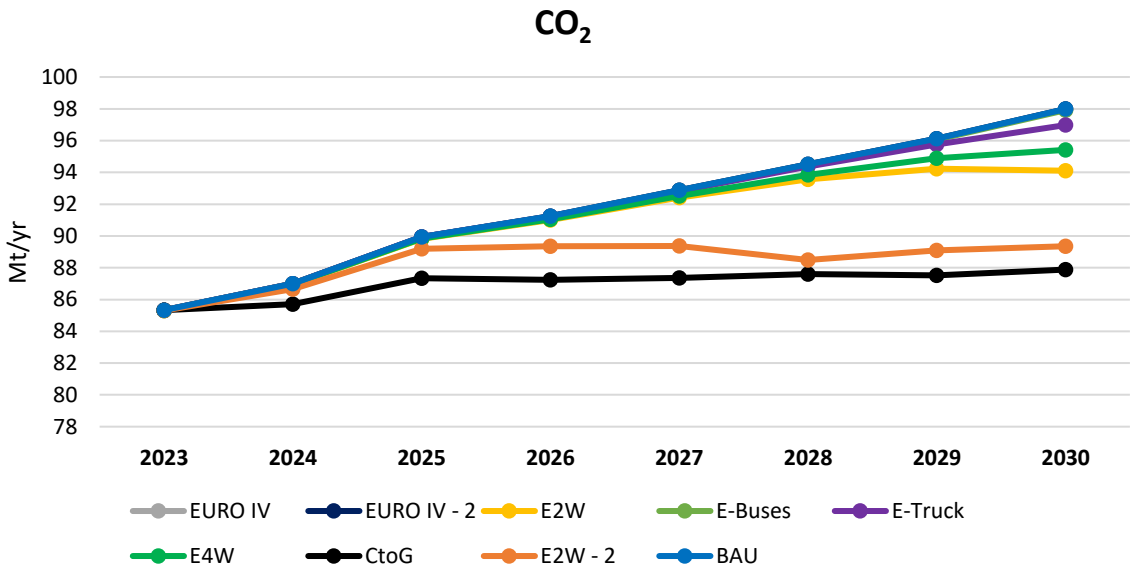


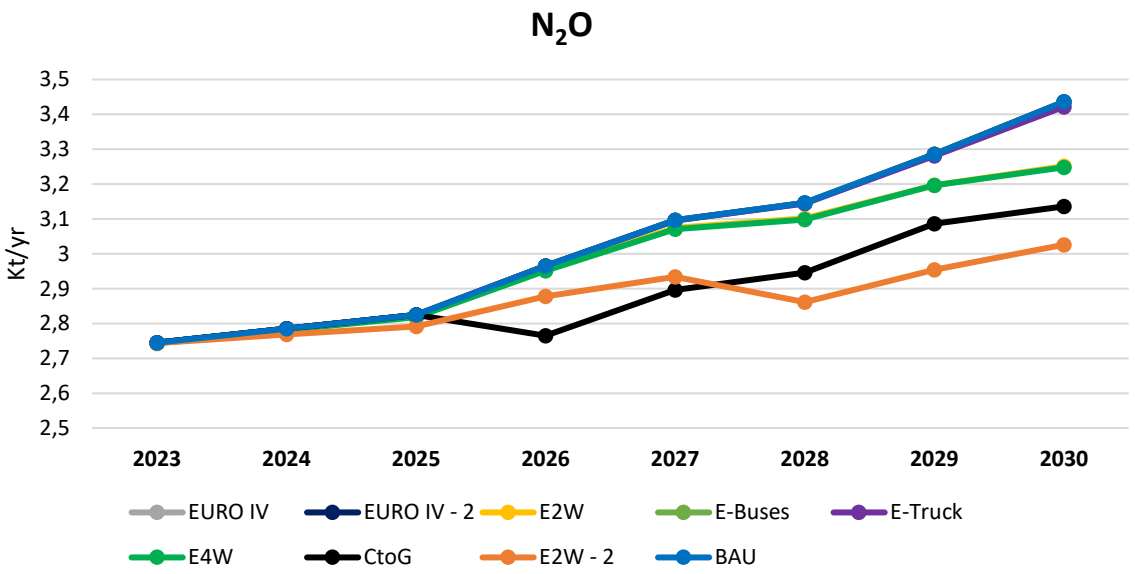


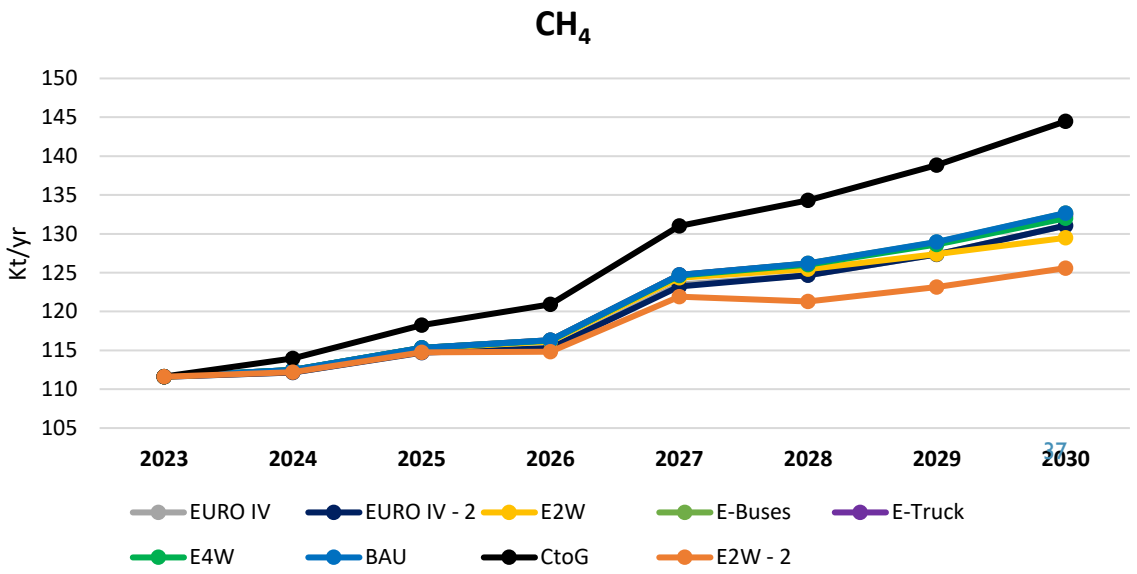


BAU vs Key Levers on All Sector



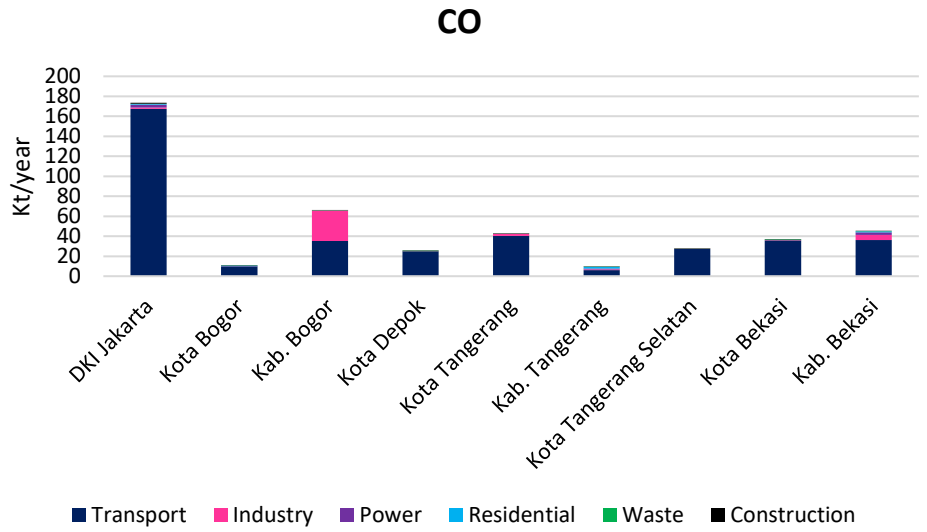


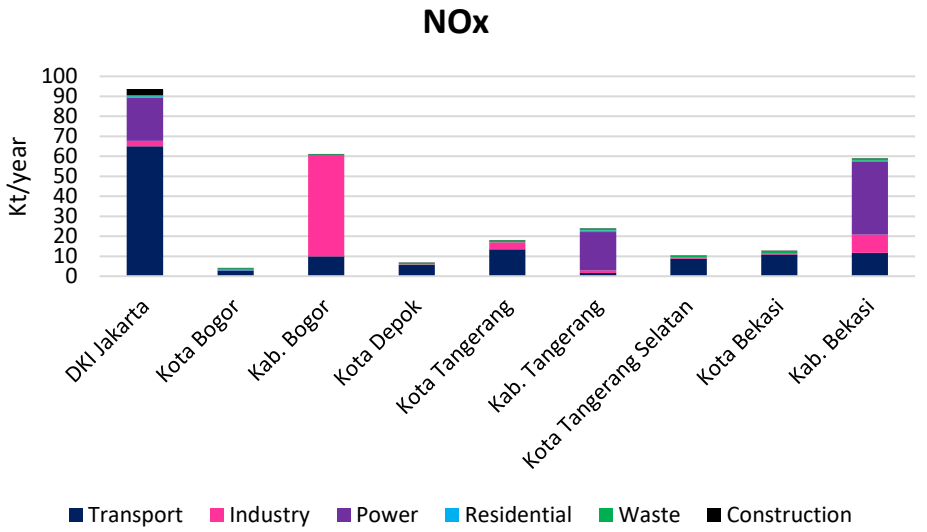


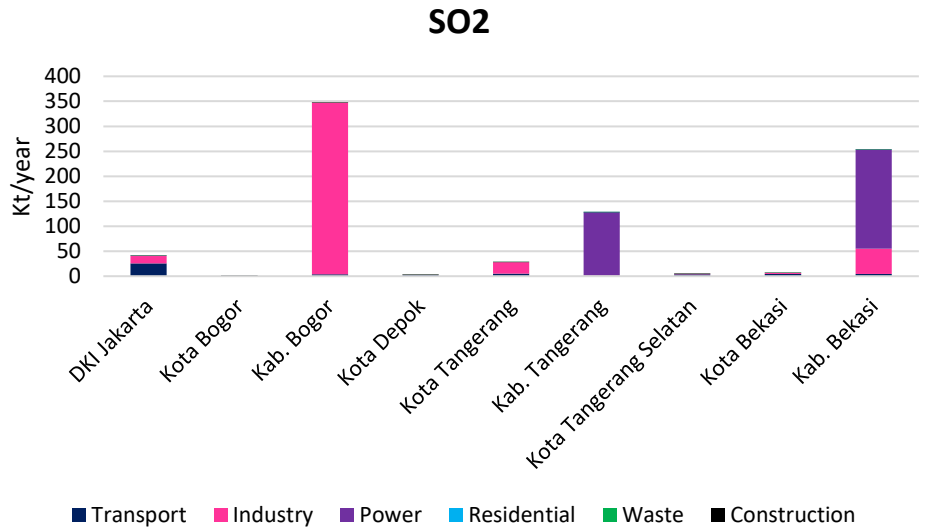


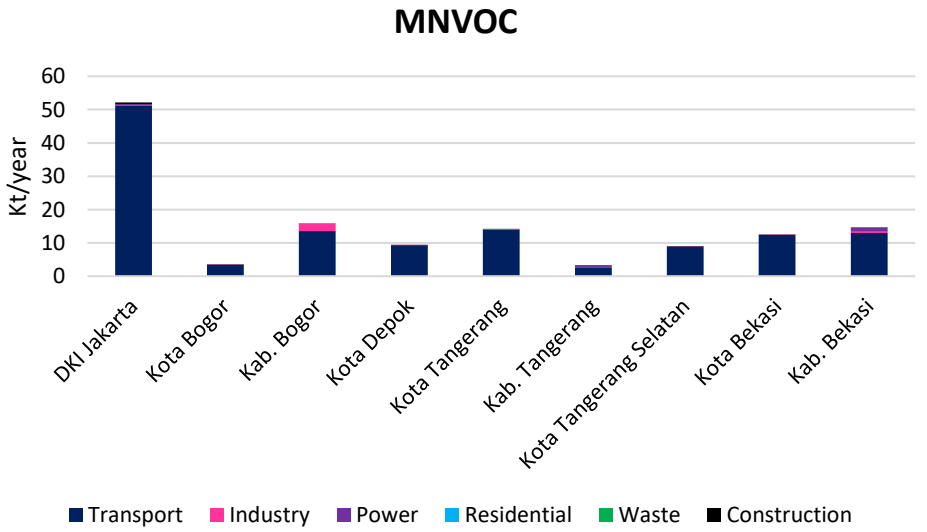
SOURCE CONTRIBUTION FOR EACH AREA IN JABODETABEK

2023 Emission Estimation in each region of Jabodetabek

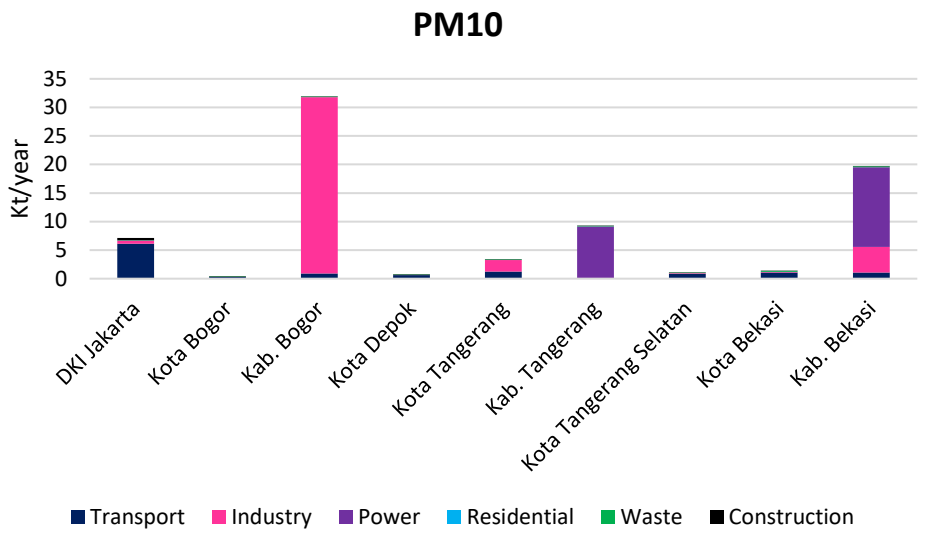


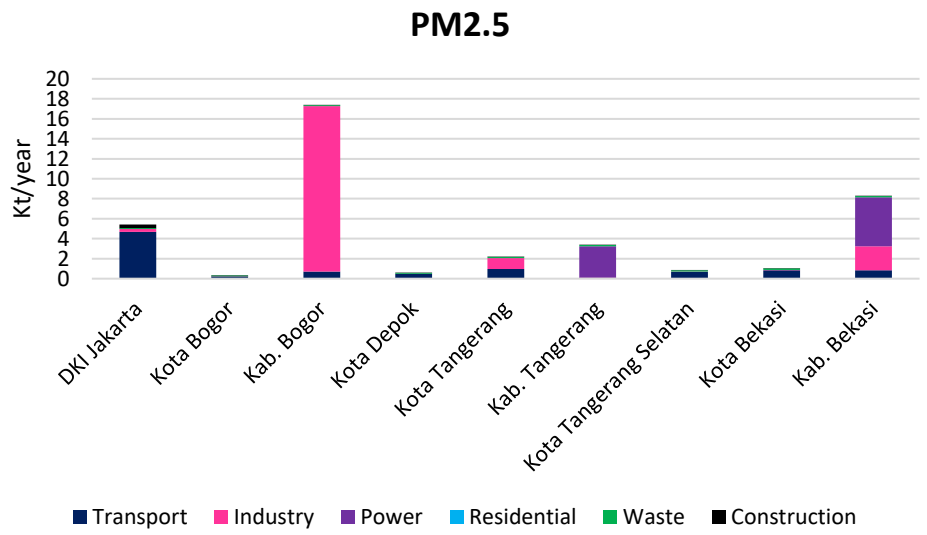


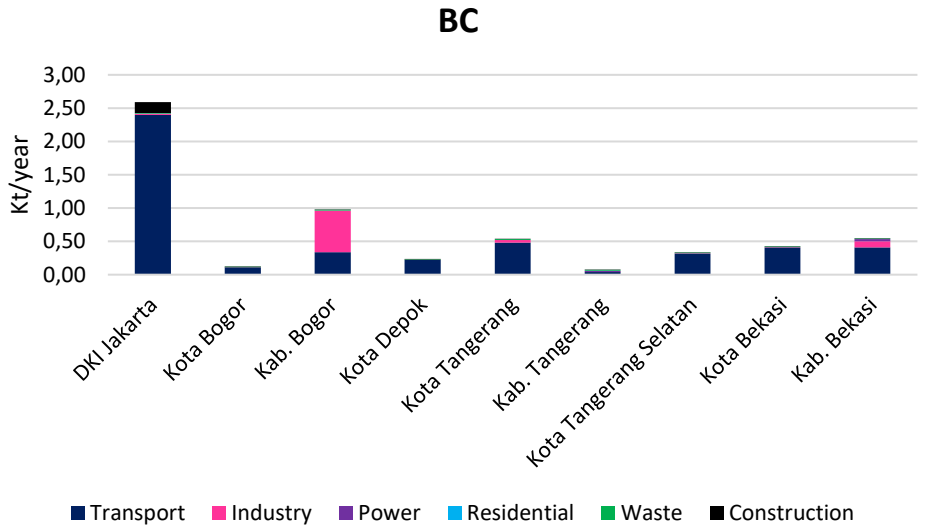




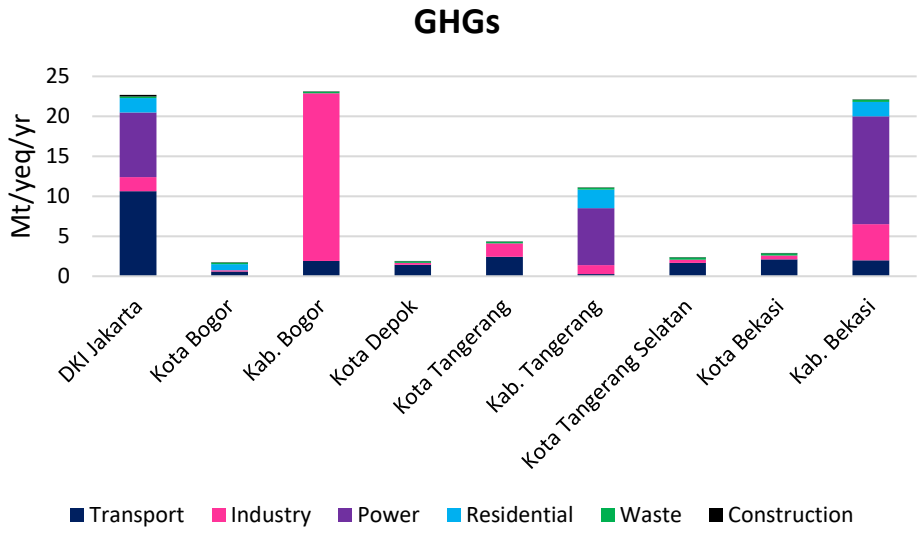
2023 Emission Estimation in each region of Jabodetabek

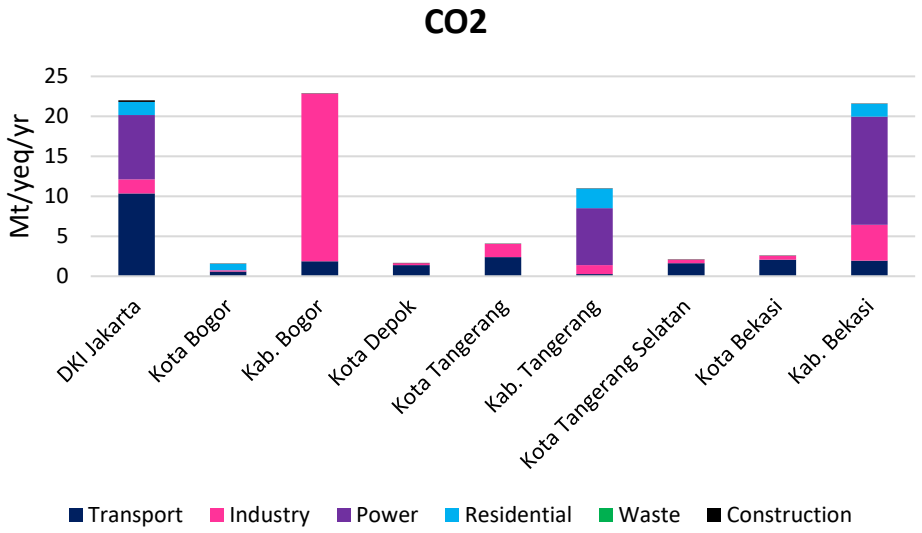


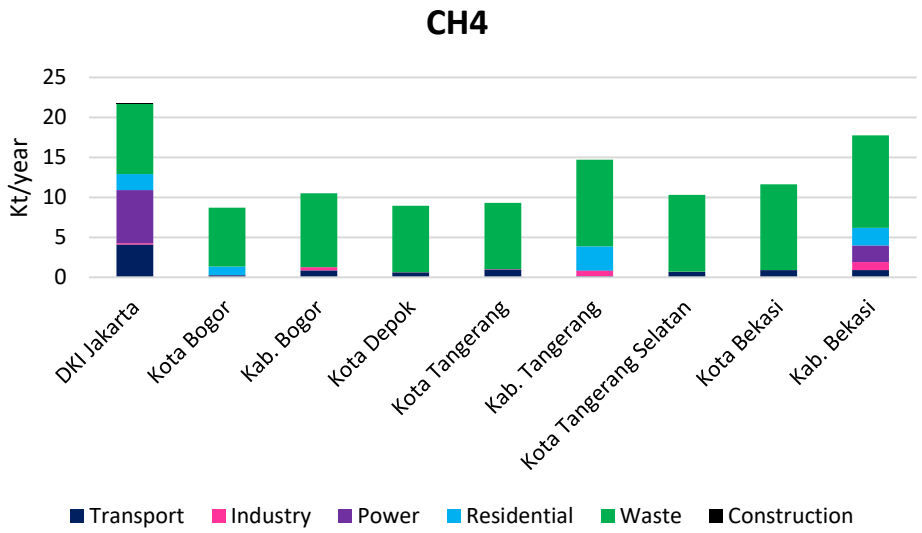


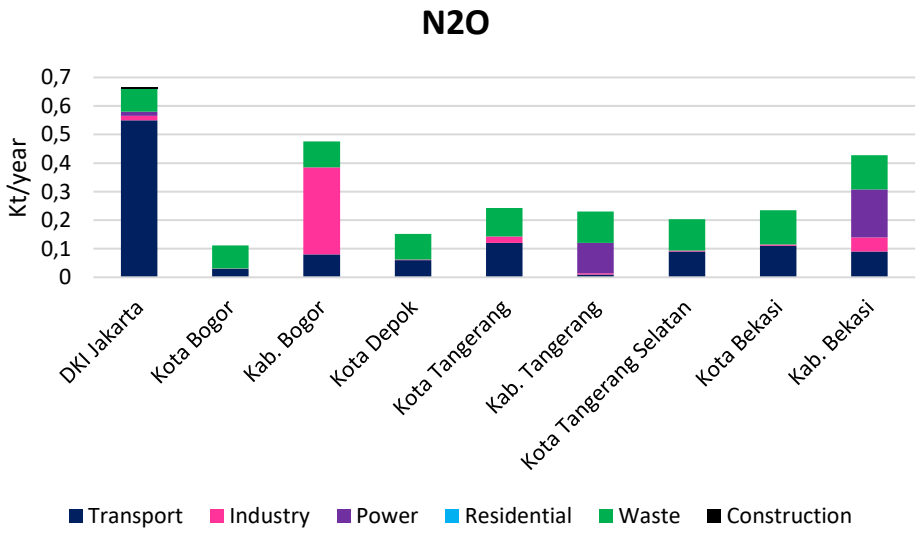


2023 Emission Estimation in each region of Jabodetabek



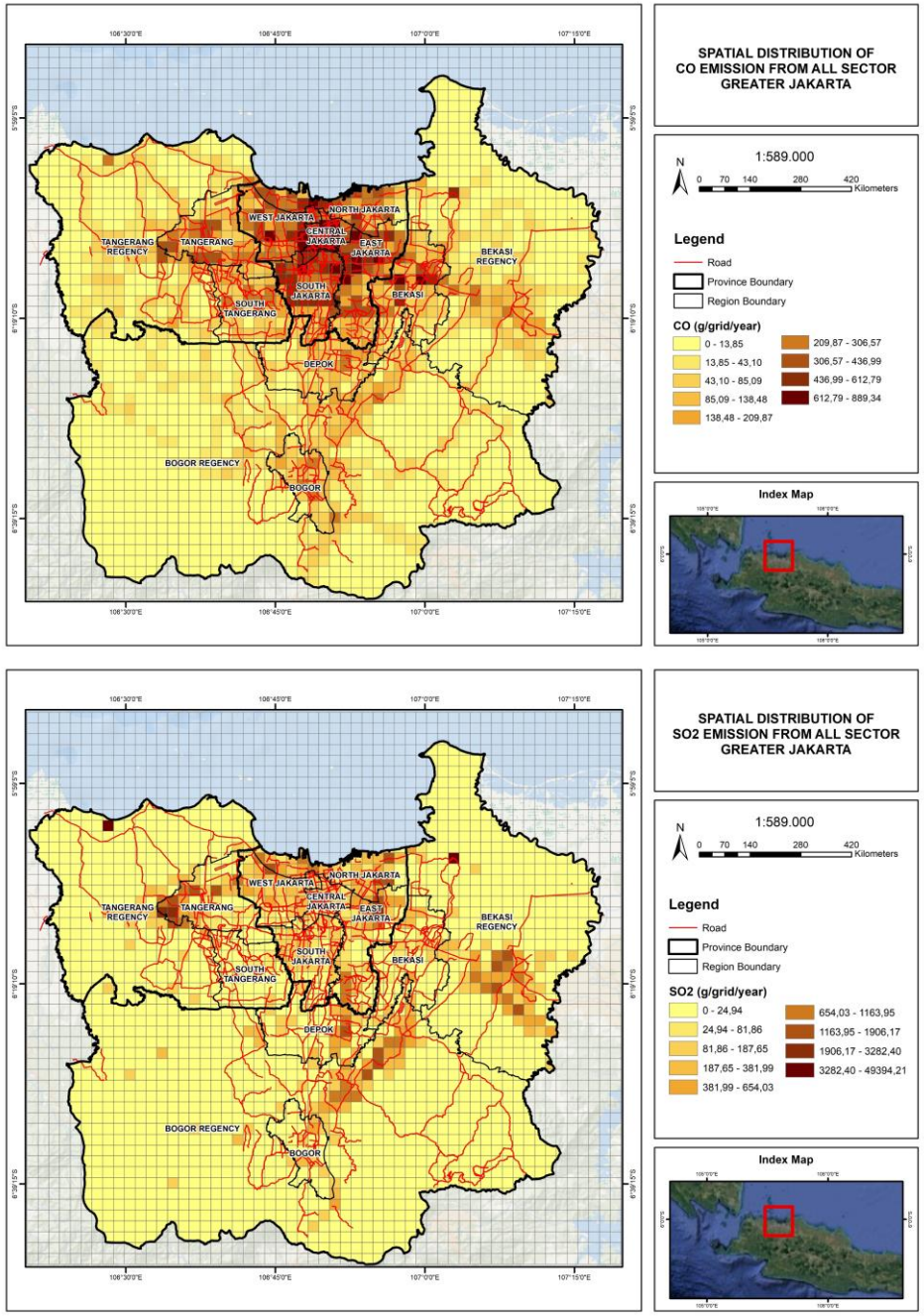






Emission Spatial Distribution

CO



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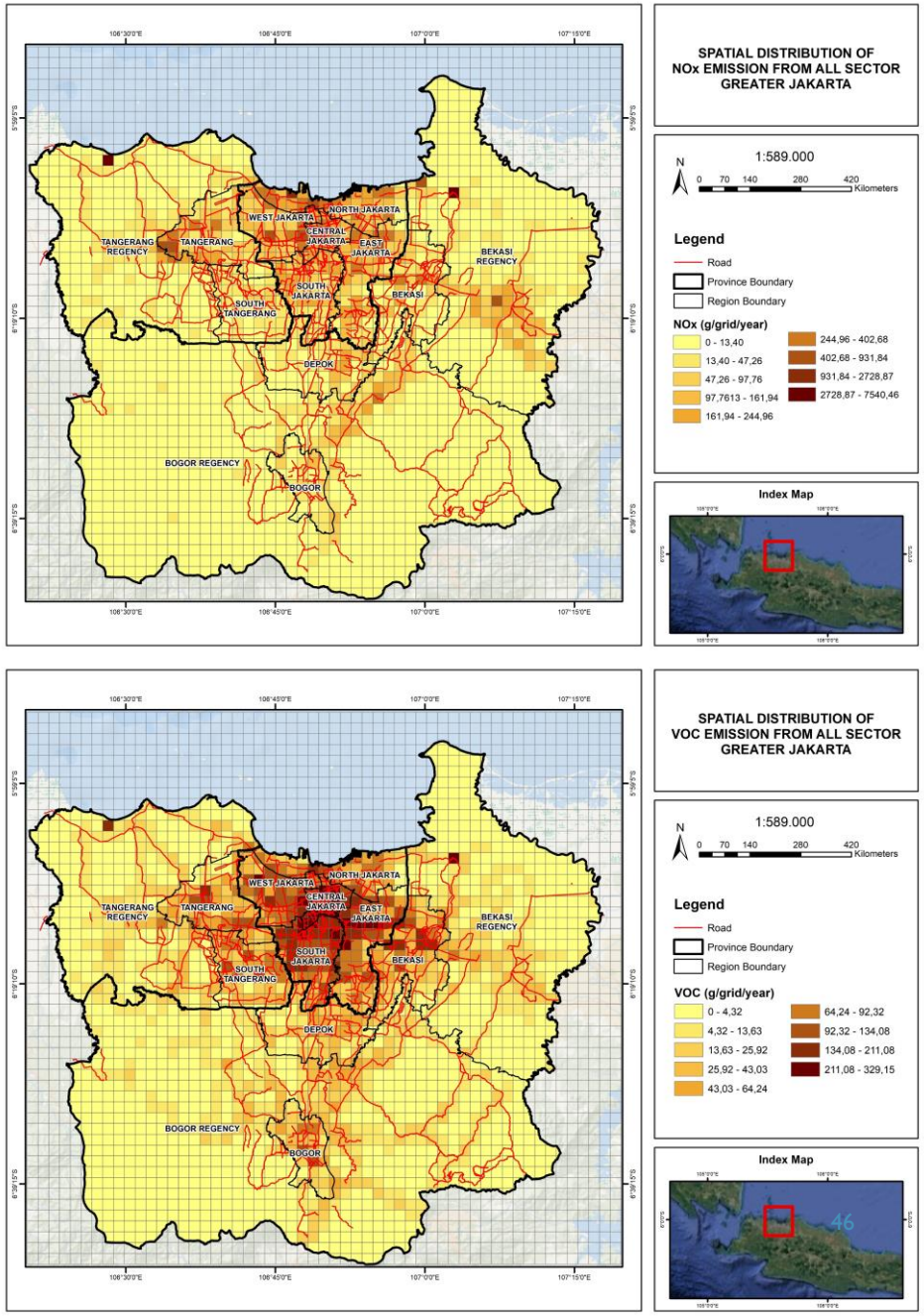
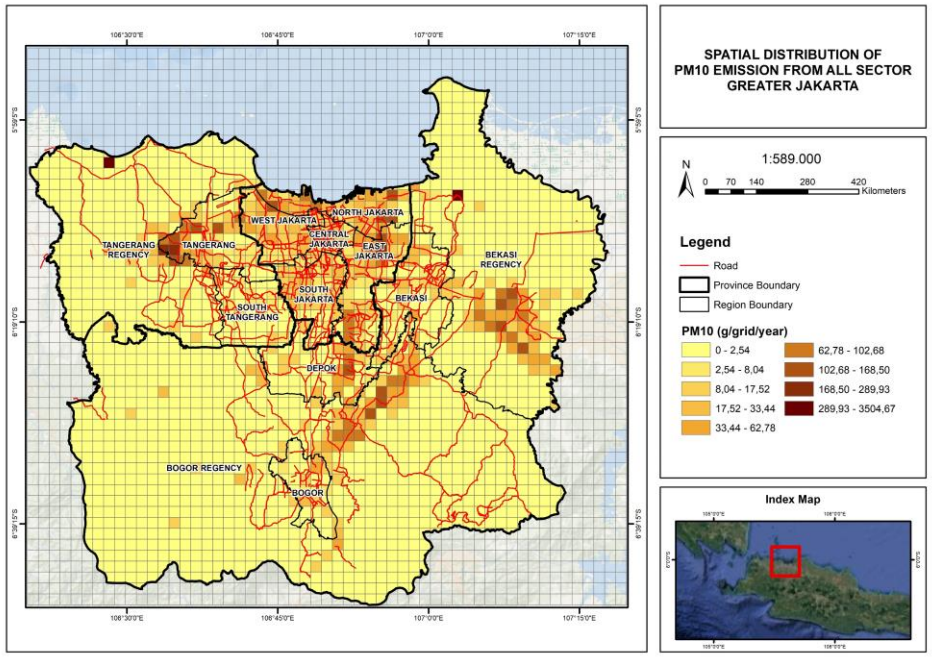


SO_2

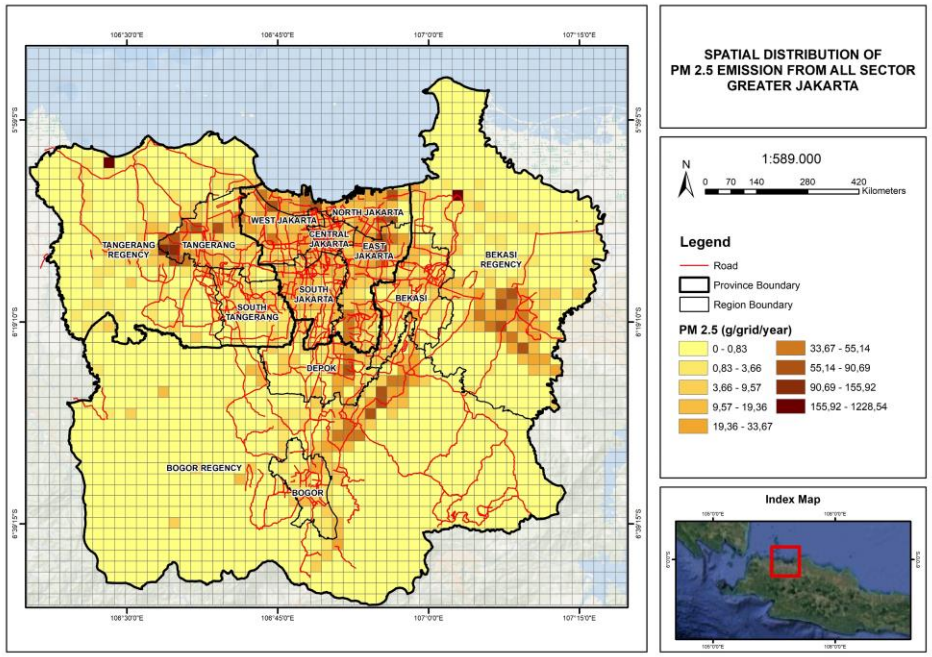
VOC

Emission Spatial Distribution

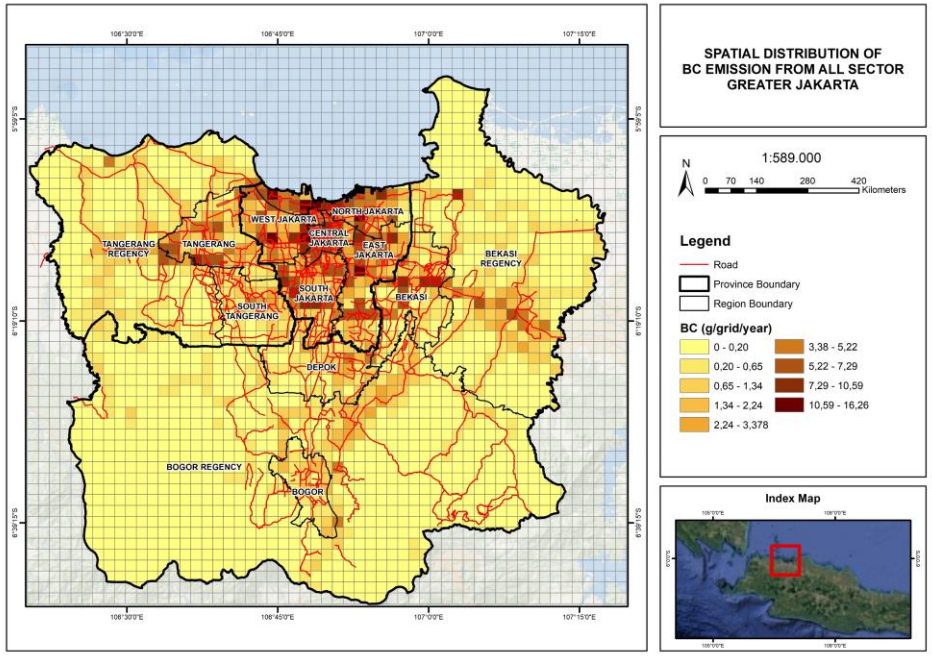
PM_{10}



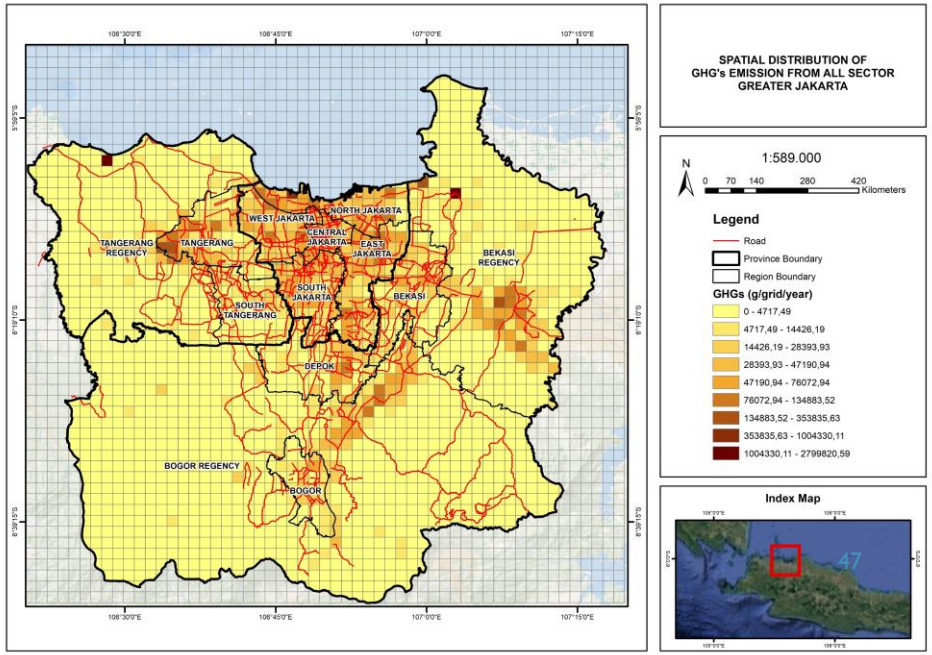
$PM_{2.5}$

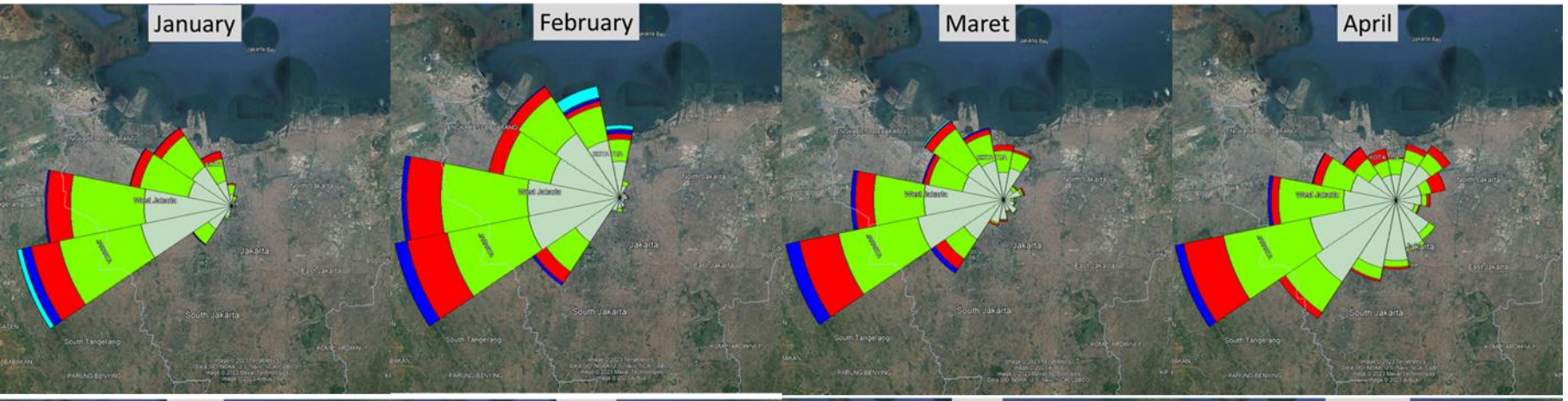


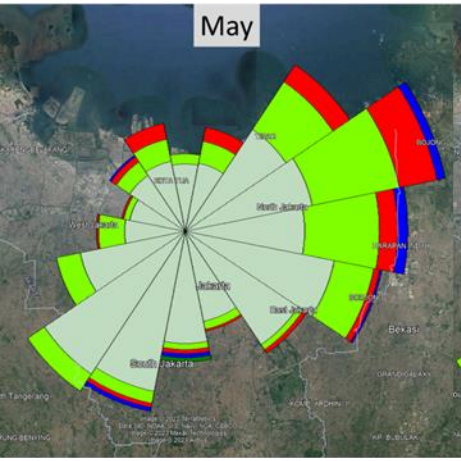
BC

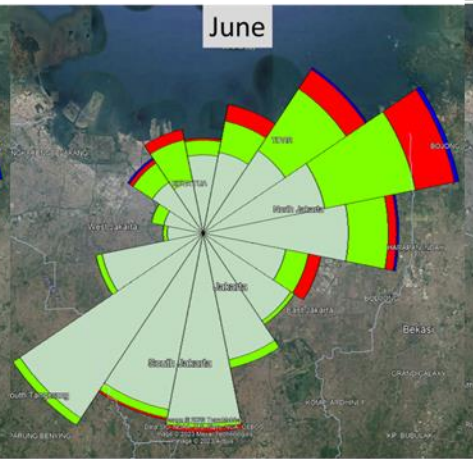


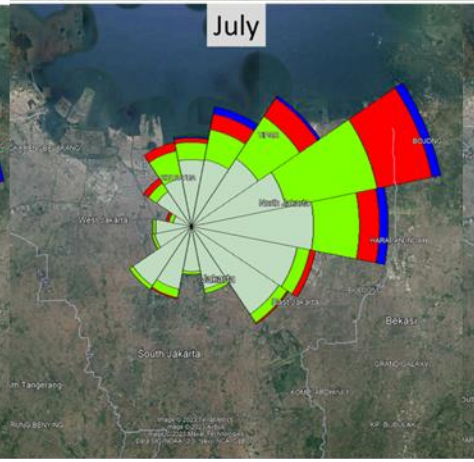
GHGs

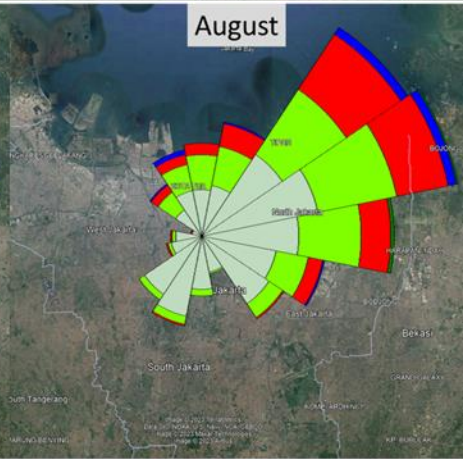


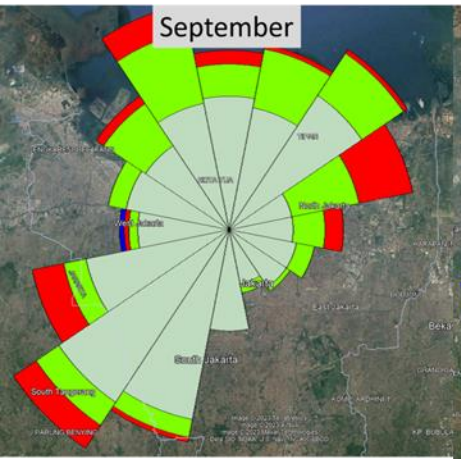


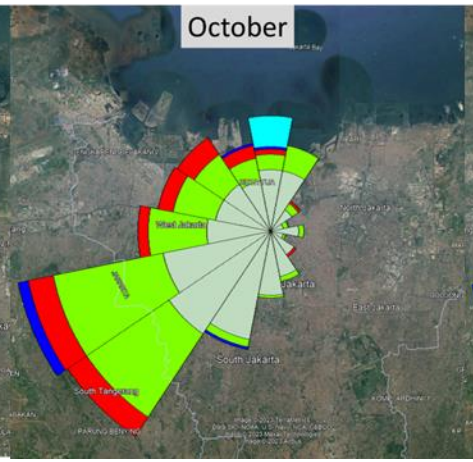


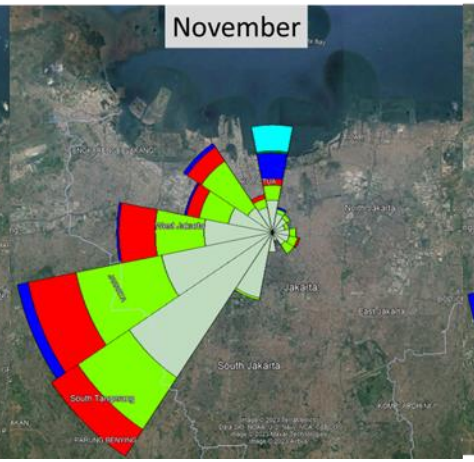


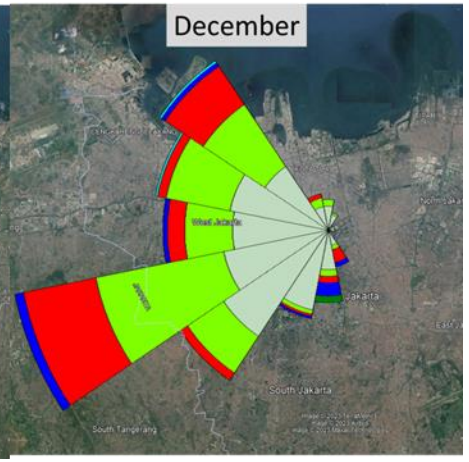










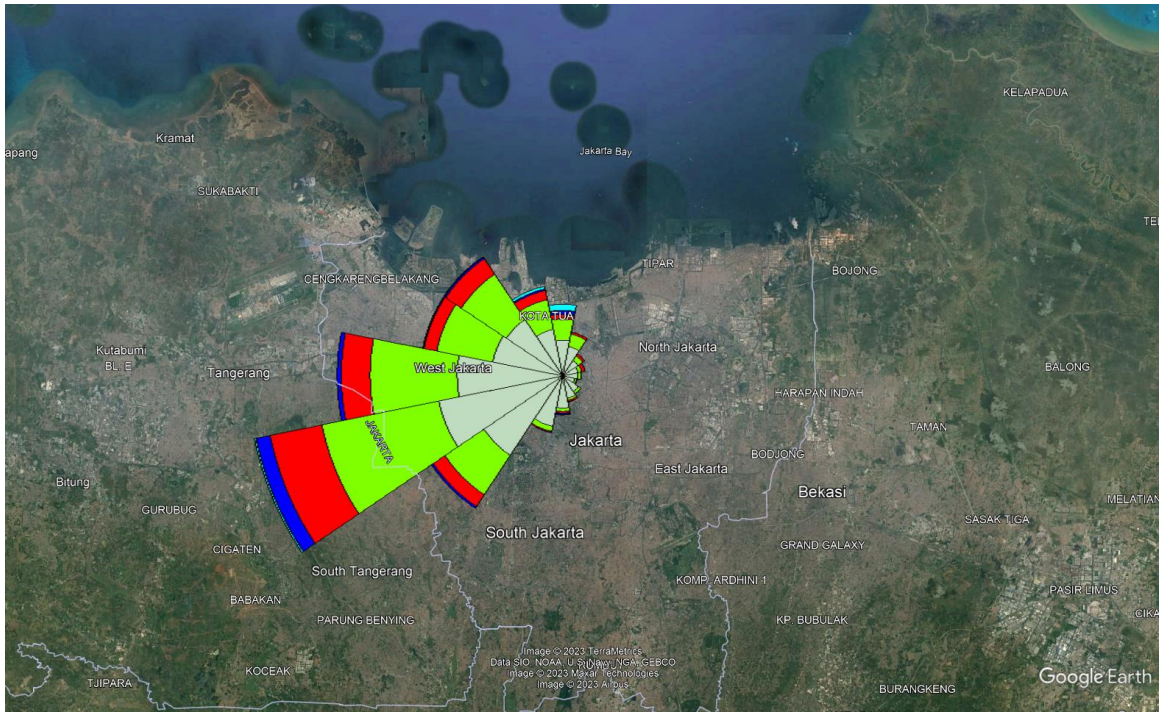


WIND ROSE – MONTHLY 2023

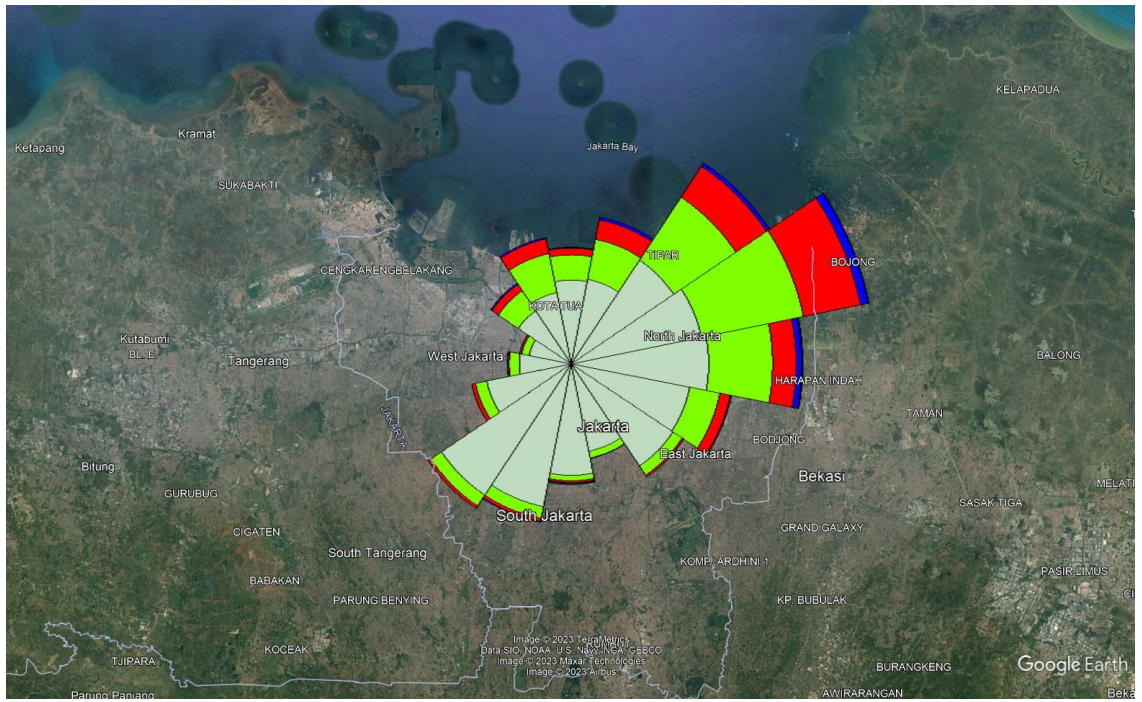
Blowing from

Met:
Januari 2022 –2023 (Hasil CALMET dengan titik lokasi GBK)

WET SEASON 2022-2023



DRY SEASON 2022-2023



CONCLUSSIONS

- The emission sources characteristic between Jakarta and Jabodetabek is slightly different
- The source characteristic and contribution for each pollutant is varied from region to region
- The main sources of air pollutant in Jabodetabek for PM10 and SO2 is mainly from industry, Power plant and transport. While for PM2.5, industry is still the main contributor follow by transport sector and power plant.
- Transport is also still the major contributor to pollutants VOCs, CO, BC and NOx. Truck and other Diesel vehicles are the major source of PM2.5, PM10, NOx, SO2 and BC. While motorcycles is the highest contributor for CO and VOCs in the transport sector
- The best levers to reduce emission from transport sector by far is the adoption of Euro iv (for SO2 & PM, BC) and E2W (CO, and VOC)
- While for industries the key levers are coal to gas conversion and implementation of Air Pollution Control (APC)
- Spatial distribution indicating that PM2.5, PM10 as well SO2, distributed mostly in the outside of Jakarta, including Bekasi, Tangerang and Kab Bogor. While other pollutant are well concentrated in Jakarta

RECOMMENDATIONS

UCAPAN TERIMA KASIH

- Viriya ENB
- Kemenko Infrastruktur dan Pembangunan Kewilayahan (Deputi Bidang koordinasi Infrastruktur Dasar)
- Kementrian Lingkungan Hidup : support data dan kerjasamanya
- Dinas Lingkungan Hidup (DLH) Jakarta, Kota & Kabupaten Bogor. Kota & Kabupaten Bekasi, Kota & Kabupaten Tangerang, dan Depok
- Team Peneliti ITB

THANK YOU