EMISSION INVENTORY OF BANGLADESH
under Malé Declaration on Control and Prevention of Air Pollution And Its Likely Transboundary Effects for South Asia

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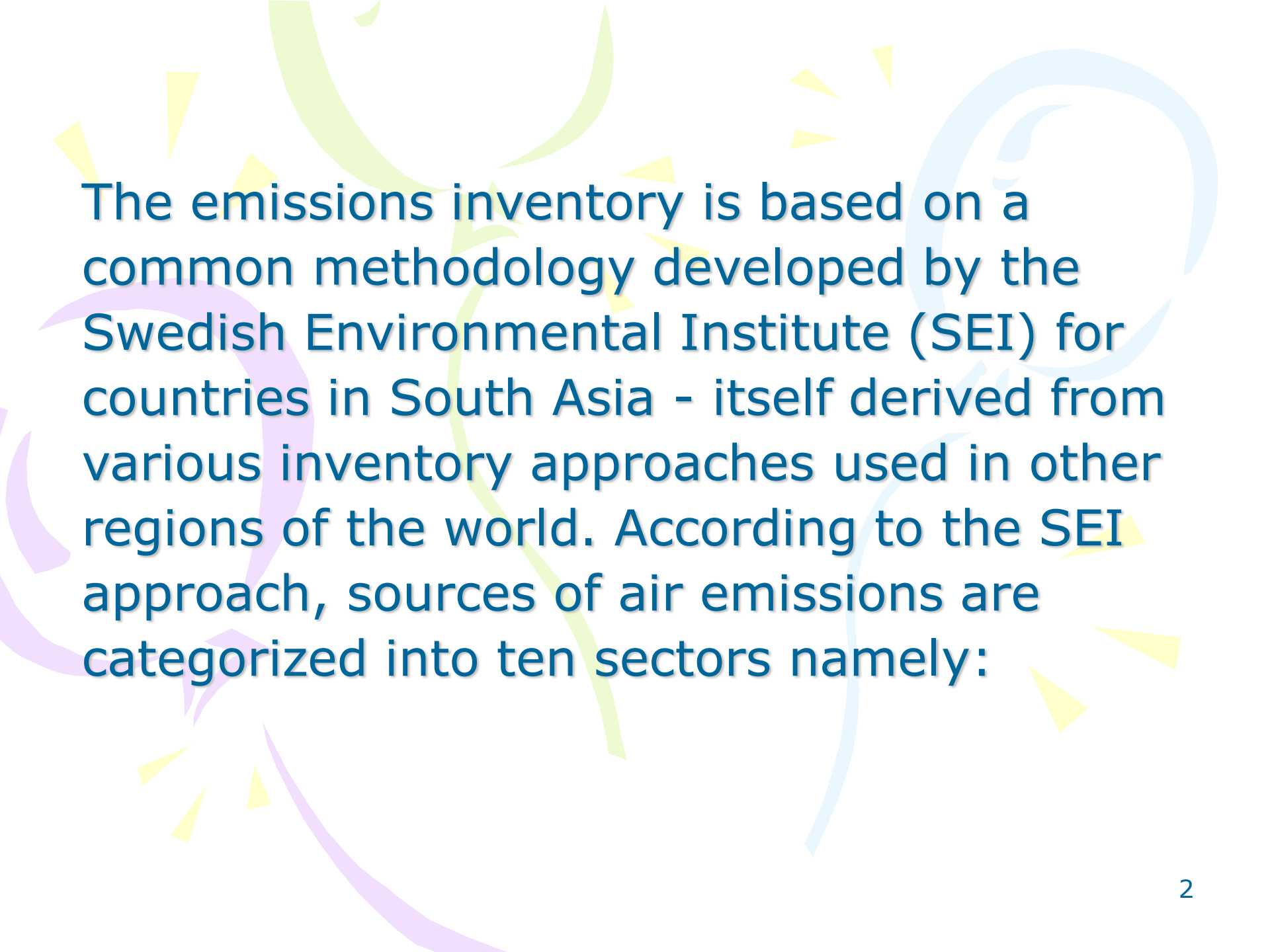DEPARTMENT OF ENVIORNMENT, BANGLADESH
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The emissions inventory is based on a common methodology developed by the Swedish Environmental Institute (SEI) for countries in South Asia - itself derived from various inventory approaches used in other regions of the world. According to the SEI approach, sources of air emissions are categorized into ten sectors namely:

Source Sectors

1. Combustion in the Energy Industries
2. Combustion in Manufacturing Industries and construction
3. Transport
4. Combustion in Other Sectors
5. Fugitive emissions from fuels
6. Industrial processes
7. Solvent and other product use
8. Agriculture
9. Vegetation fires and Forestry
10. Waste

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Source Sectors

Energy

This sector includes Fuel Combustion Activities (Sectors 1 to 4) as well as sources of Fugitive Emissions from Fuels (Sector 5). Sectors 1 to 4 include fuel combustion activities within the Energy Industries (Sector 1), Manufacturing Industries and Construction (Sector 2), Transport (Sector 3), and Other Sectors (Commercial/Institutional, Residential and Agriculture/ Forestry/Fishing—Sector 4). Sector 5 includes non-combustion activities related to the extraction, processing, storage, distribution and use of fuels.

Source Sectors

Industrial processes

This category covers those industrial processes that generate by-product emissions (that is, process emissions) or fugitive emissions of the pollutants covered by this Manual. It specifically *excludes all combustion emissions* from industry as these are already covered in Sector 2. However, it includes emissions from energy commodities used as a raw material in processes and coal and coke used as reducing agents for metal production (e.g. in iron manufacture). This sector includes the Mineral Products Industry, the Chemical Industry, Metals Production and the Pulp and Paper Industry.

Source Sectors

Solvent and Other Product Use

This category covers the use of solvents and other products containing volatile compounds that are sources of NMVOC emissions. It includes the application of paint, glue and adhesives; metal degreasing and dry cleaning of fabrics; the manufacture of certain chemical products; and the use of solvents in the printing industry.

Source Sectors

Agriculture

This category includes livestock manure management and the application of nitrogen-containing fertilizers, both of which are responsible for ammonia emissions. It also covers field burning of agricultural crop residues. Fuel combustion emissions in agriculture are excluded as these are covered in Sector 4.

Source Sectors

Vegetation fires and forestry

This sector includes the on-site burning of forests and natural grasslands (excluding savannas). These fires may be man-induced (due to prescribed burning for management purposes or conversion to other land uses, or by accident) or natural wildfires.

Source Sectors

Waste

This emissions source category covers all types of waste incineration except waste-to-energy facilities (which are dealt with under Energy facilities) and on-field burning of crop residues (dealt with under Agriculture). It includes the incineration of municipal solid waste (MSW), industrial waste and commercial waste. Also included are emissions of ammonia from human excreta stored in latrines ("dry" toilets located outside the house) or from defecation/urination outdoors (e.g. in the fields or bush).

Estimation methods

Most emissions can be estimated using the simple relation:

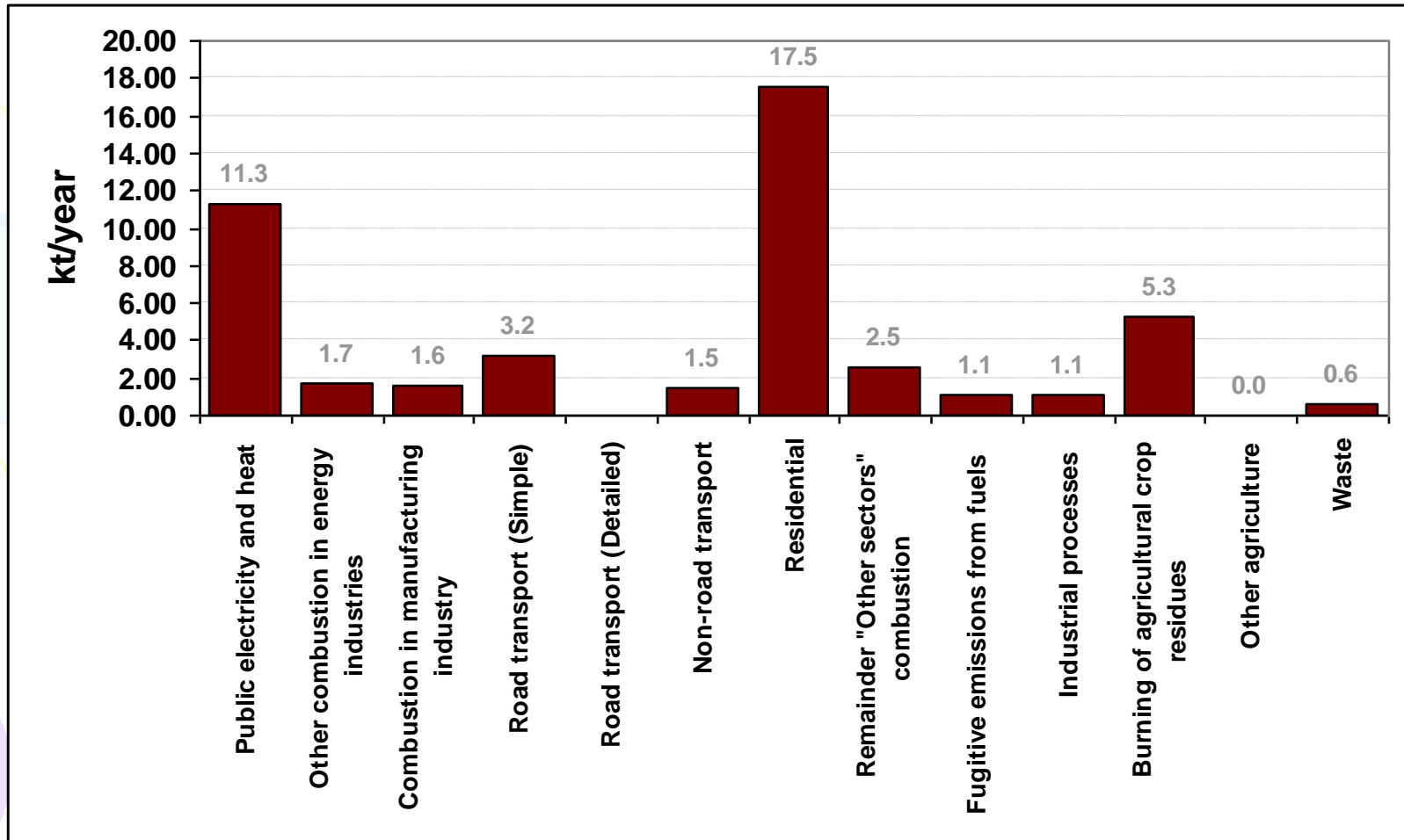*Emissions = Emission factor x Activity rate*

Emission Inventory Workbook

Sources of Data:

1. International Energy Agency (IAEA)
2. FAOSTAT
3. Bangladesh Bureau of Statistics (BBS)
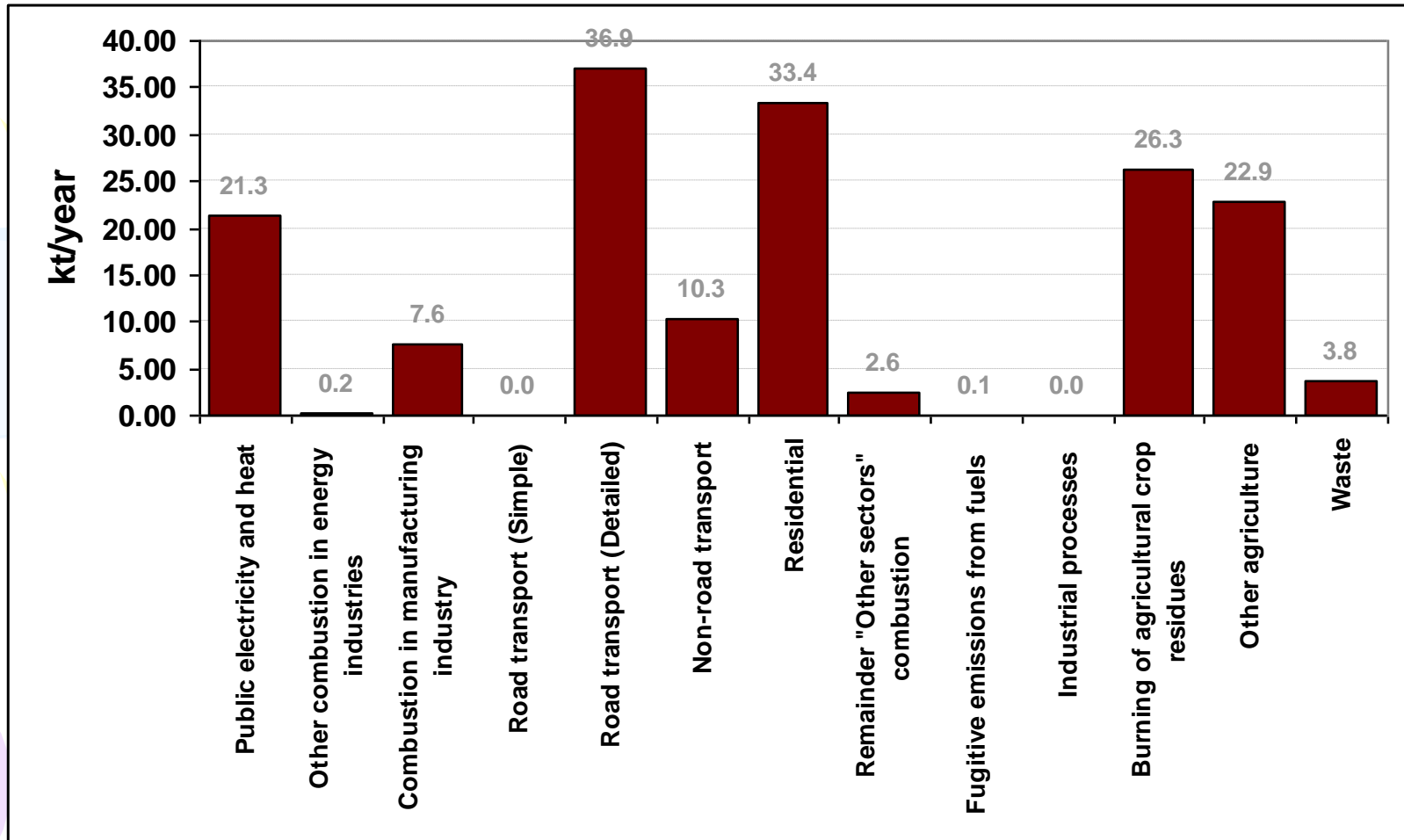4. Bangladesh Road Transport Authority (BRTA)
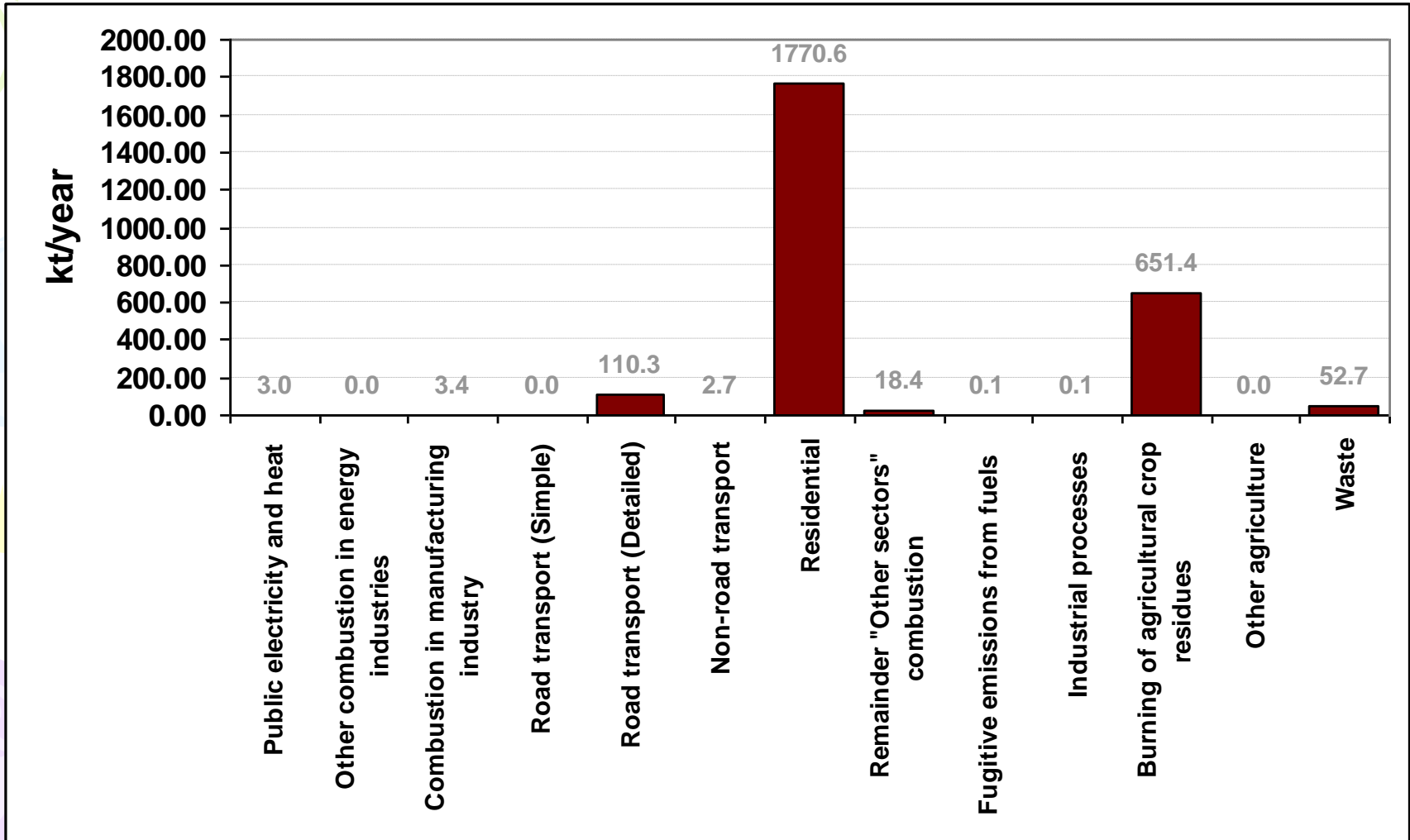
Emission by pollutant type
Sulphur dioxide (SO$_2$)

Emission by pollutant type
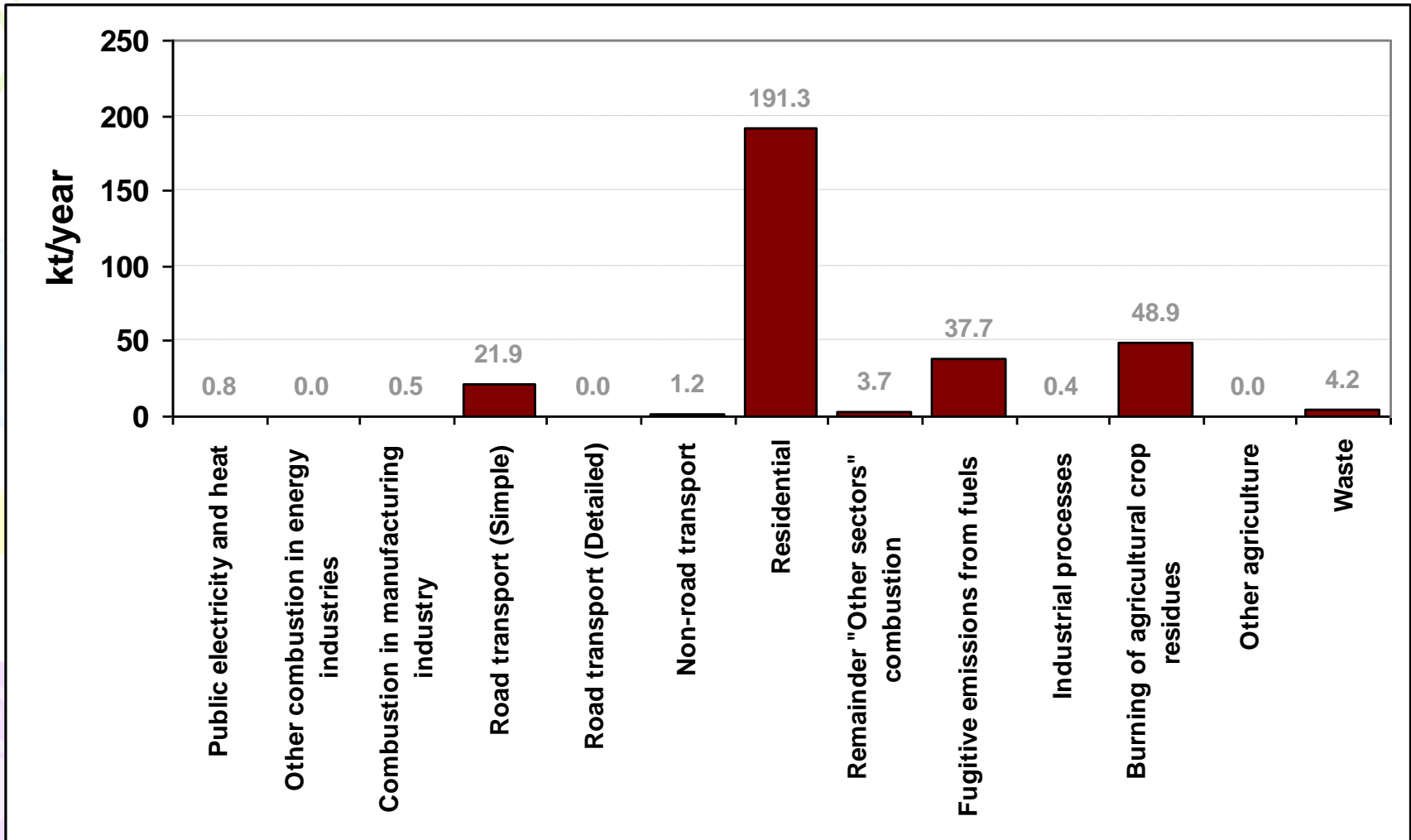
Oxides of Nitrogen (NOₓ)

Emission by pollutant type
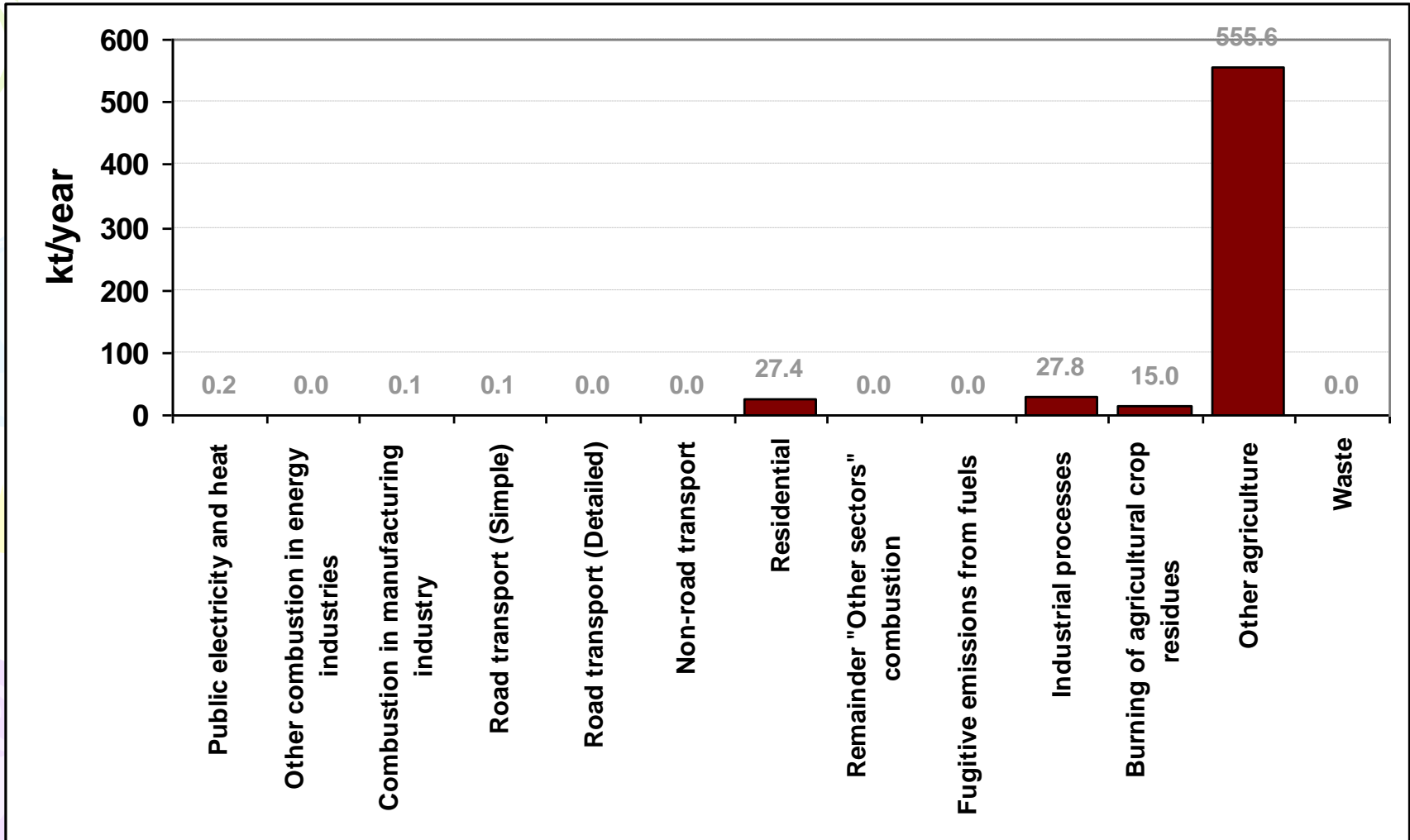## Carbon Monoxide (CO)

Emission by pollutant type

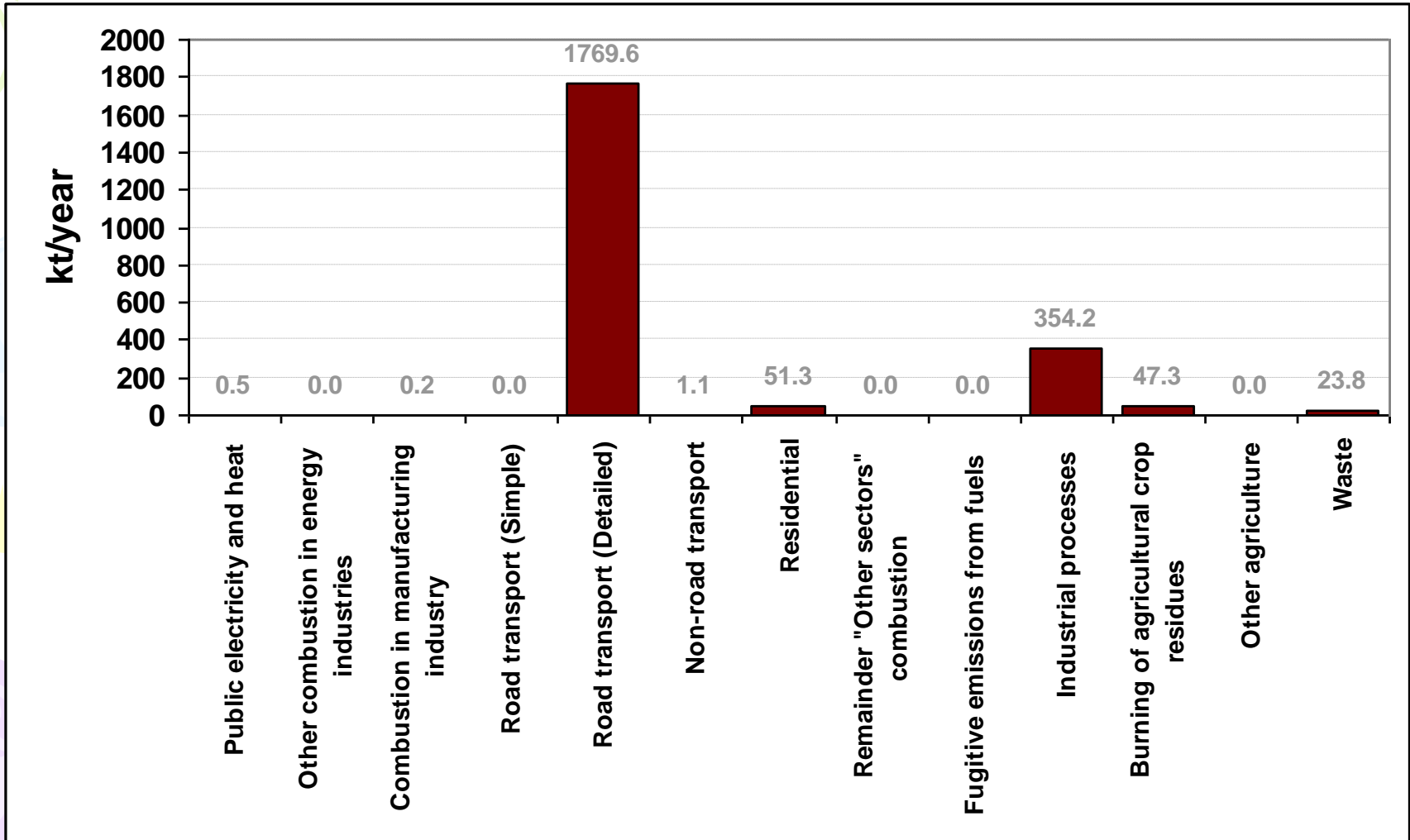## *Non-Methane Volatile Organic Compounds (NMVOC)*
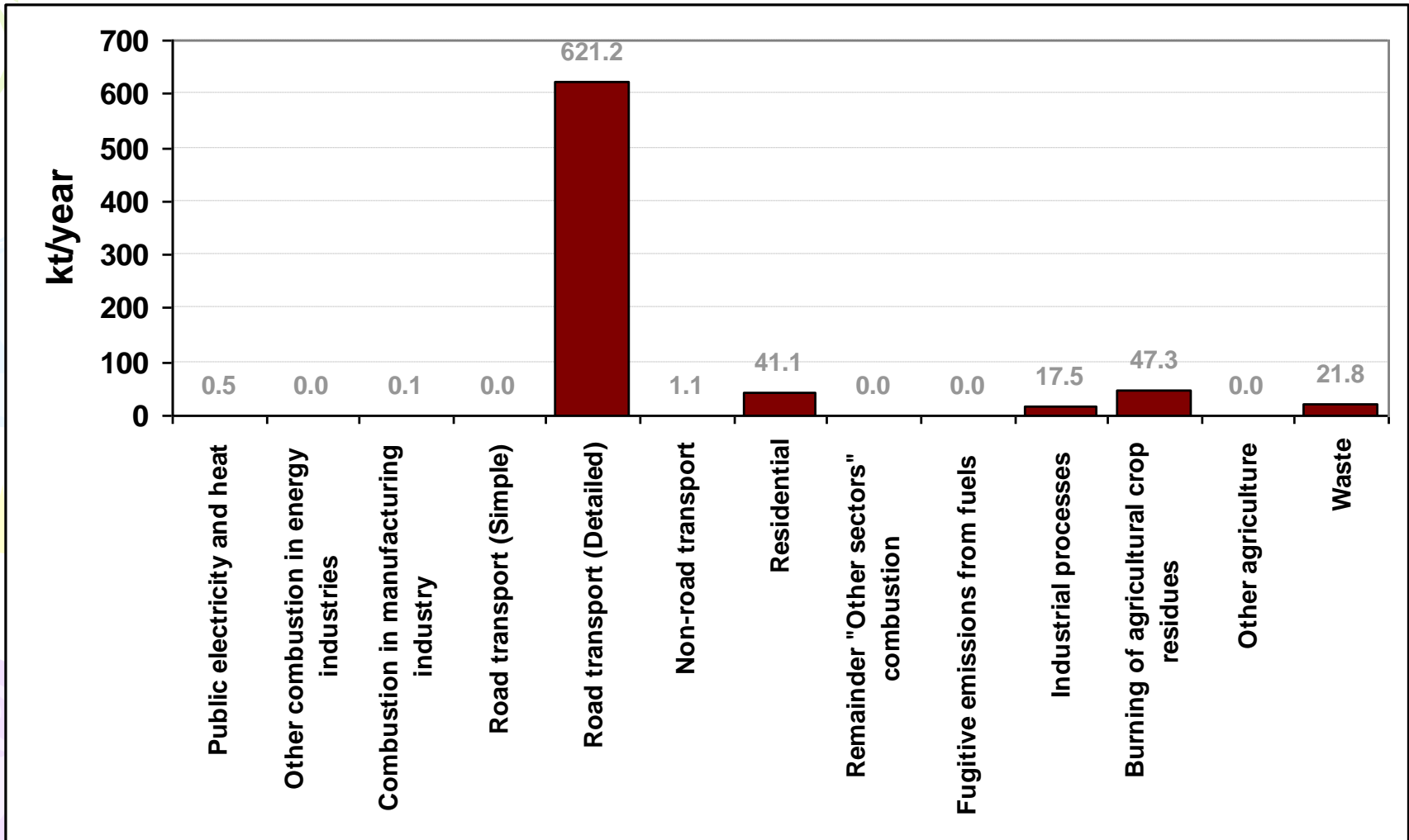
Emission by pollutant type

Ammonia (NH₃)

Emission by pollutant type

Particulate matter less than 10μm (PM$_{10}$)

Chart: Emission values (kt/year) by pollutant source type:

| Source	kt/year
Public electricity and heat	0.5
Other combustion in energy industries	0.0
Combustion in manufacturing industry	0.2
Road transport (Simple)	0.0
Road transport (Detailed)	1769.6
Non-road transport	1.1
Residential	51.3
Remainder "Other sectors" combustion	0.0
Fugitive emissions from fuels	0.0
Industrial processes	354.2
Burning of agricultural crop residues	47.3
Other agriculture	0.0
Waste	23.8

Emission by pollutant type

Particulate matter less than 2.5μm (PM$_{2.5}$)

Emissions by Sector

Public electricity and heat Sector

Pie chart — Public electricity and heat Sector:
- SO_2 30%
- NO_x 58%
- CO 8%
- NMVOC 2%
- NH_3 1%
- PM_{10} 1%
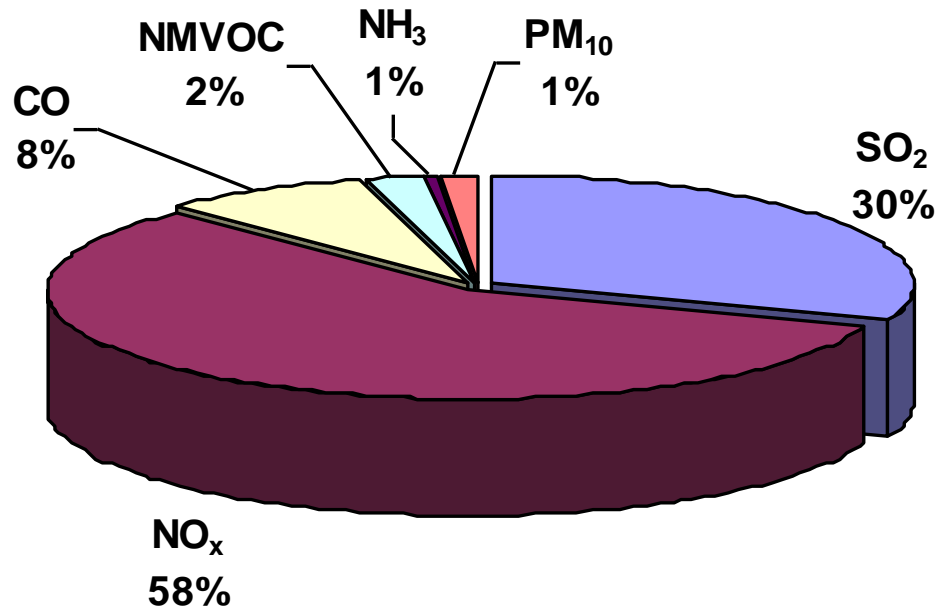
SO_2	NO_x	CO	NMVOC	NH_3	PM_{10}	$PM_{2.5}$
11.29	21.31	2.99	0.77	0.20	0.55	0.47

Emissions by Sector

Other combustion in energy industries
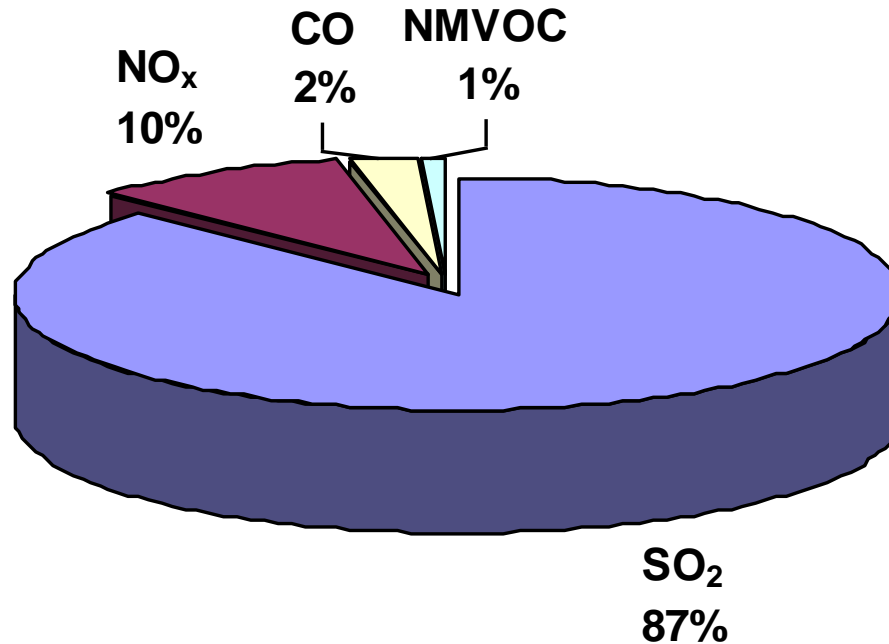
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
1.68	0.18	0.05	0.0.02	0.00	0.00	0.00

Emissions by Sector

Combustion in manufacturing industry
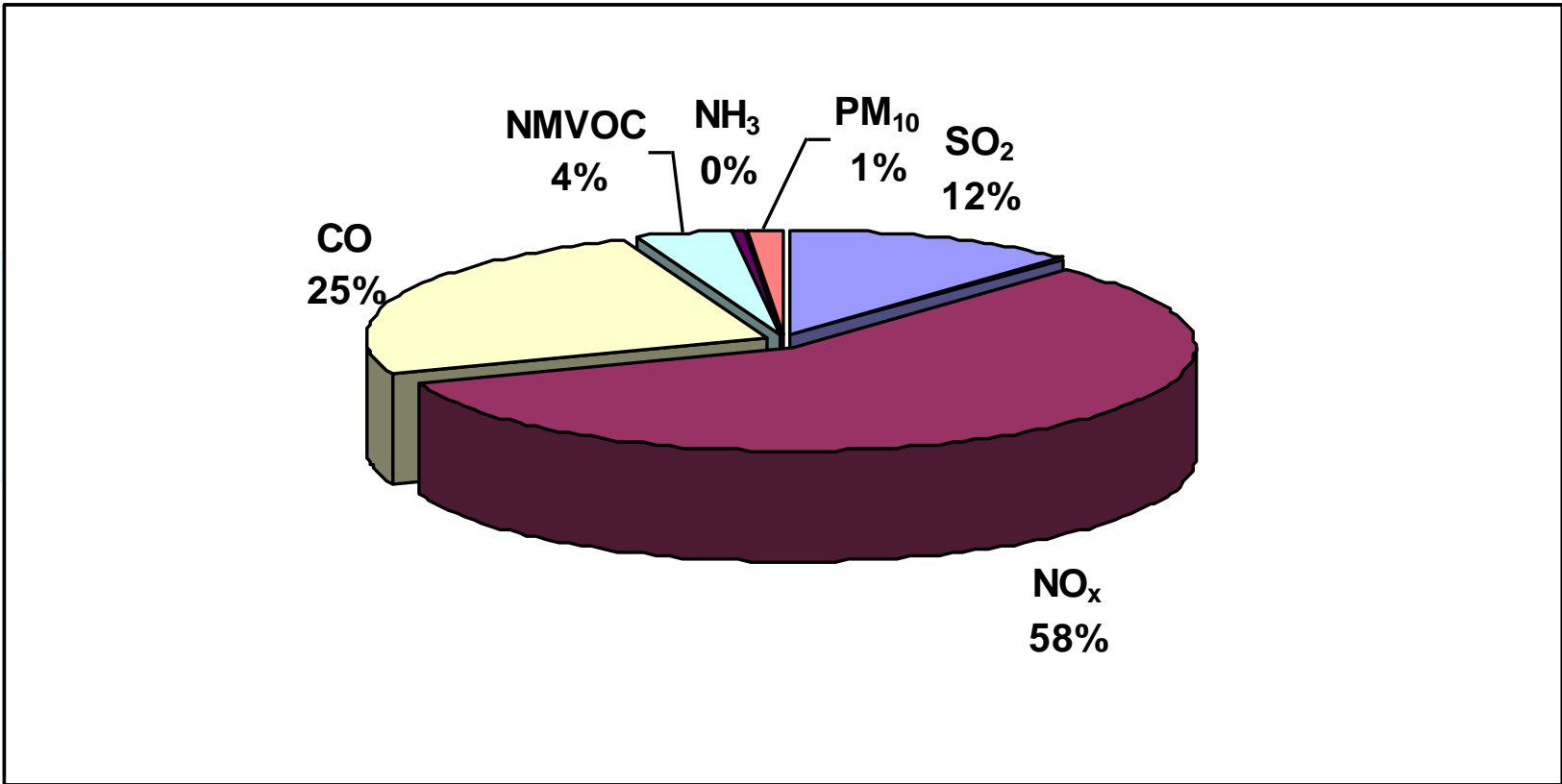
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
1.59	7.64	3.35	0.51	0.06	0.19	0.07

Emissions by Sector

Road Transport Sector

SO$_2$ 0.2% NOx 2% CO 6% NMVOC 1%

PM$_{10}$ 91%
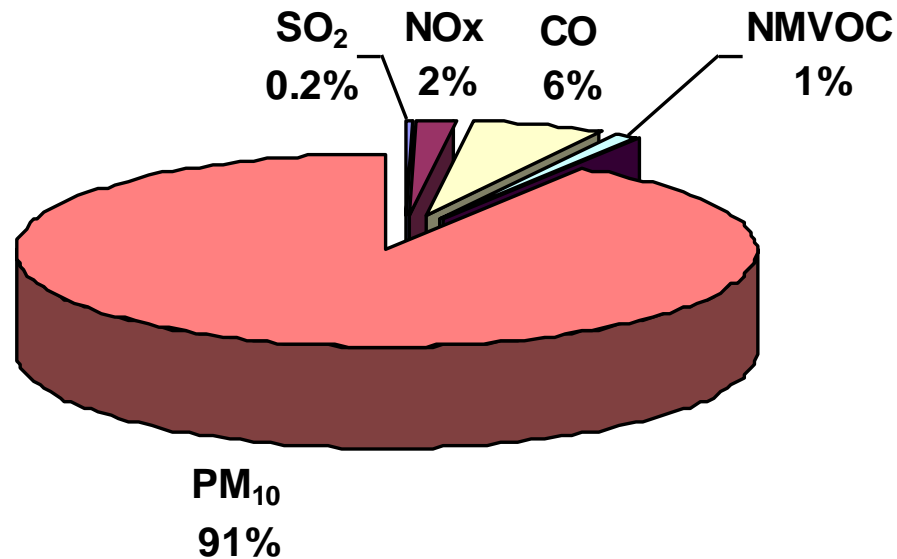
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
3.17	36.94	110.34	21.87	0.08	1769.56	621.21

Emissions by Sector

Non-road transport

Pie chart:
- SO$_2$ 9%
- NO$_x$ 61%
- CO 16%
- NMVOC 7%
- PM$_{10}$ 7%
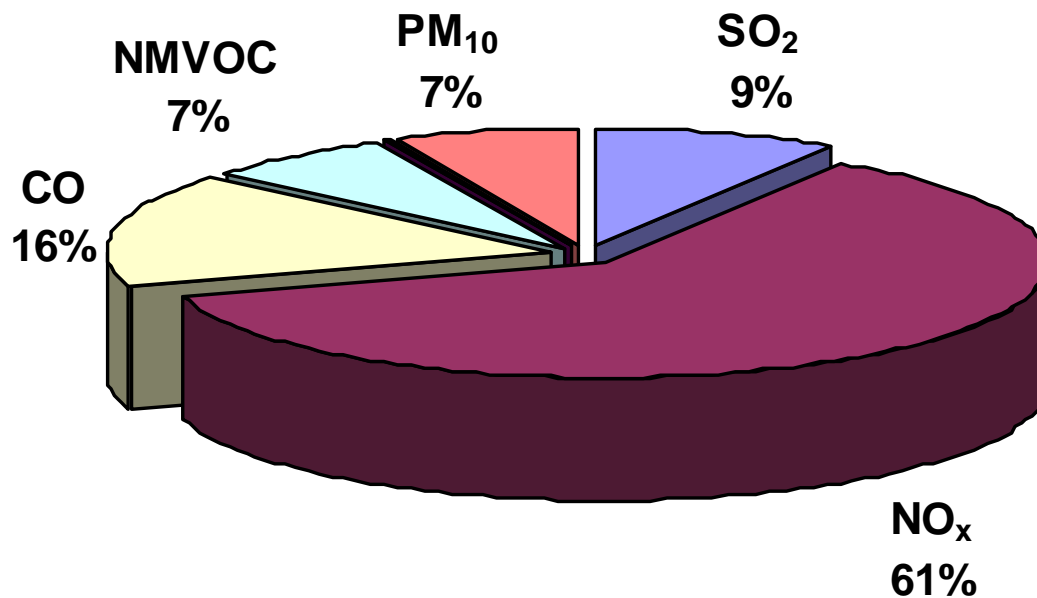
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
1.49	10.34	2.70	1.19	0.03	1.13	1.06

Emissions by Sector

Residential Sector
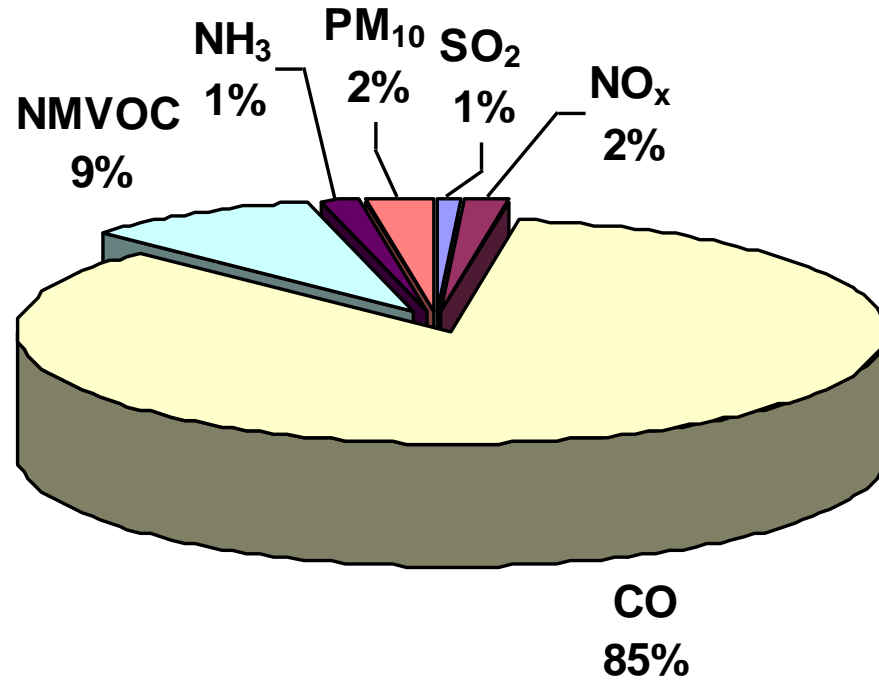
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
17.50	33.44	1770.63	191.26	27.38	51.31	41.06

Emissions by Sector

Combustion in Other Sectors

NMVOC
13%

SO$_2$
9%

NO$_x$
9%

CO
69%
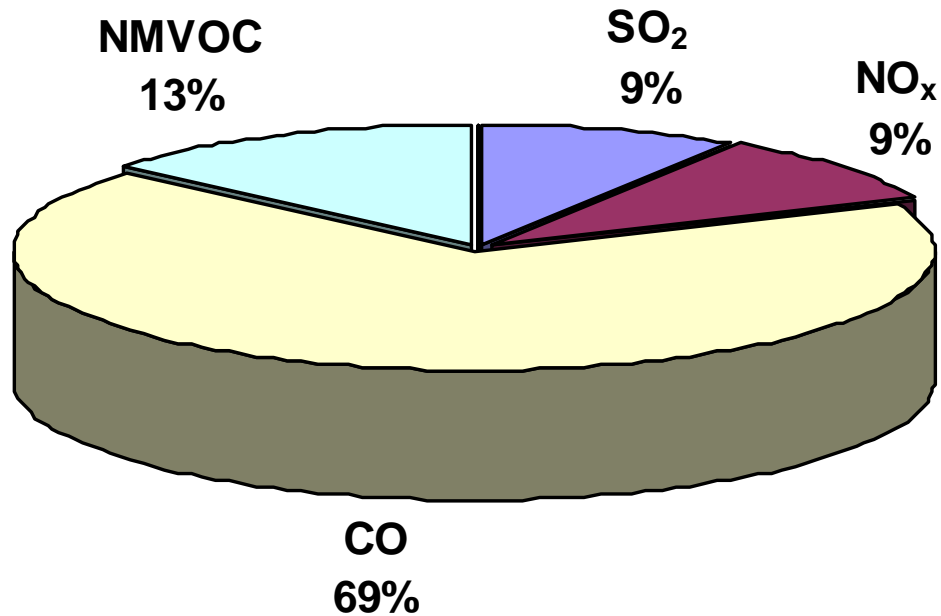
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
2.53	2.56	18.42	3.67	0.00	0.01	0.00

Emissions by Sector

Emissions from Industrial Processes
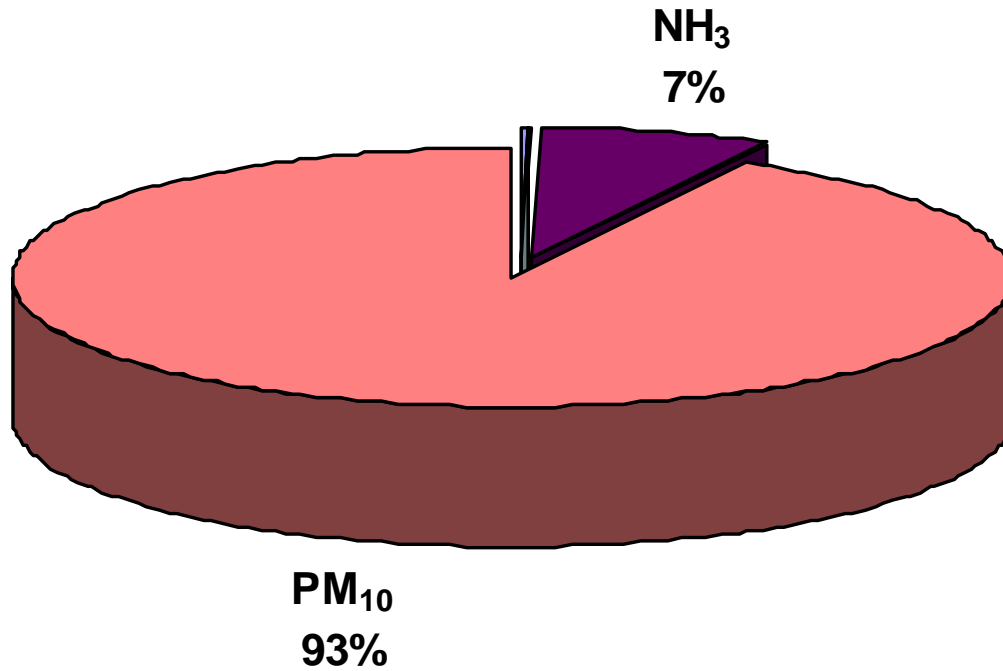
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
1.12	0.02	0.06	0.39	27.80	354.25	17.50

Emissions by Sector

Burning of agricultural crop residues
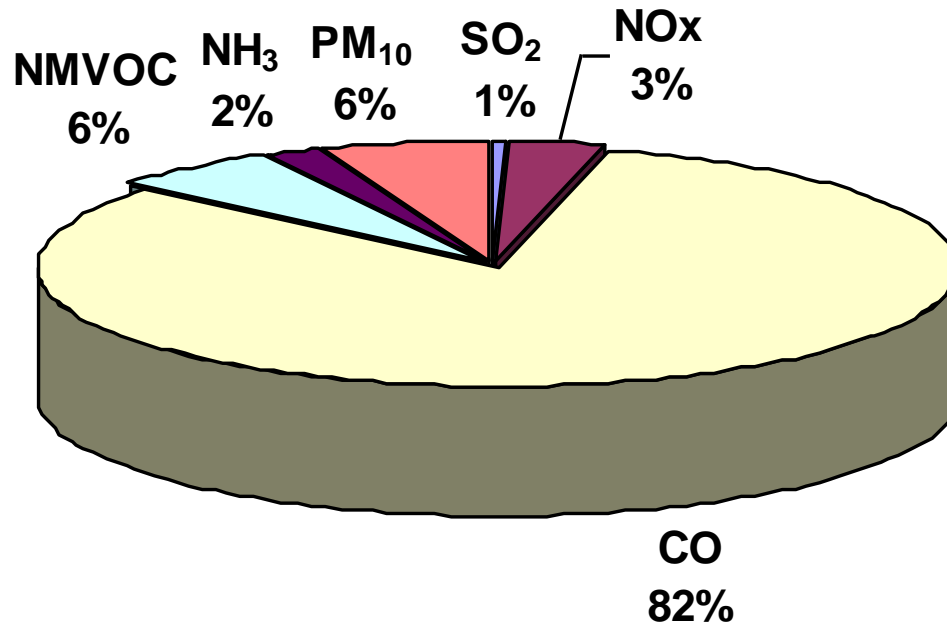
SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
5.33	26.34	651.38	48.86	14.96	47.26	47.26

Total Emissions
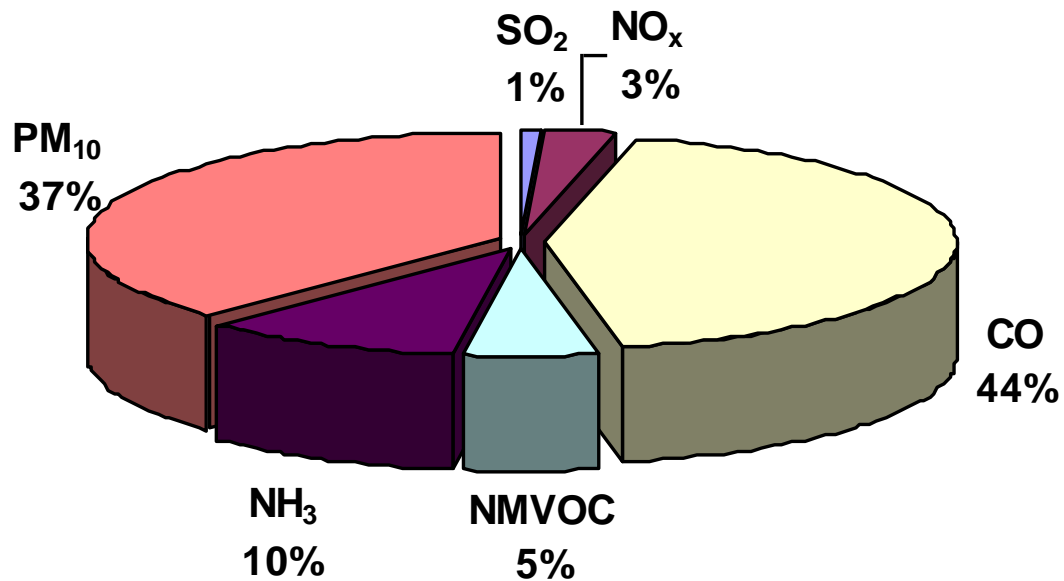
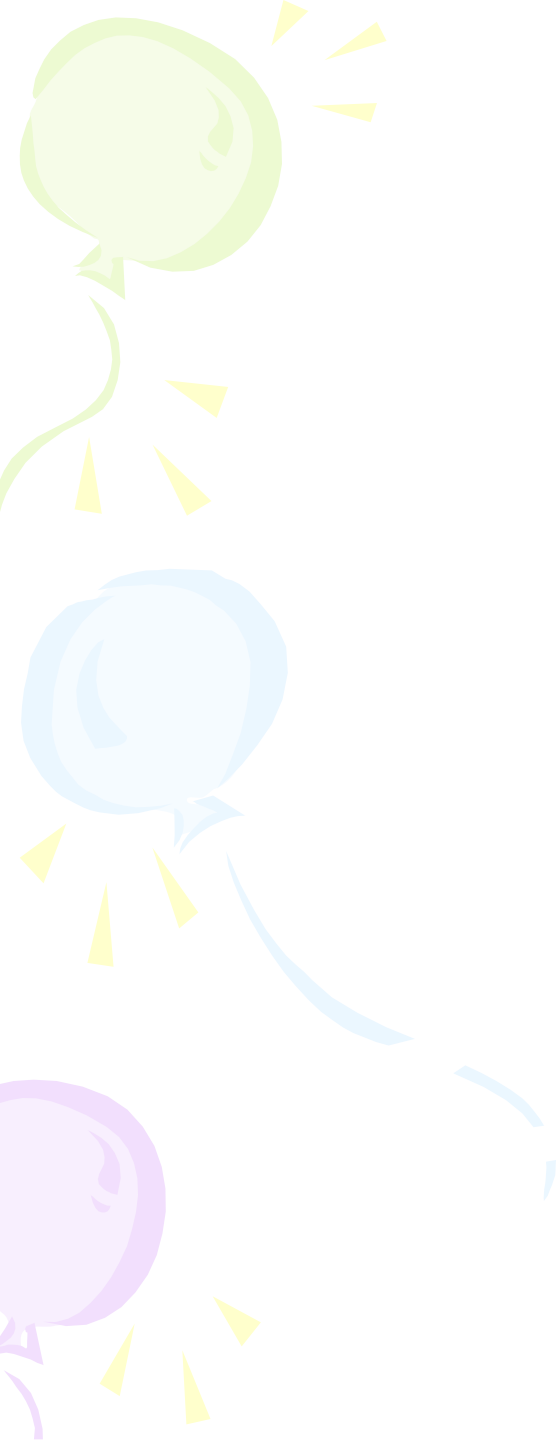| SO$_2$	NO$_x$	CO	NMVOC	NH$_3$	PM$_{10}$	PM$_{2.5}$
47.40	165.48	2612.74	310.38	626.15	2248.09	750.48

LIMITATIONS…..

- **Data were not available in all sectors (e.g. solvent and other product use).**
- **Difficult to acquire information (e.g. fugitive emissions of particulate matter from major building construction activities).**
- **Incomplete data**

FUTURE PLAN…..

- **It is to be needed for updating emission inventory by using 2005 data**

THANKS