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GHG and Air Emission Inventory of Can Tho City, Mekong Delta, Vietnam

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- Can Tho City

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2. METHODOLOGY
3. RESULTS AND DISCUSSION
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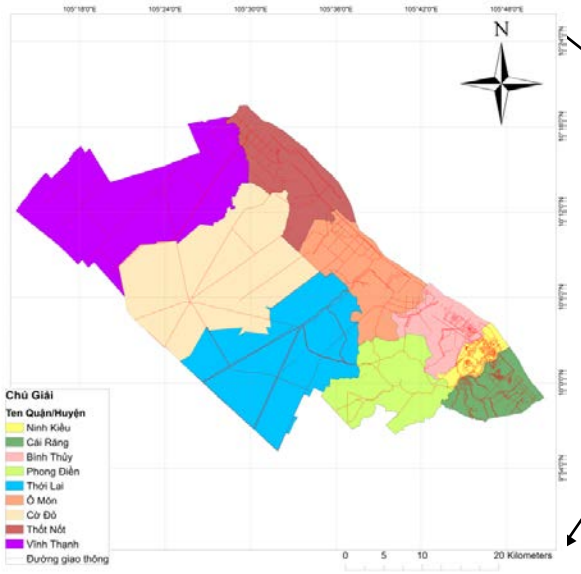
INTRODUCTION

Why CANTHO ?

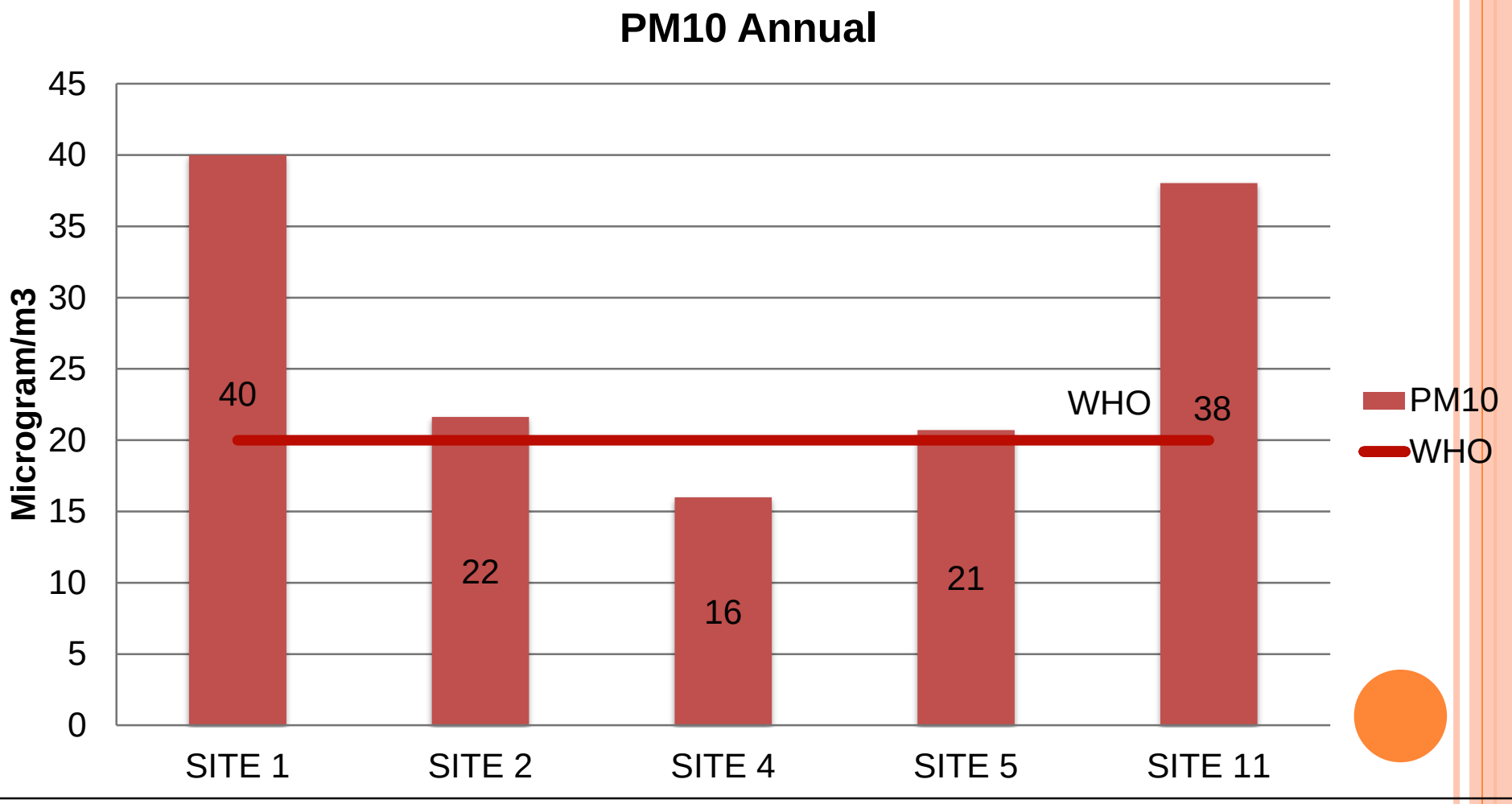
- Developing city & polluted
- The Mekong Delta: one of the most areas affected strongly by climate change and SLR
- Collect & Measure a lot of data

- 1,232 mi habitants, 140,894.9 ha
- 1’115’259 motorcycles 9’809 cars
- 815 industries



INTRODUCTION

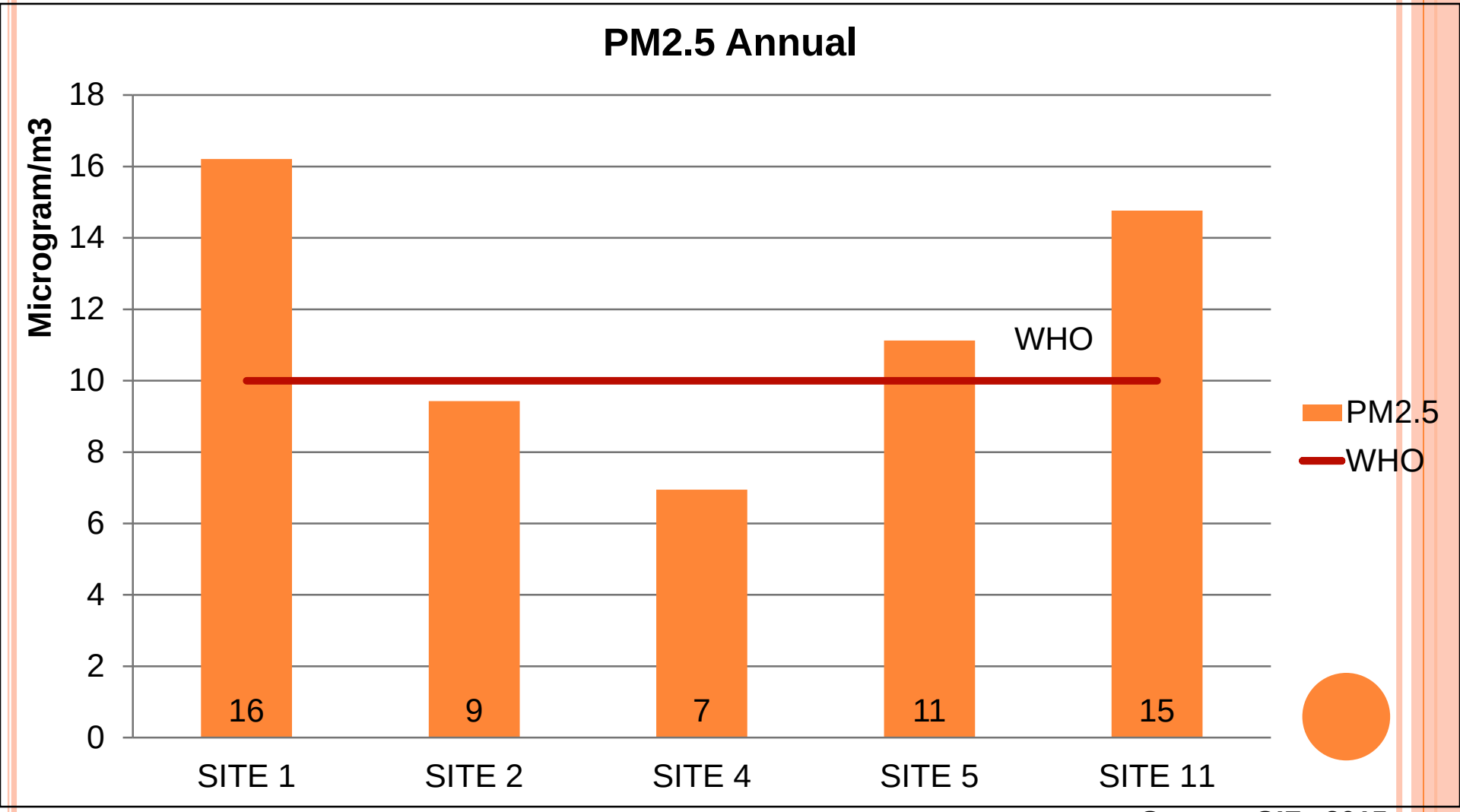
AIR POLLUTION!



Source: GIZ., 2015

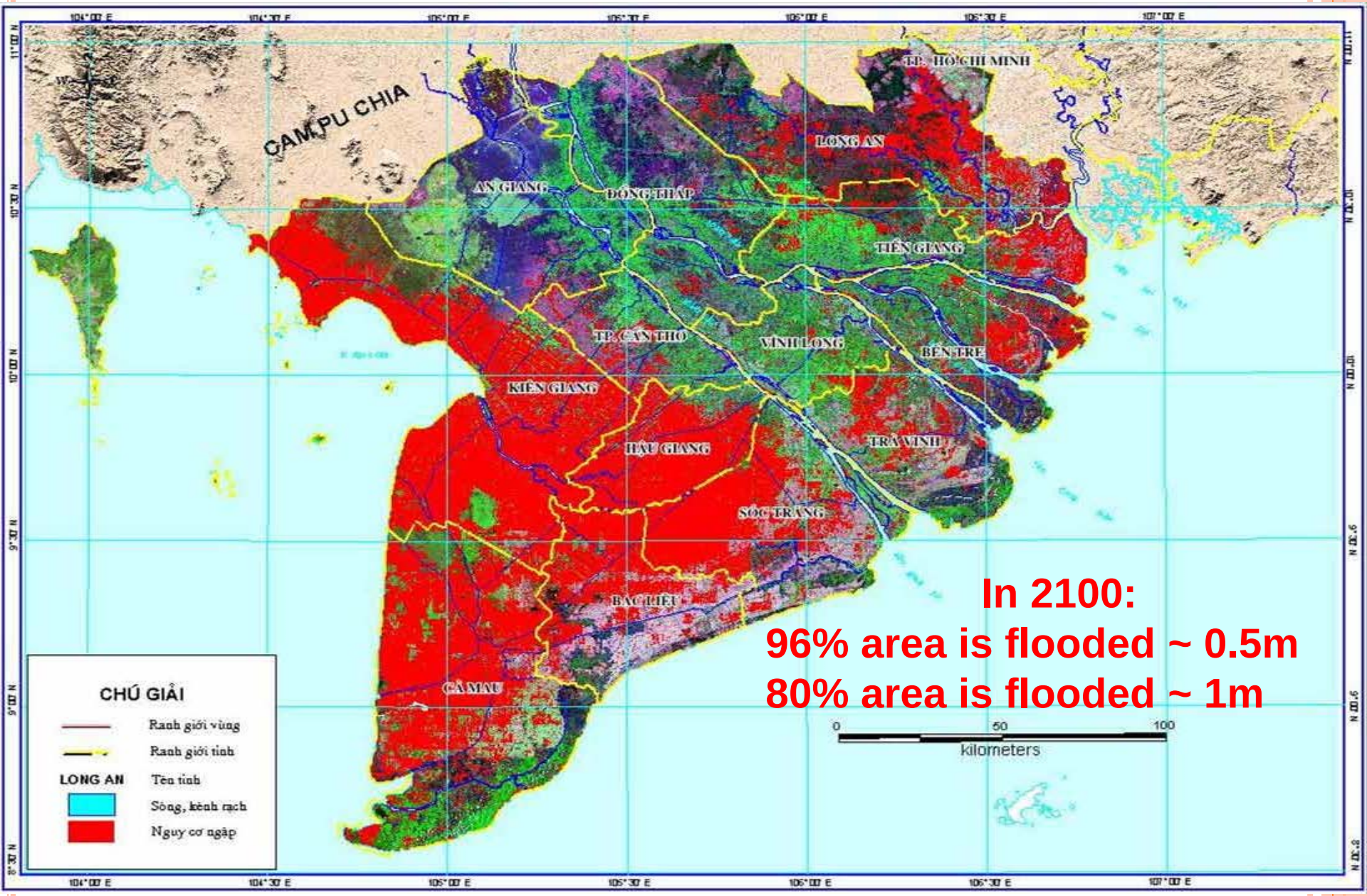
INTRODUCTION

AIR POLLUTION!



Source: GIZ., 2015

CLIMATE CHANGE & SLR: FLOODING



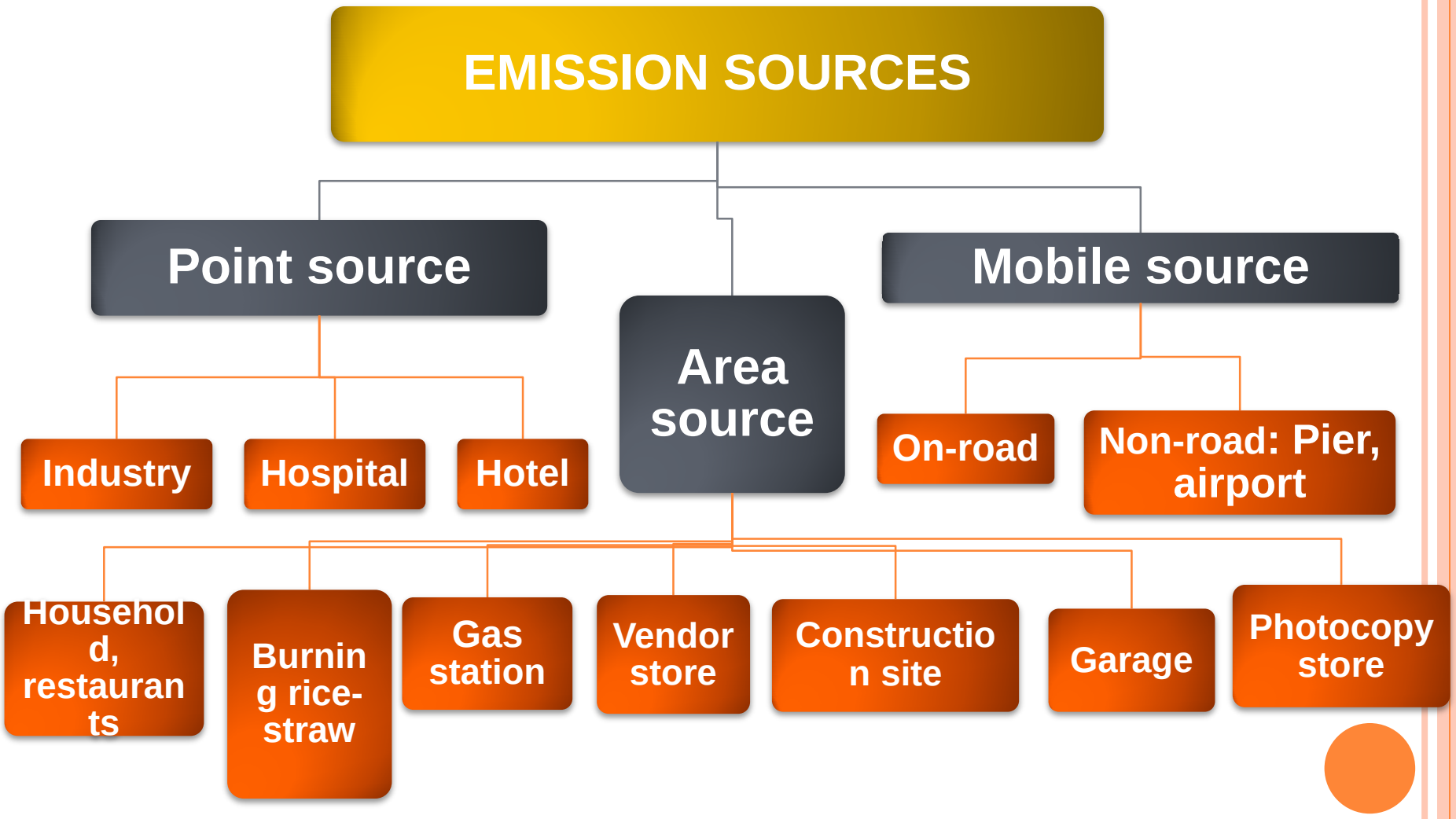
Source: MONRE., 2012

OBJECTIVES

- To conduct an emission of air pollutants (EI) and Green House Gases (GHG) for Can Tho city;
- To design abatement strategies to reduce the air pollutants and to reduce GHG for the city

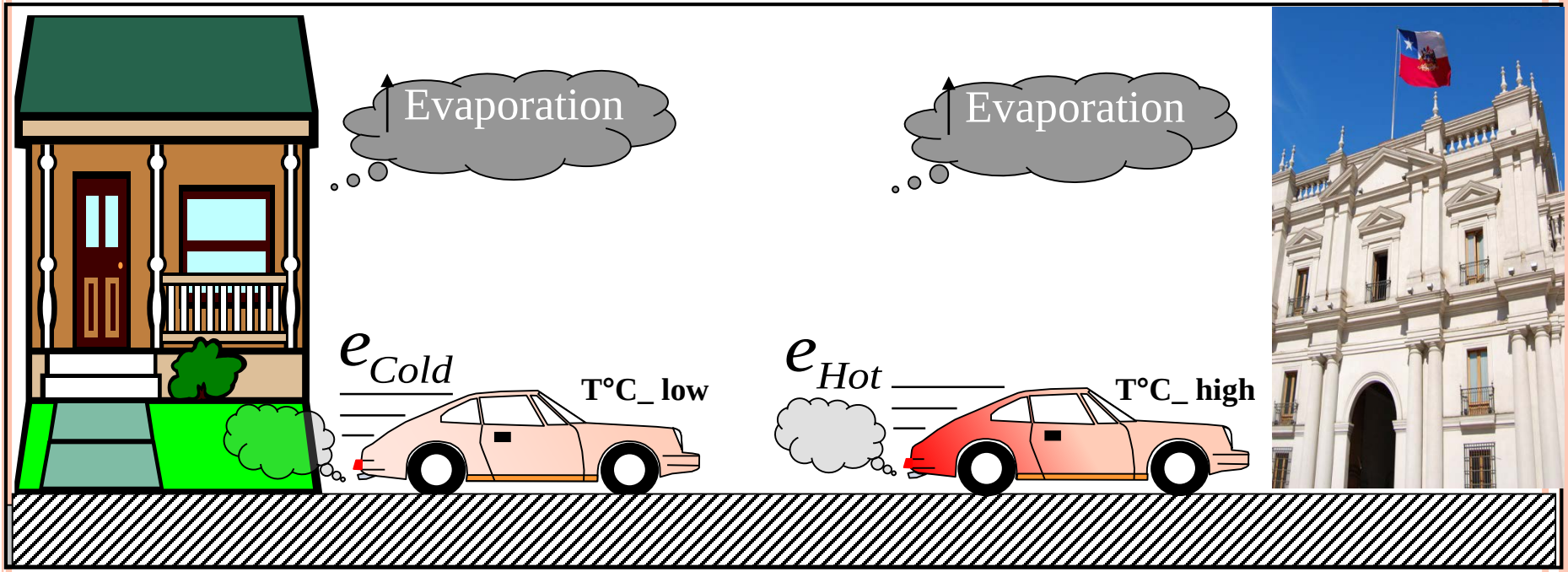
Source: GIZ., 2015

METHODOLOGY



METHODOLOGY: MOBILE SOURCE (EMISENS MODEL)

$$E_{Total} = E_{Cold} + E_{Hot} + E_{Evaporation}$$



- $E_{(hot,i,k,T)} = F_k \times L_{(a,T)} \times e_{(h,i,k,T)}$

METHODOLOGY: AIRPORT

EMEP/EEA emission inventory guidebook 2009 Tier 2

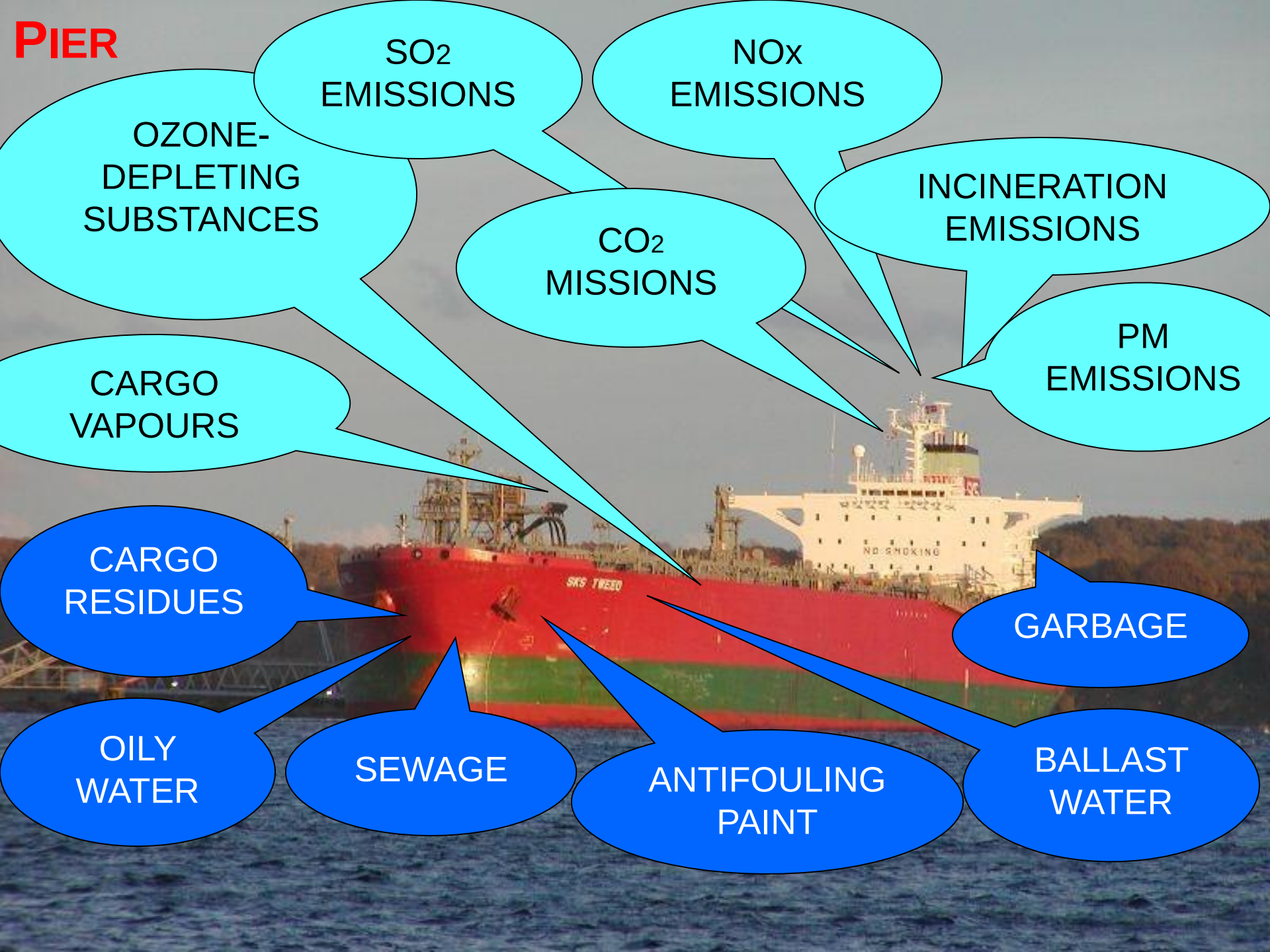
$$E_{pollutant} = \sum_{Aircrafttypes} AR_{fuel\ consumption,\ aircrafttype} \times EF_{pollutant,\ aircrafttype}$$

where, analogous to before:

$E_{pollutant}$ = annual emission of pollutant for each of the LTO and cruise phases of domestic and international flights;

$AR_{fuel\ consumption,\ aircraft\ type}$ = activity rate by fuel consumption for each of the flight phases and trip types, for each aircraft type;

$EF_{pollutant,\ aircraft\ type}$ = emission factor of pollutant for the respective flight phase and trip type, for each aircraft type.


PIER
SO2 EMISSIONS
NOx EMISSIONS
OZONE-DEPLETING SUBSTANCES
CO2 MISSIONS
INCINERATION EMISSIONS
PM EMISSIONS
CARGO VAPOURS
CARGO RESIDUES
GARBAGE
OILY WATER
SEWAGE
ANTIFOULING PAINT
BALLAST WATER
NO SMOKING
SKS TWEED

Air emission inventory for Pier-port

- The project applied air emission inventory methodology which is based on OGVs emission inventories in US EPA guidance (2009). Formula:

$$E = P * LF * A * EF$$

where: E = Emissions (g); P = Maximum Continuous Power Rating (kW); LF = Load Factor (%)

A = Activity (hours); EF = Emission Factor (g/kW.h). With regards to the main engine load factors were calculated using the formula:

$$LF = (AS/MS)^3$$

where: LF = Load Factor (%); AS = Actual Speed (knots); MS = Maximum Speed (knots)

- Emission factors and load factors for auxiliary engines and boilers where taken as default values from US EPA (2009). The following US EPA (2009) modes of vessel activity were used: Reduced speed zone (RSZ); Maneuvering; and Hotelling (time at berth).

METHODOLOGY:
POINT SOURCES

E = A x EF x [1-(ER/100)]

E = emissions

A = activity rate: e.g. amount of fuel burnt, amount of raw material processed or number of product units produced

EF = emission factor; unit e.g. kg particles per kg fuel burnt or g NO_x per km driven

ER = overall emission reduction efficiency, % (only if abatement devices are used)

EF:

- EMEP/EEA Emission Inventory Guidebook (CORINAIR):
- US EPA – AP 42 Emission Factor
- IPCC 2006 – Greenhouse Gases Emission Inventory Guidebook

METHODOLOGY:
AREA SOURCE

$$E_{k,i} = A_k \times EF_{k,i}$$

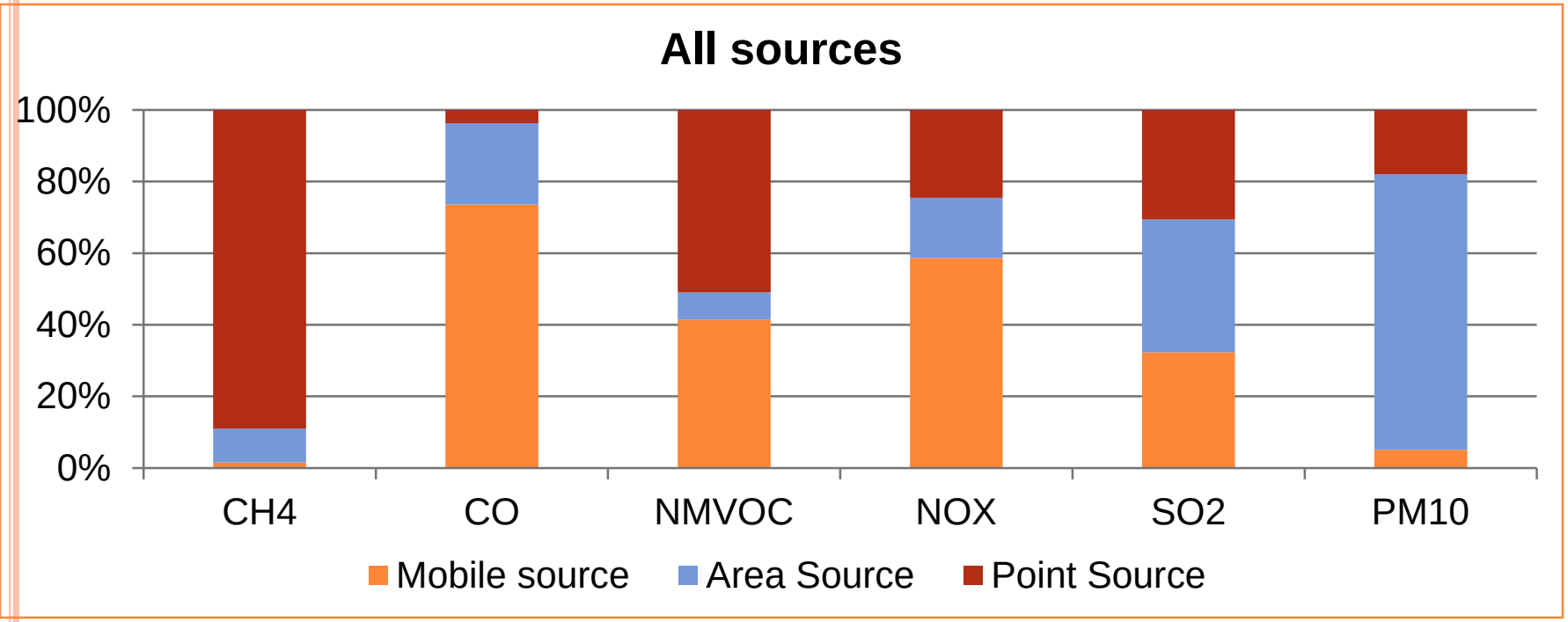
Where:

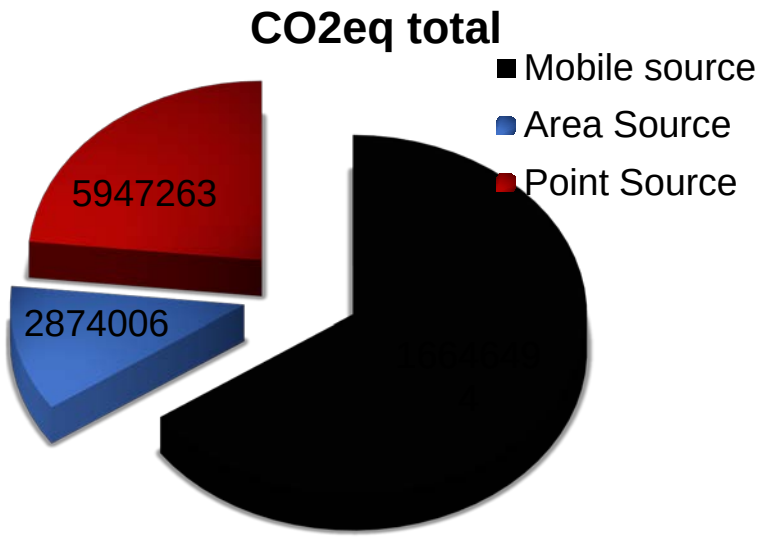
$E_{k.i}$ = Total Emission for pollutant I in source category k in selected grid cell

A_k = Activity rate: e.g. amount of fuel burnt of source category k in the selected grid cell or surrogate data.

$EF_{k,i}$ = Appropriate average emission factor for pollutant i for source category k

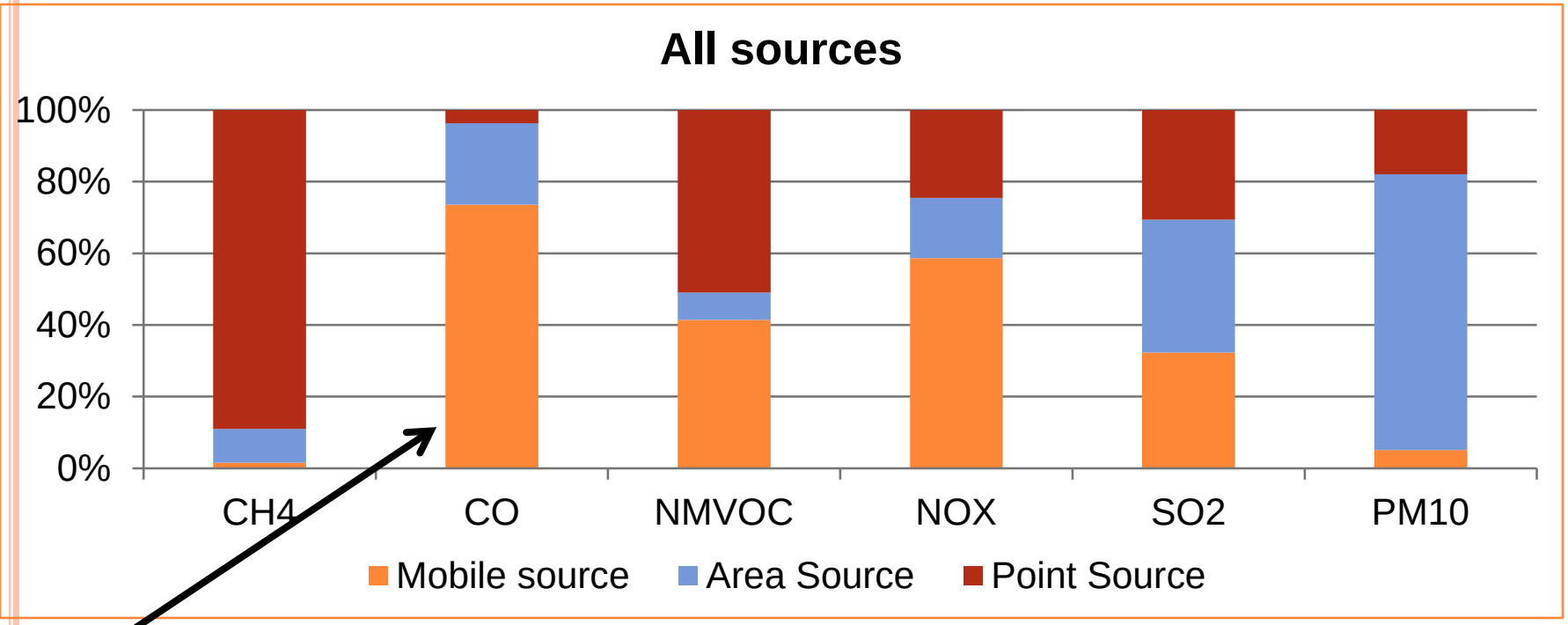
RESULTS & DISCUSSION

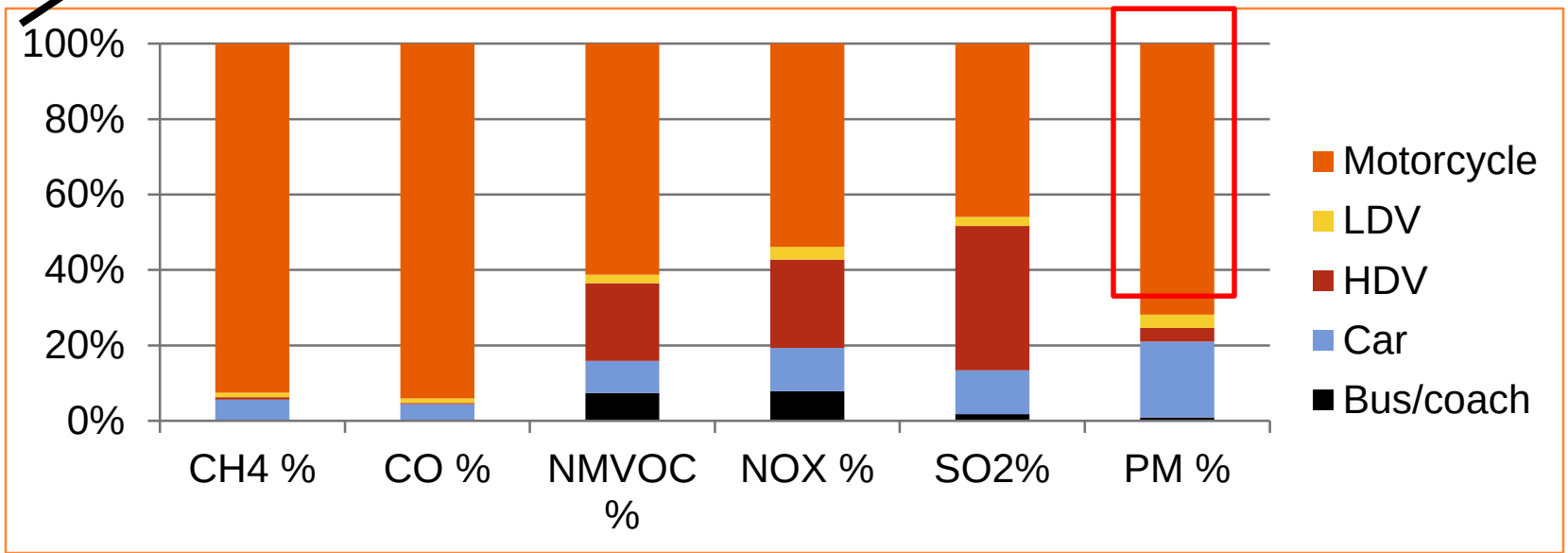




25.467.129 Ton/year
POINT= 24%
AREA=11%
TRAFFIC = 65%

RESULTS & DISCUSSION





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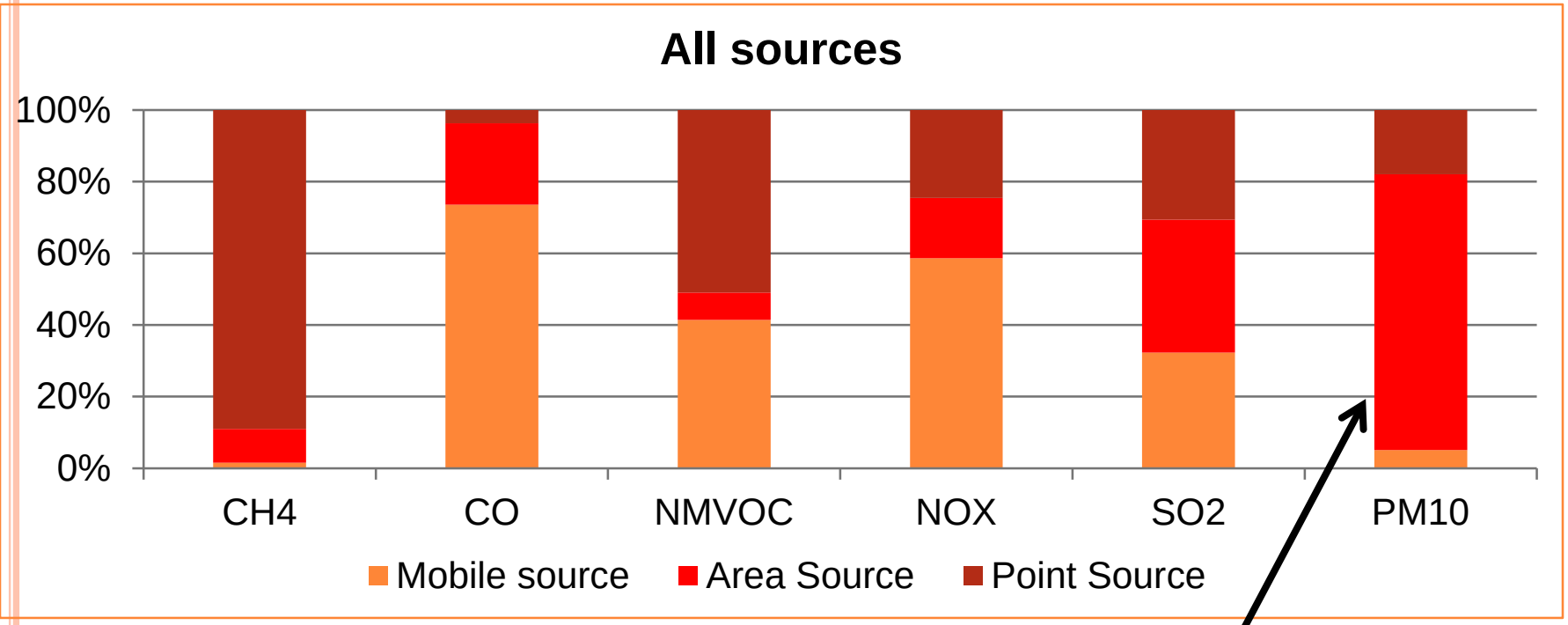

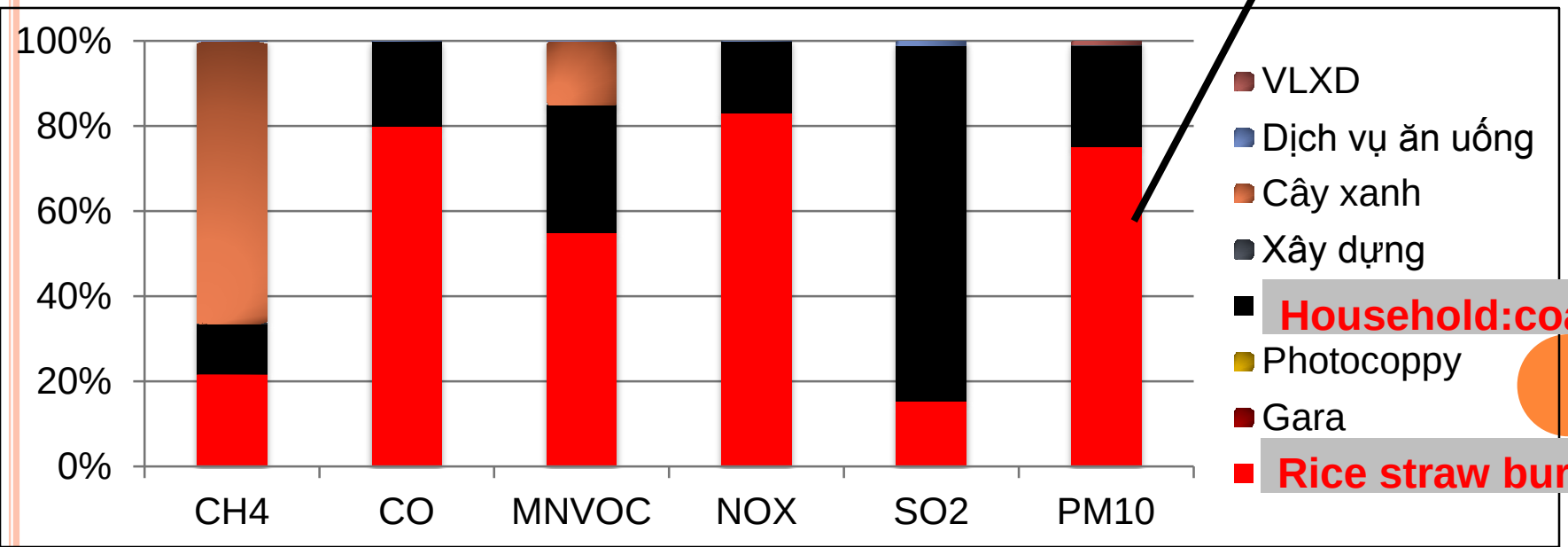

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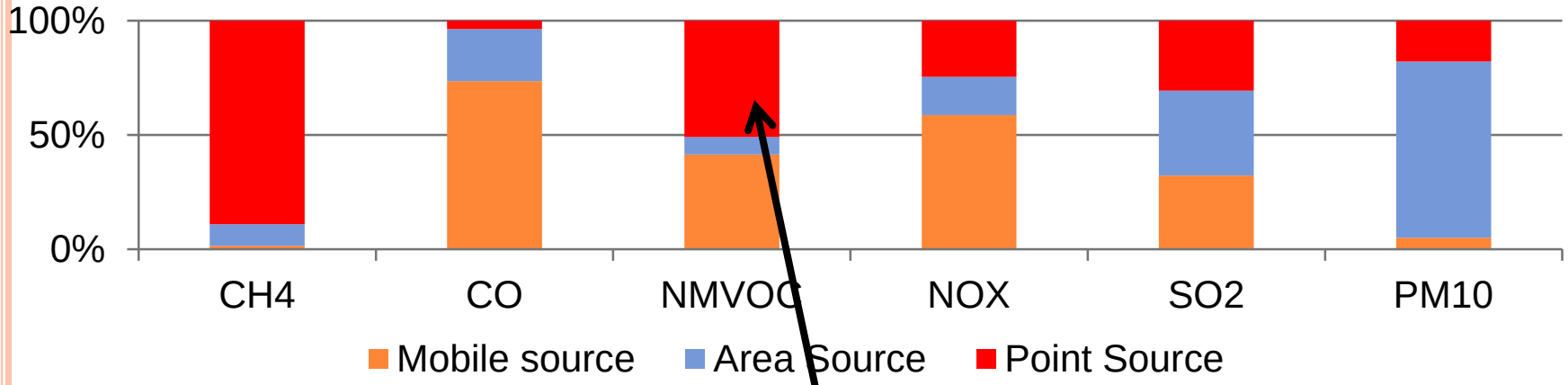
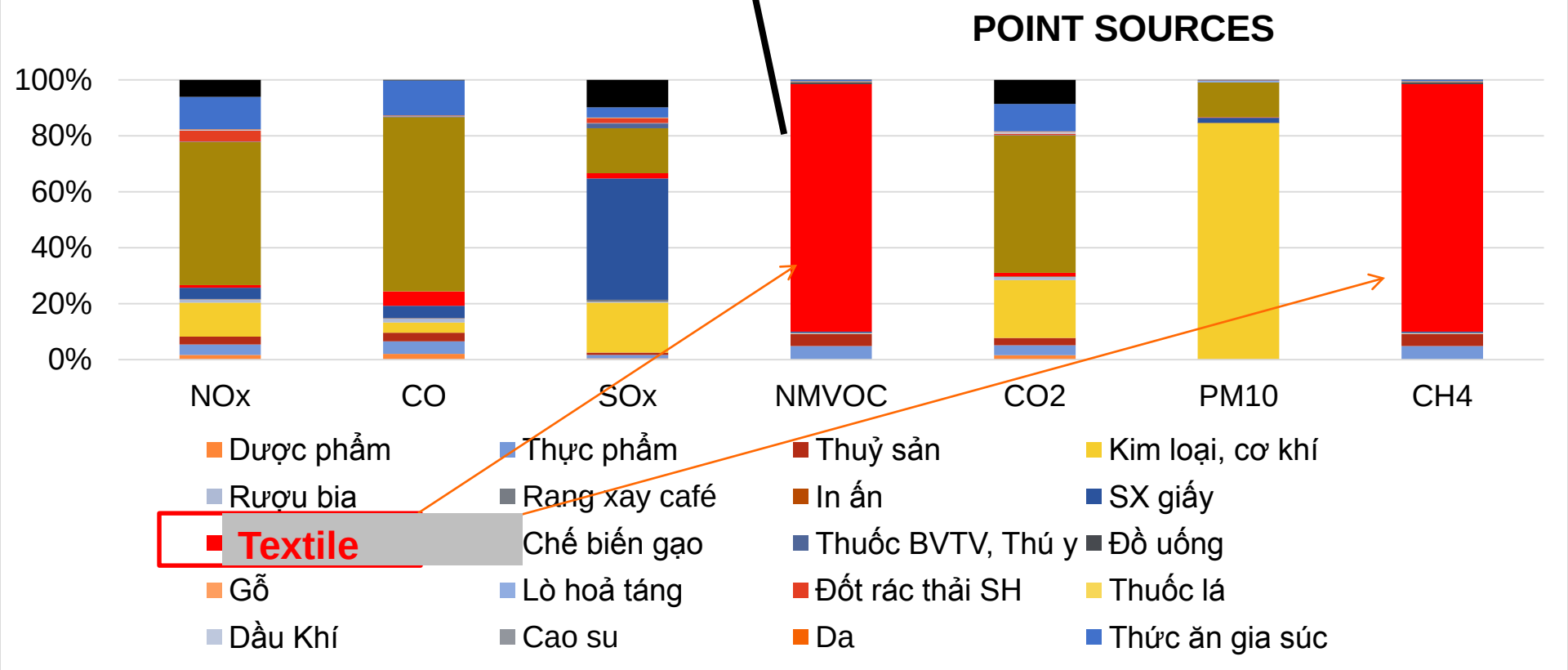
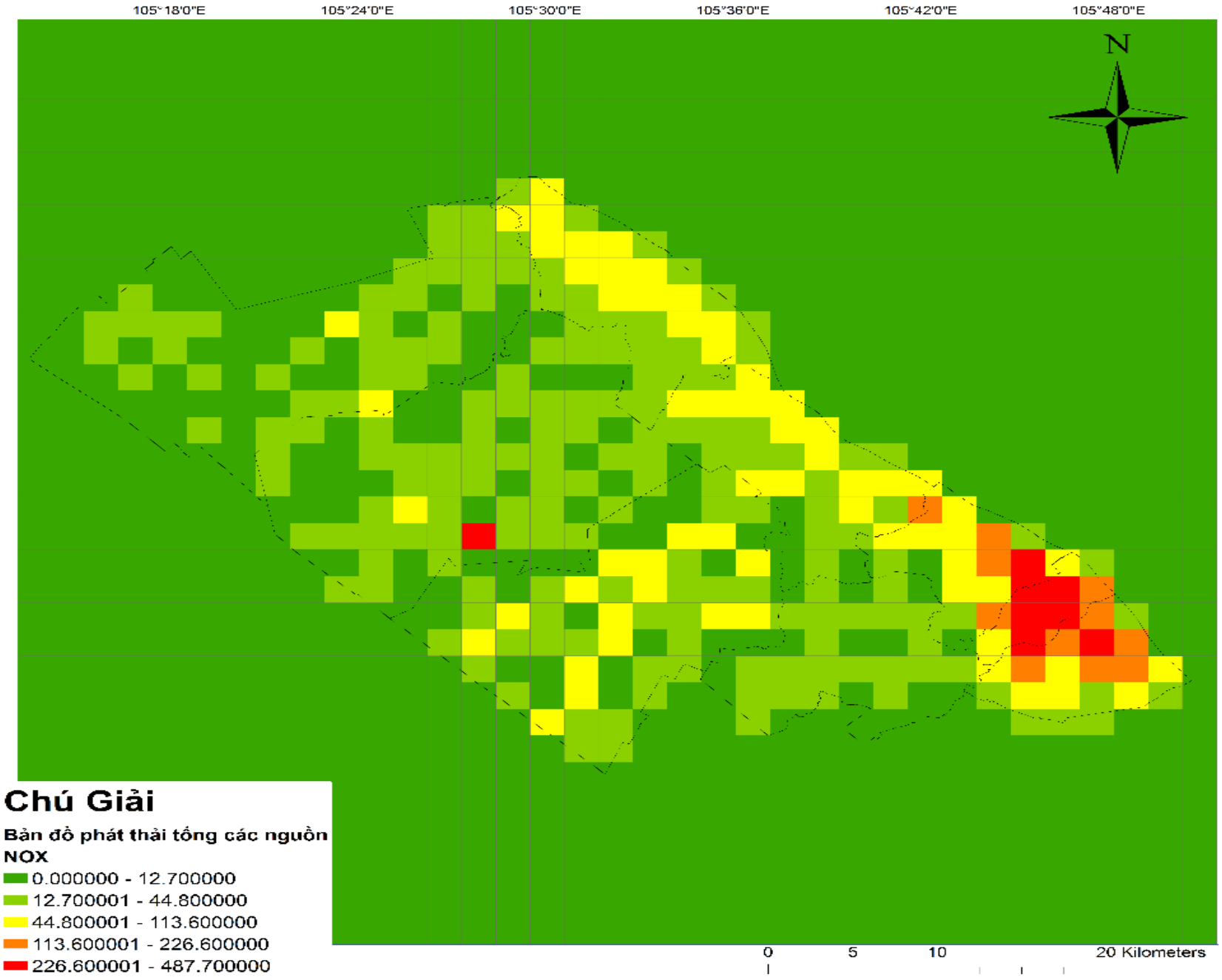




RESULTS & DISCUSSION: NOX (TON/YEAR)



CONCLUSIONS & REDUCTION MEASURES

- Road traffic is the main emission sources of NOx (accounted for more than 60% of total emission), CO (accounted for more than 75%), NMVOC about 40%. Among that Motorcycle occupies about 55% of NOx of road traffic sources, 92% of CO and 63% of NMVOC.
- The traffic source is the main emission source of GHG accounted for 68%, then point source accounted for 24%. The main emission of CO_2 is from Motorcycles (57%).
- Measures: Smoke checking Motorcycles, New Emission standards for new motorcycles; Household: change Coal-> Gases; Textile: Solvent (VOC)

THANK YOU
FOR
YOUR ATTENTION.
ANY QUESTIONS?