AIM/Local Model: India Application

Manmohan Kapshe
Indian Institute of Management
Ahmedabad, India

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IIM Ahmedabad

Overview

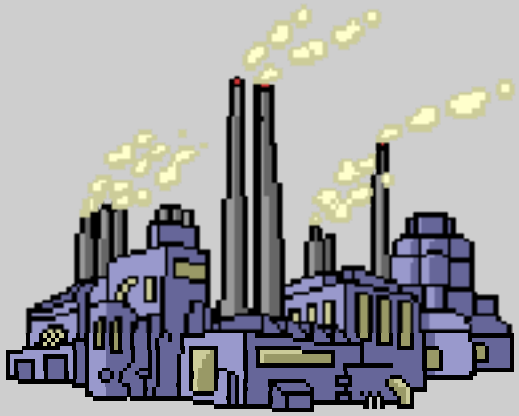
- AIM/Local Model
- India AIM/Local Application
  - Large Point Sources (LPS)
  - Area Sources
- Sub-regional AIM/Local Application (Ahmedabad District)

AIM/Local Model

Introduction

- Modeling the dilemma of providing energy services and protecting the environment in a local region

CO_2, SO_2, NO_X

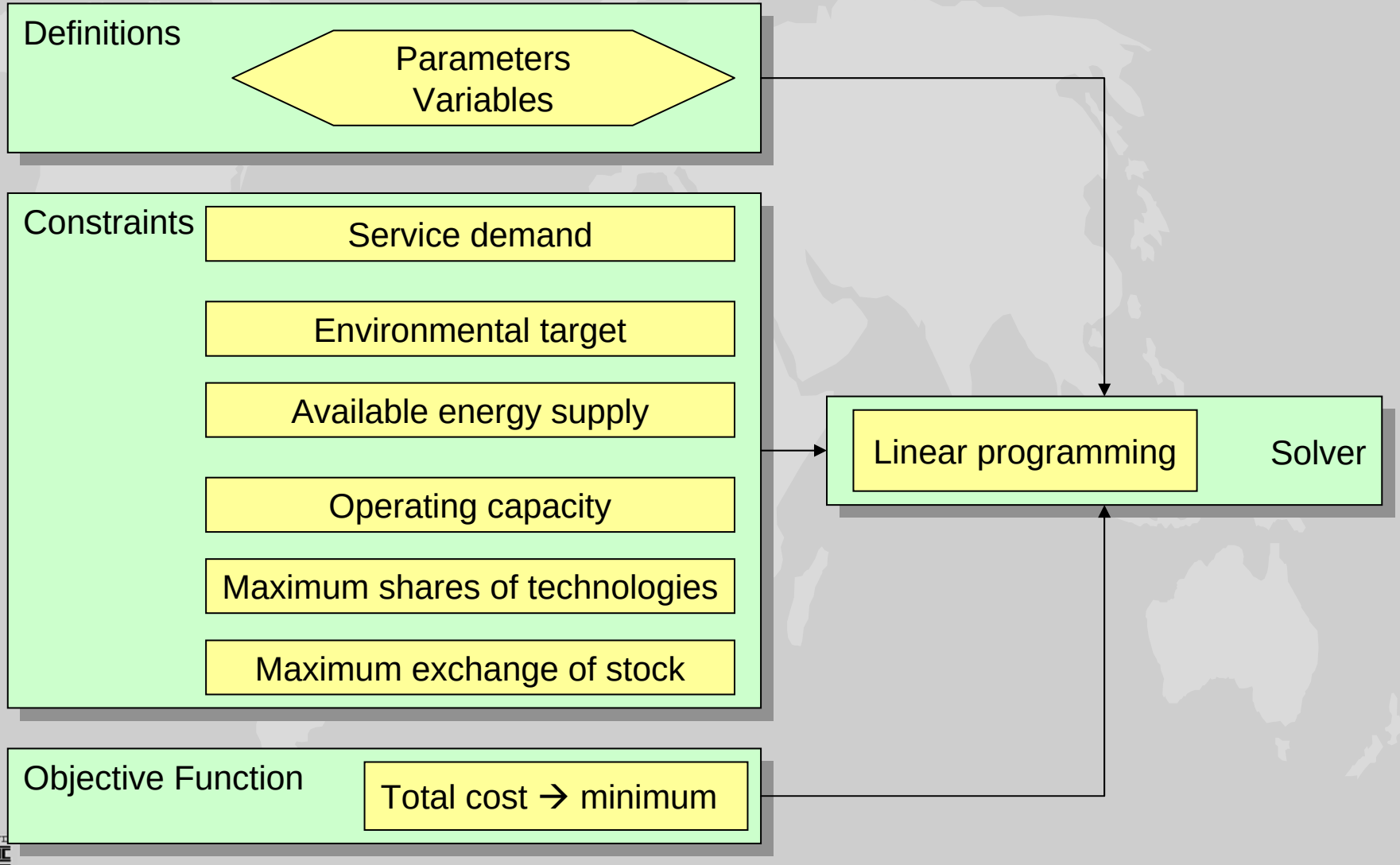


Energy Technology ⇌ Energy Service Demand

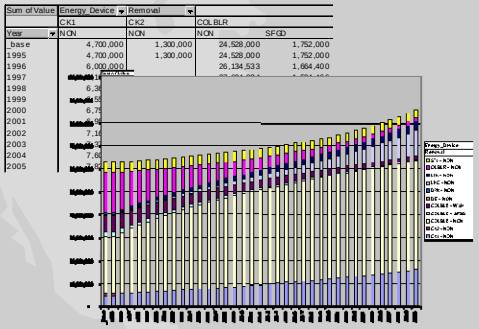
Features

- Simplified Structure
- Modeling local environmental constraints
- Direct benefit and co-benefit of counter measures
- Flexible model structure to cope with various practical situation in different regions
- GAMS programming
- Separate representation of LPS and Area Sources
- GIS Interface

Methodology



AIM-Local Database System



AIM-Local Database System

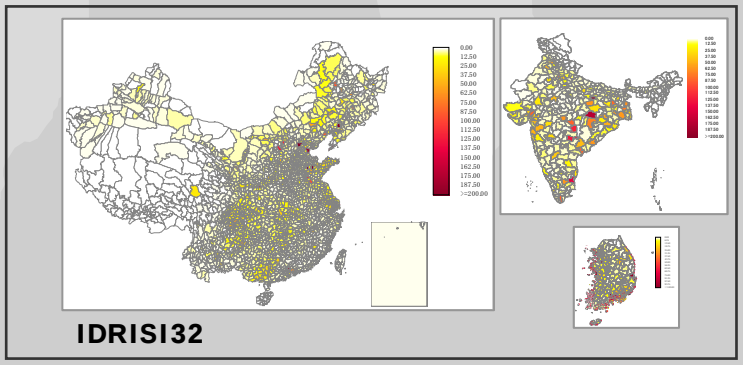
Input File for GAMS

Output file from GAMS

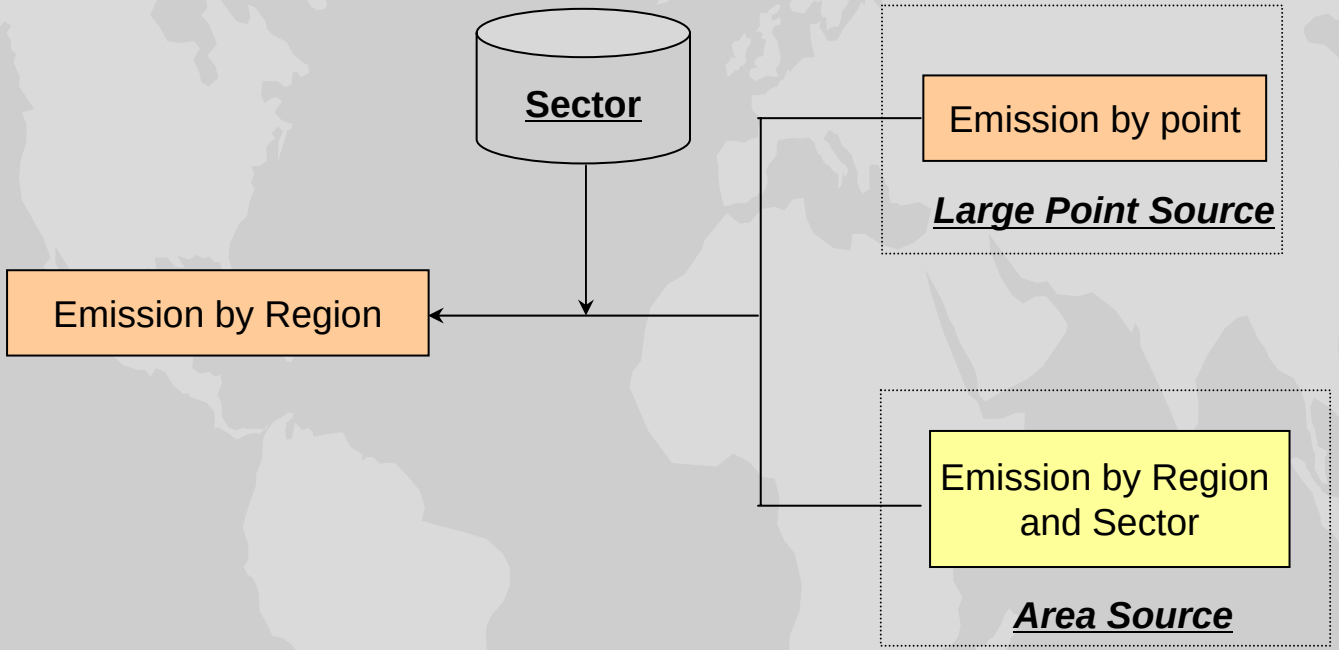
AIM-Local model GAMS version

GAMS

Input file from IDRISI



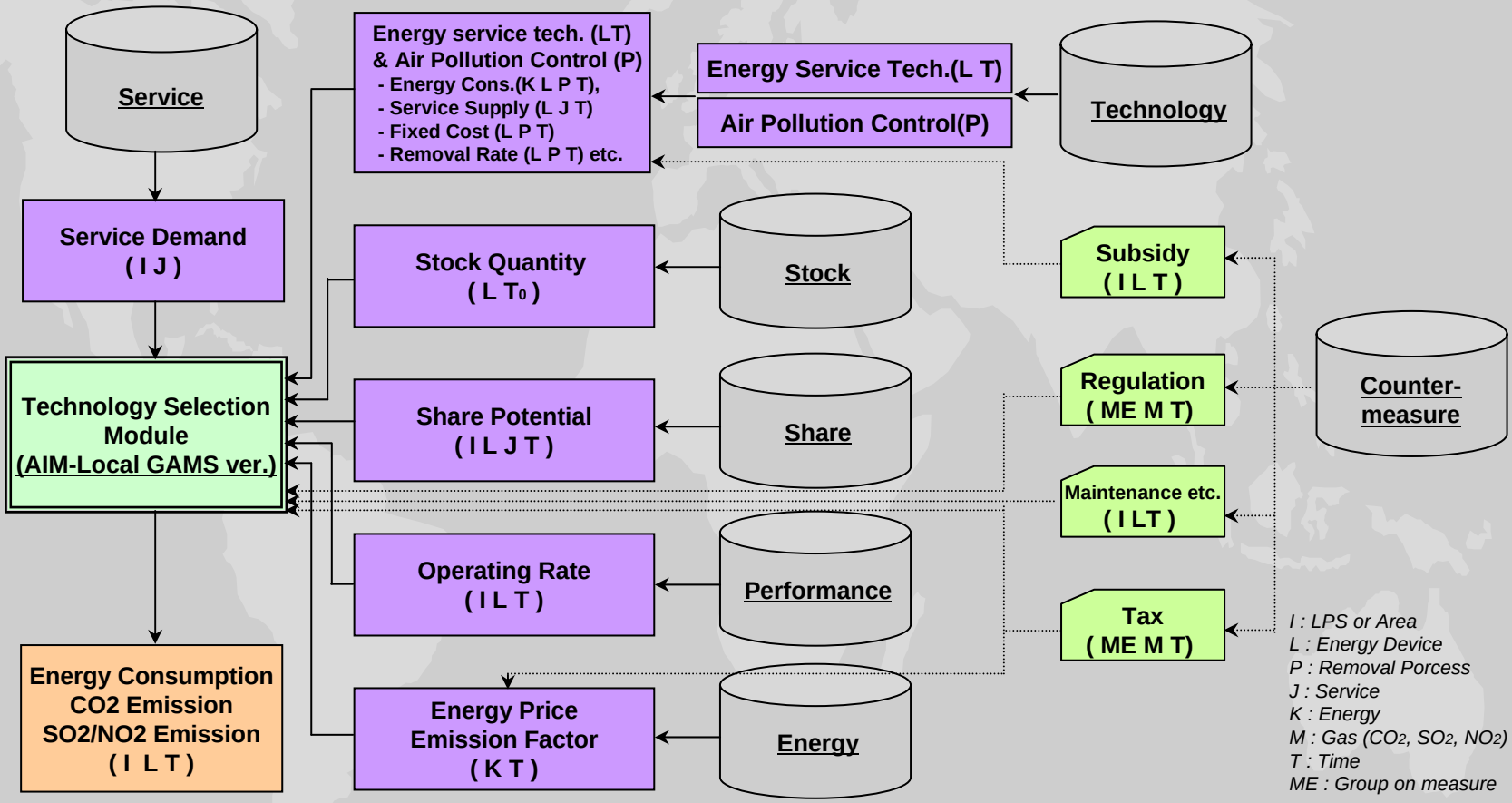
Large Point Source and Area Source



Sub-regional emissions are calculated as:

Emissions from LPS in the sub-region + Allocated Area Source Emissions

Structure of AIM-Local Database



Data requirements are similar to AIM/Enduse but more extensive, due to LPS data and GIS information requirements

What is GIS?

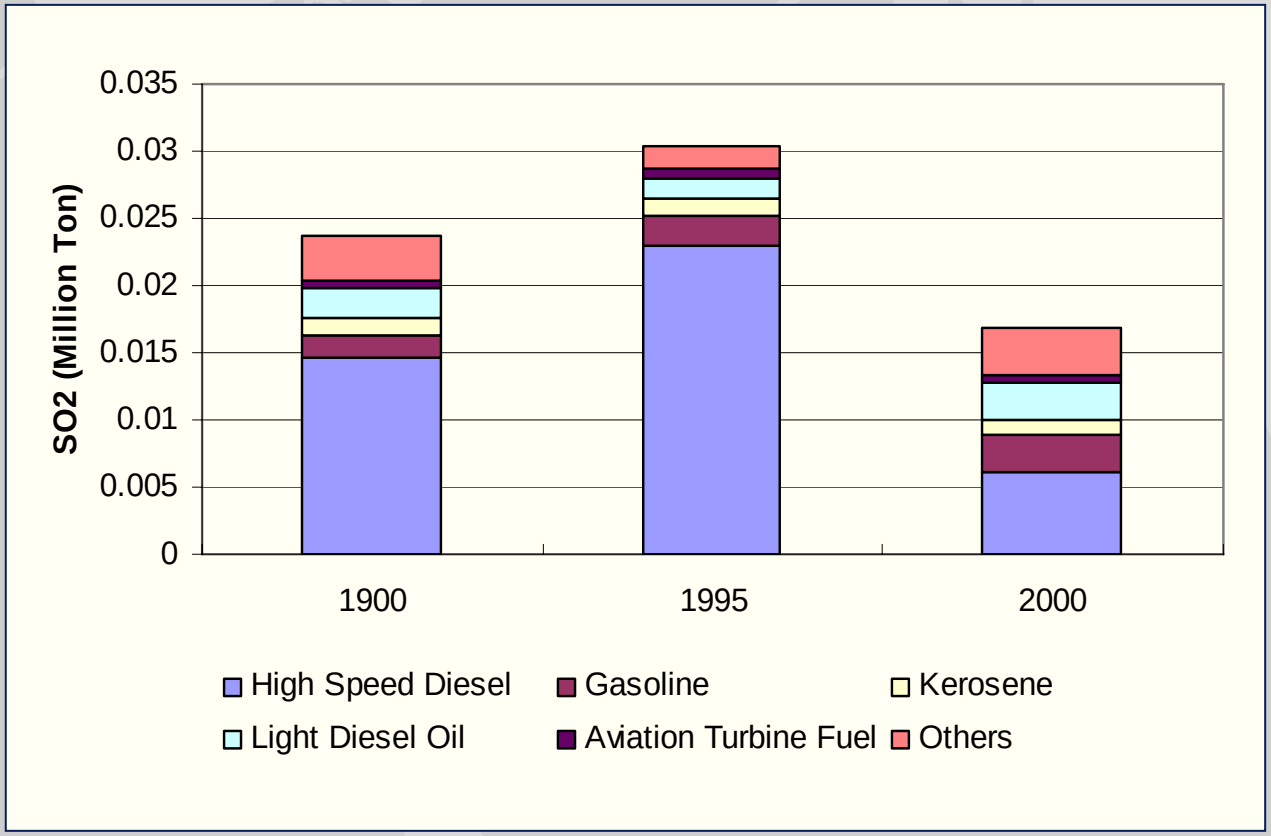
GIS is considered to answer the generic types of questions. These include questions about location, patterns, trends and conditions.

- Where are particular features found?
- What geographical patterns exist?
- Where have changes occurred over a given time period?

GIS Application

- Capture location sensitivity
- Layered information
- Time slices
- Integrating location and time information in a consistent framework

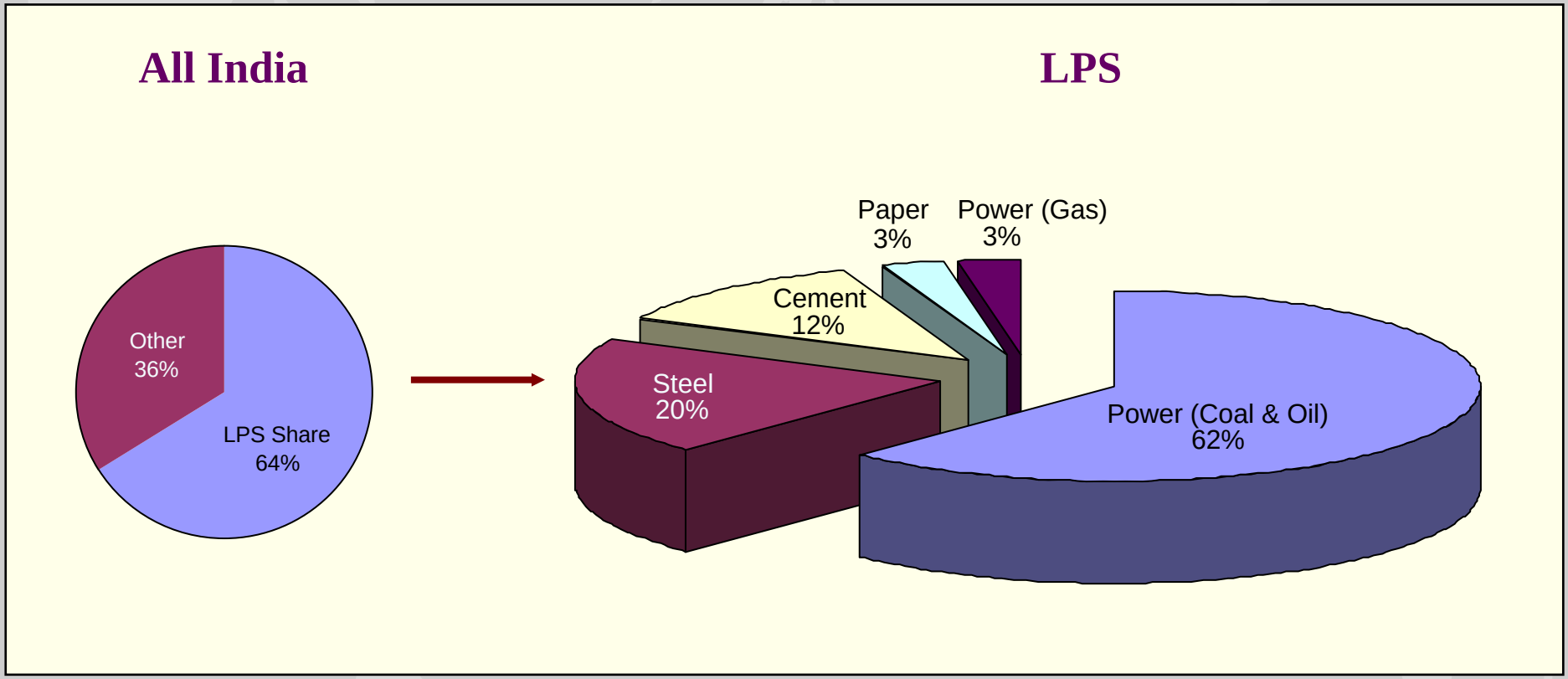
Delhi SO_2 Emissions from Oil



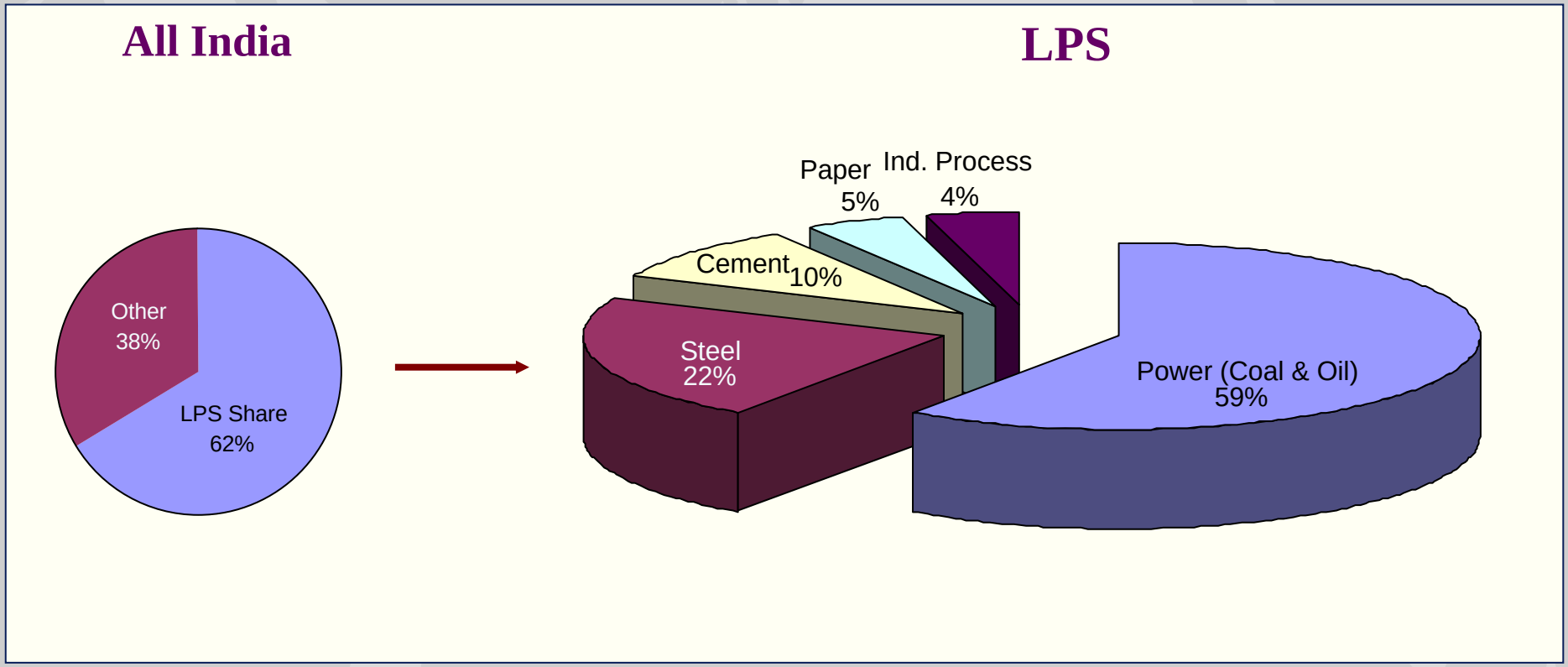
Sulfur Coefficient decrease from 1% to 0.05% (by weight) for Diesel over 1995-2002 has resulted in substantial SO_2 emission reduction in Delhi

India AIM/Local Application

Sectoral LPS share for CO_2 2000



Sectoral LPS share for SO_2 2000



LPS Database

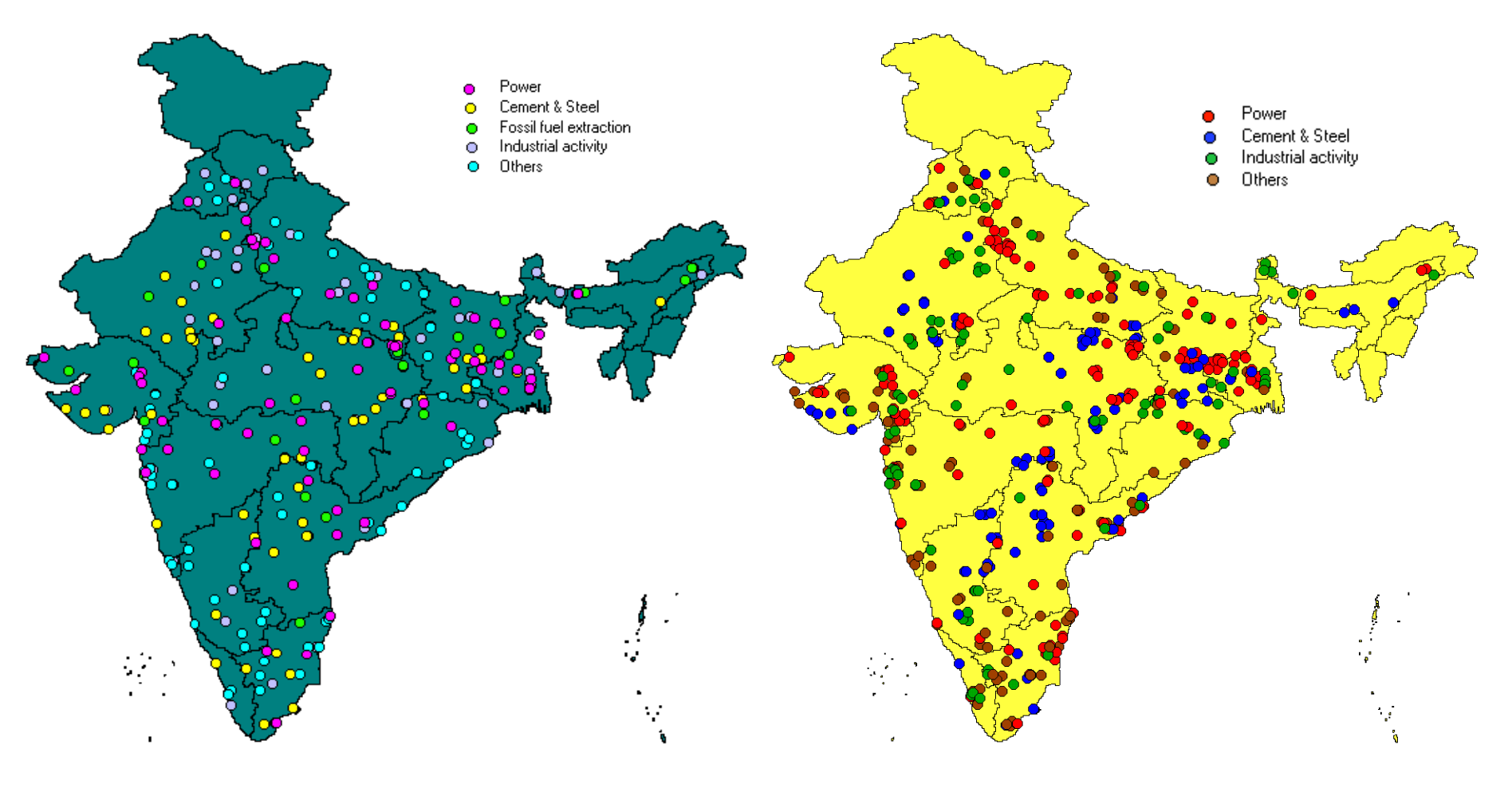
- LPS number increases in future
- Coverage of gases: CO_2 and SO_2
- Indianised emission coefficients (to the extent possible)
- Projections up to year 2030

LPS Coverage for India

Sector	Subsectors	LPS covered			
		2000	2010	2020	2030
Energy	Power (coal & Oil)	82	111	131	150
	Power (natural gas)	12	17	20	23
	Steel	10	16	22	28
	Cement *	85	98	110	123
	Fertilizer	31	41	52	62
	Paper	33	38	43	48
	Sugar	28	28	29	30
	Caustic Soda	19	21	23	26
Industrial processes	H_2SO_4 manufacturing	63	64	66	68
	Aluminium (Al)	3	4	5	5
	Copper ore smelting (Cu)	8	9	10	11
	Lead ore smelting (Pb)	5	6	7	8
	Zinc ore smelting (Zn)	3	4	5	5
Total		**382**	**457**	**523**	**587**

LPS Locations

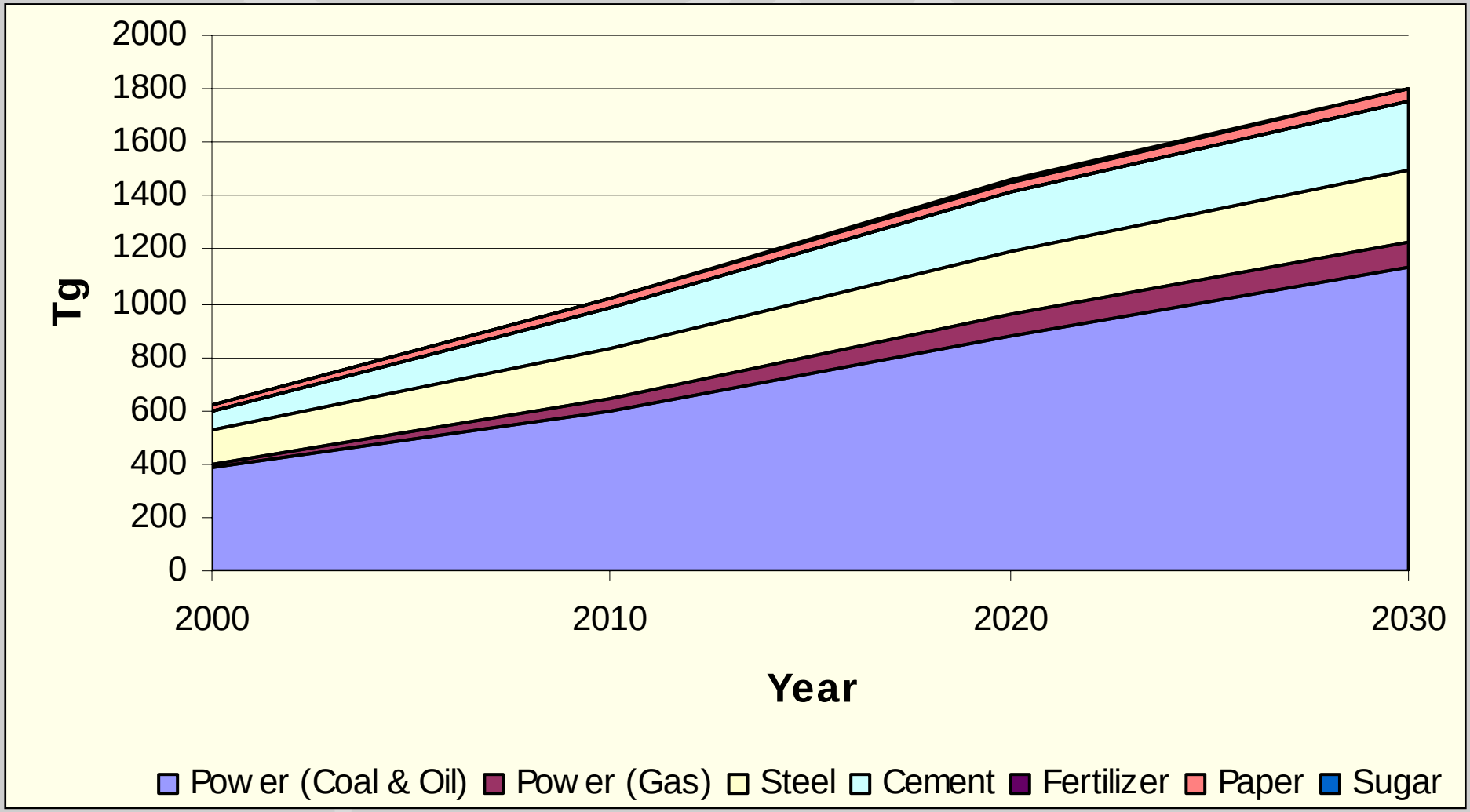
2000 **2030**



Database Generation

- Sectoral demand projections on the basis of macro-economic parameters
  - Thirty year time series GDP
  - Government projections
  - Expert opinion
- LPS demand on the basis of sectoral demand elasticity and past production trends
- Demand over and above LPS capacities assigned to Area Sources

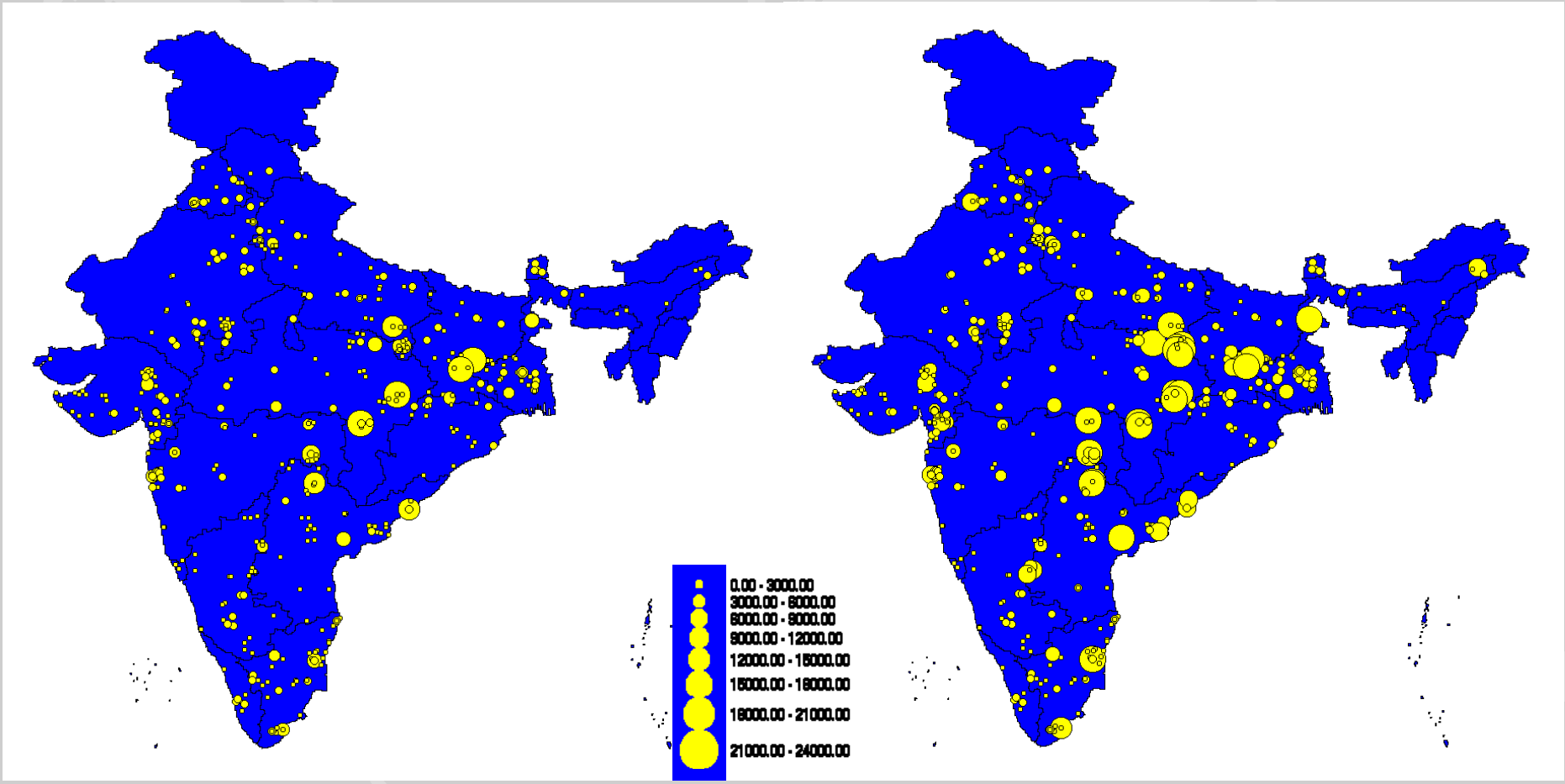
CO_2 from Energy Sector LPS



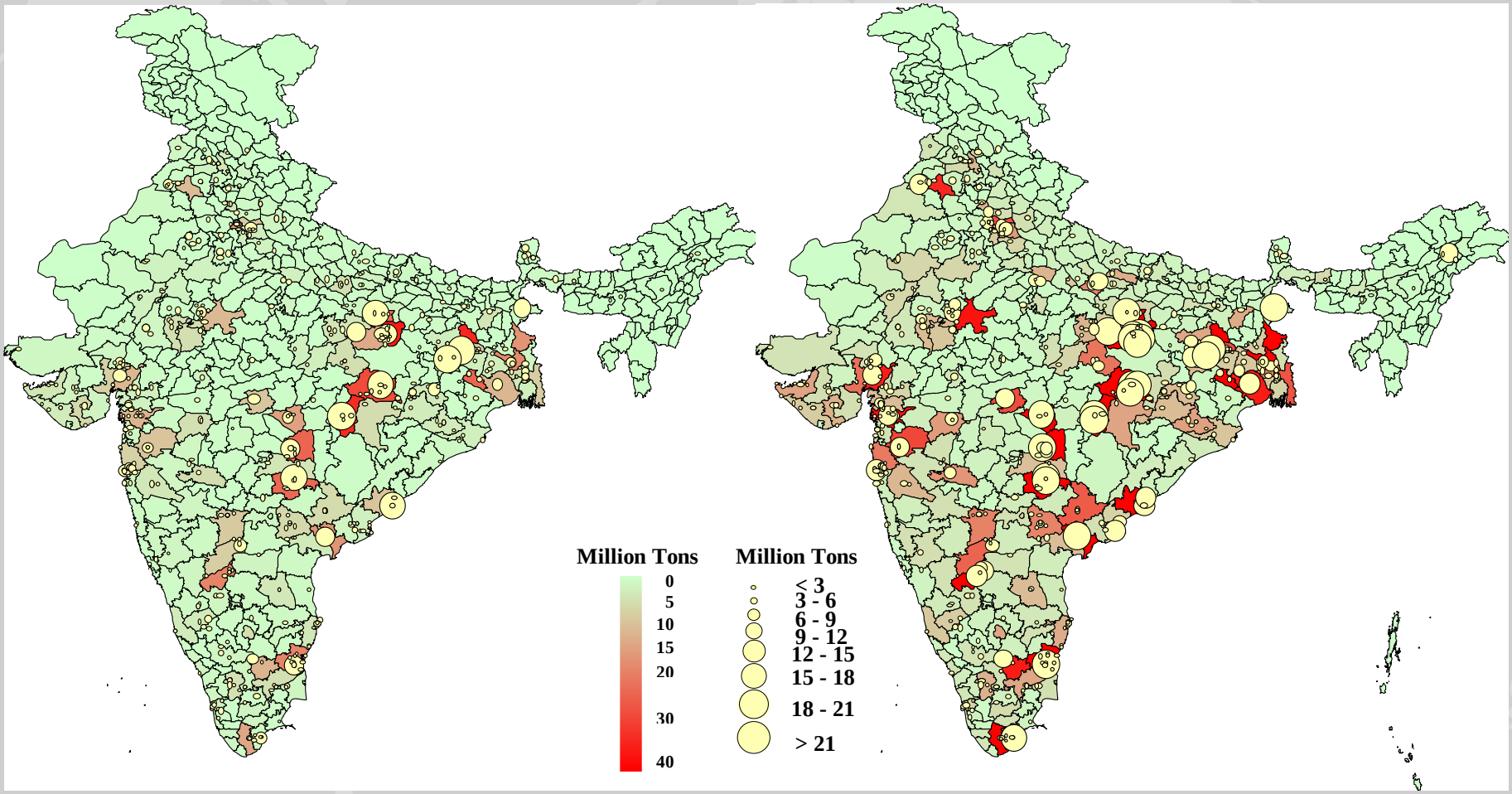
CO_2 from LPS

2000

2030



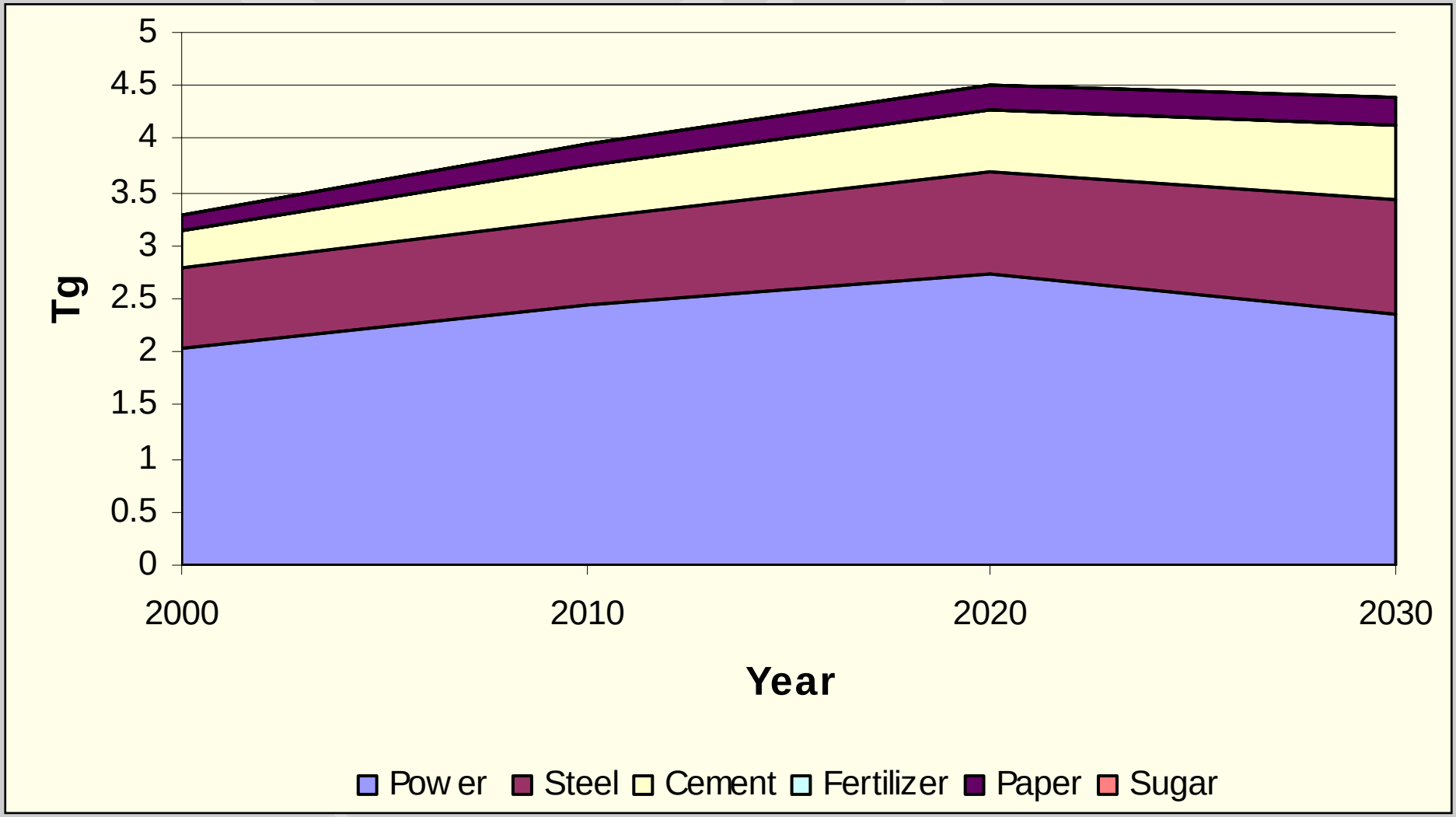
CO_2 Emission Distribution



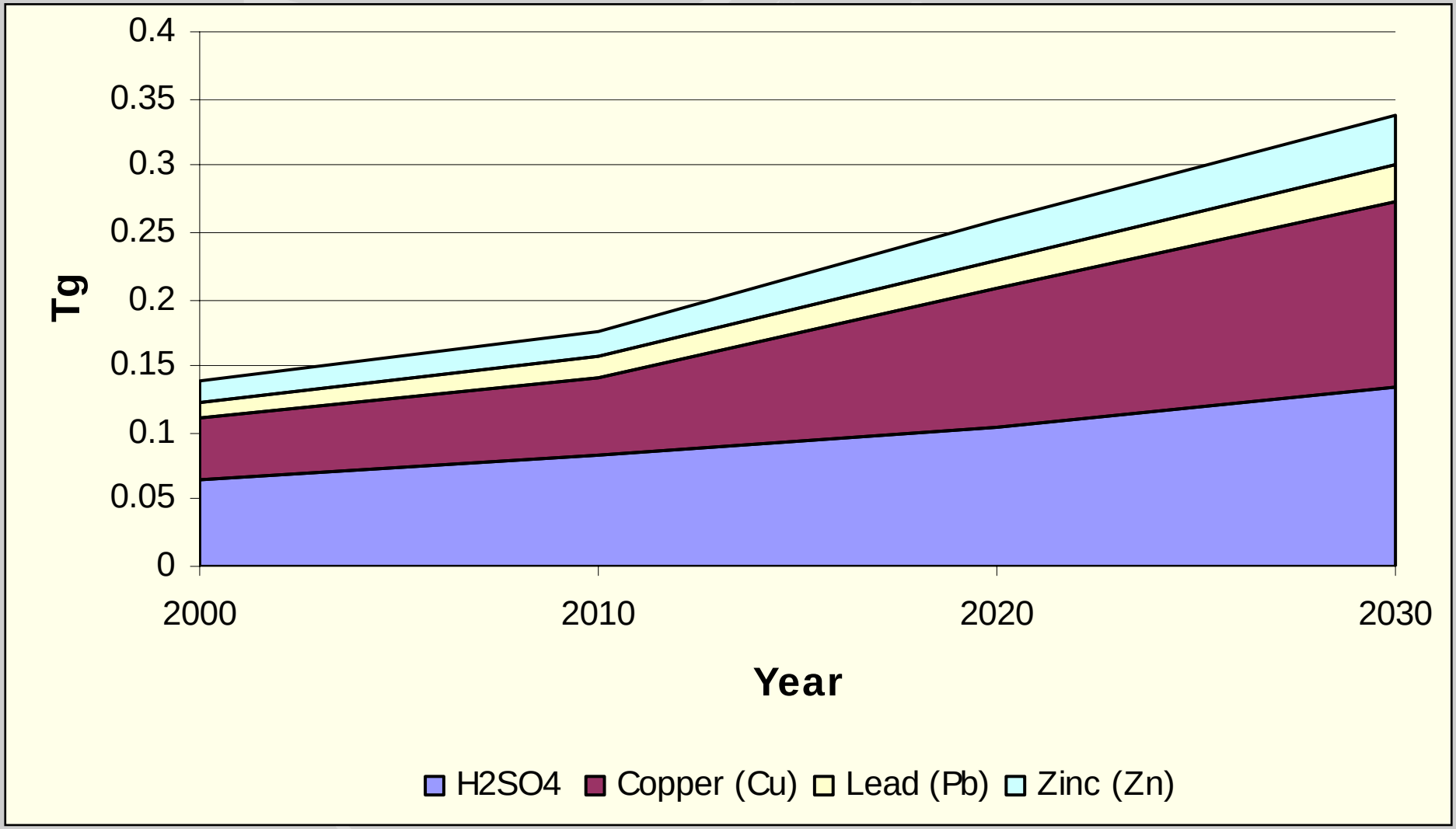
LPS contribution to CO_2

Largest LPS	Percentage CO_2 Emissions			
	2000	2010	2020	2030
1 to 25	35.2	32.5	31	31.5
26 to 100	20.9	20.3	20.7	20.8
101 to 200	6.7	7.8	8.6	8.7
All other LPS	1.3	2.7	3	3.9
Total LPS Share	64.1	63.3	63.3	64.9

SO_2 from Energy Sector LPS



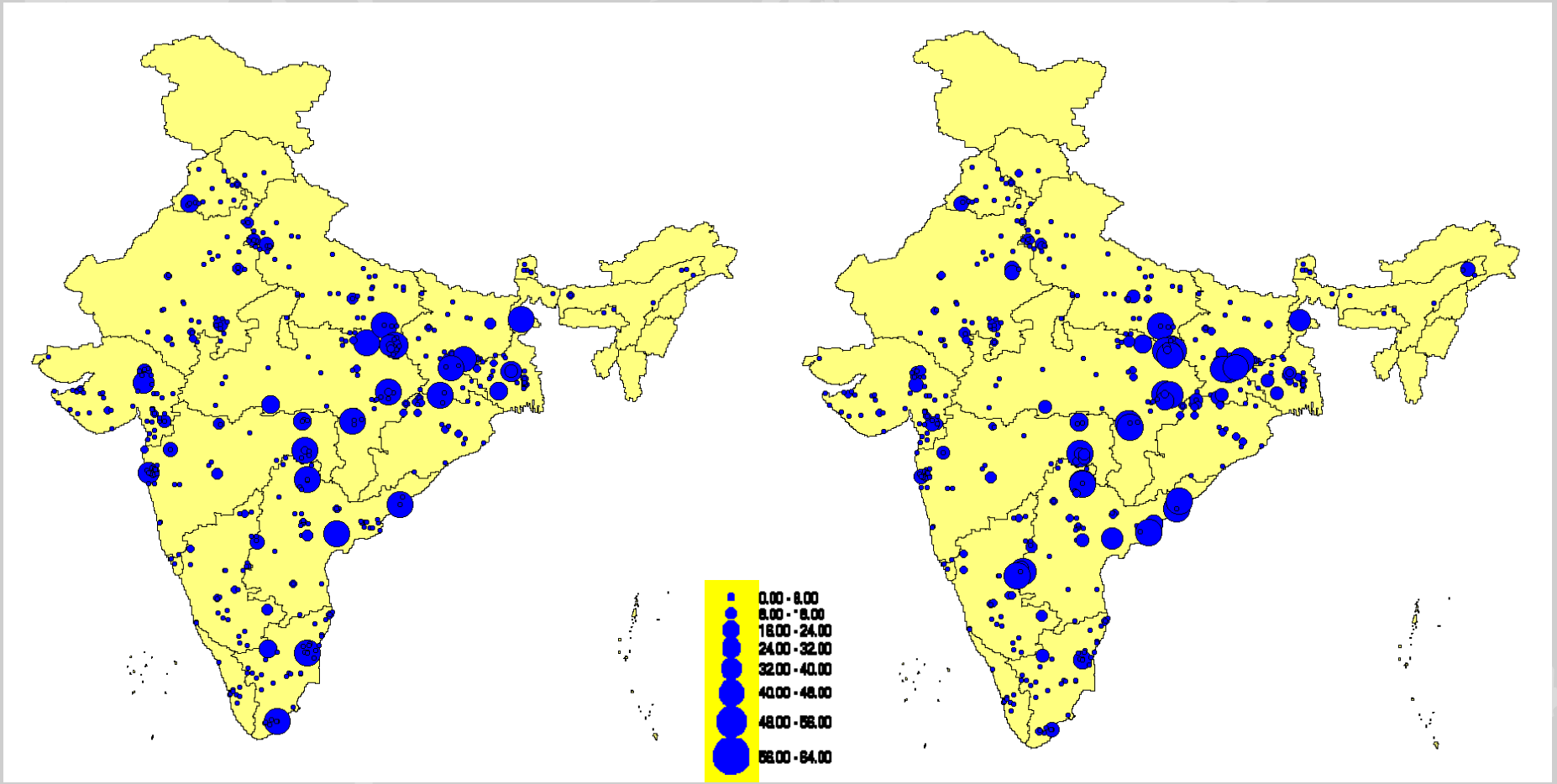
SO_2 from Industrial Processes LPS



SO_2 from LPS

2000

2030



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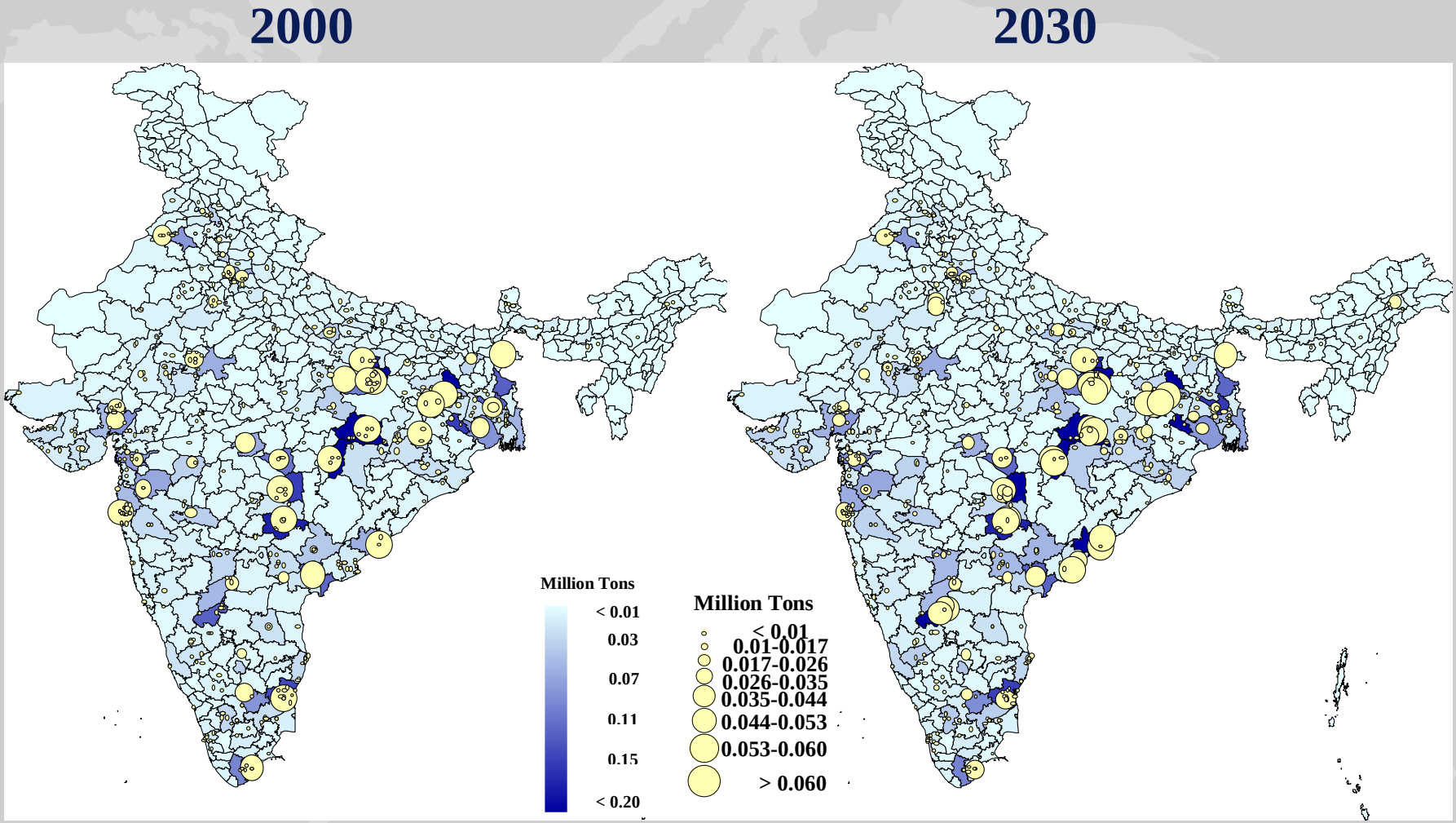
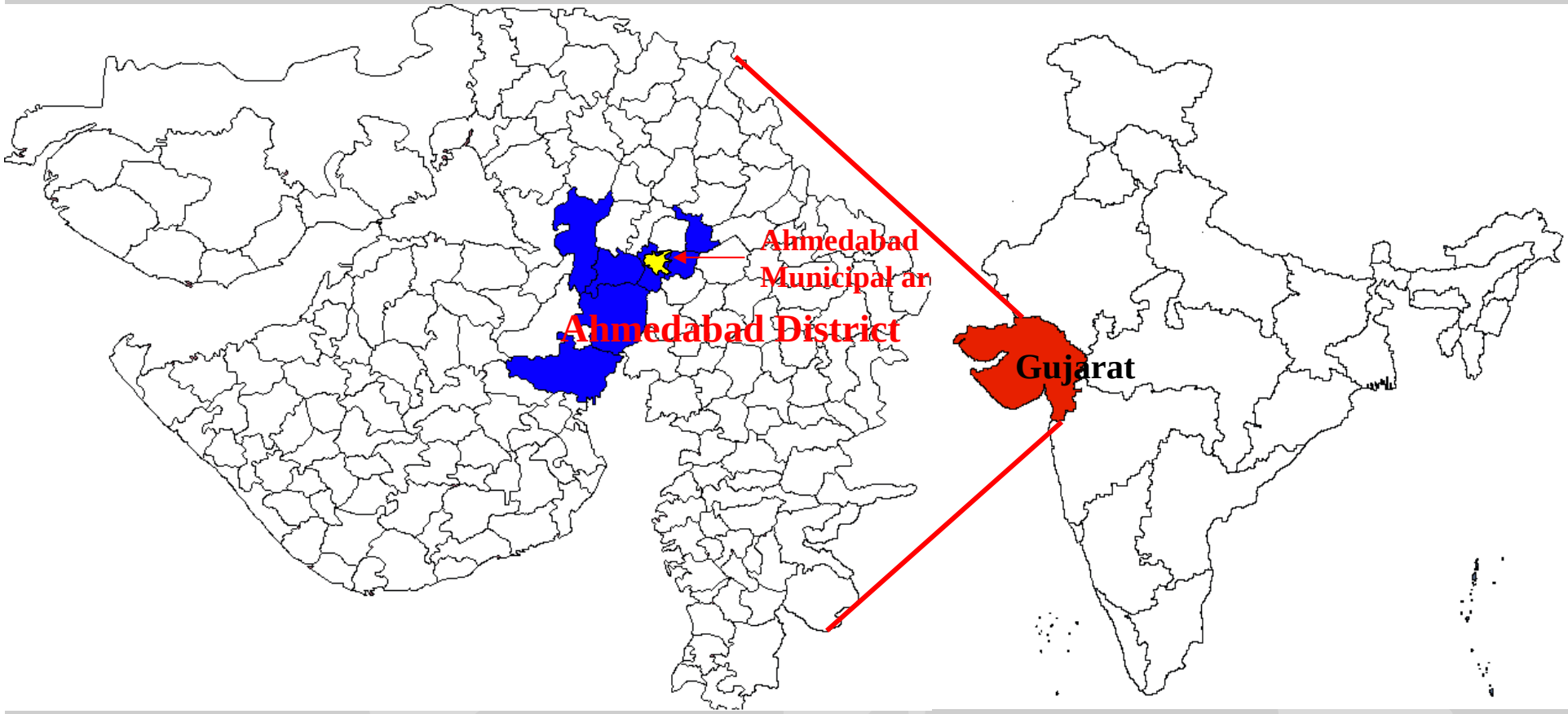


Sub-regional AIM/Local Application (Ahmedabad District)

Gujarat State & Ahmedabad District



	Villages	Taluka	Area	Population
			Sq. Km.	Thousands
Gujarat	18509	184	196024 (3)	41310 (34)
Ahmedabad Dist.	648	7	8707 (6)	4802 (75)

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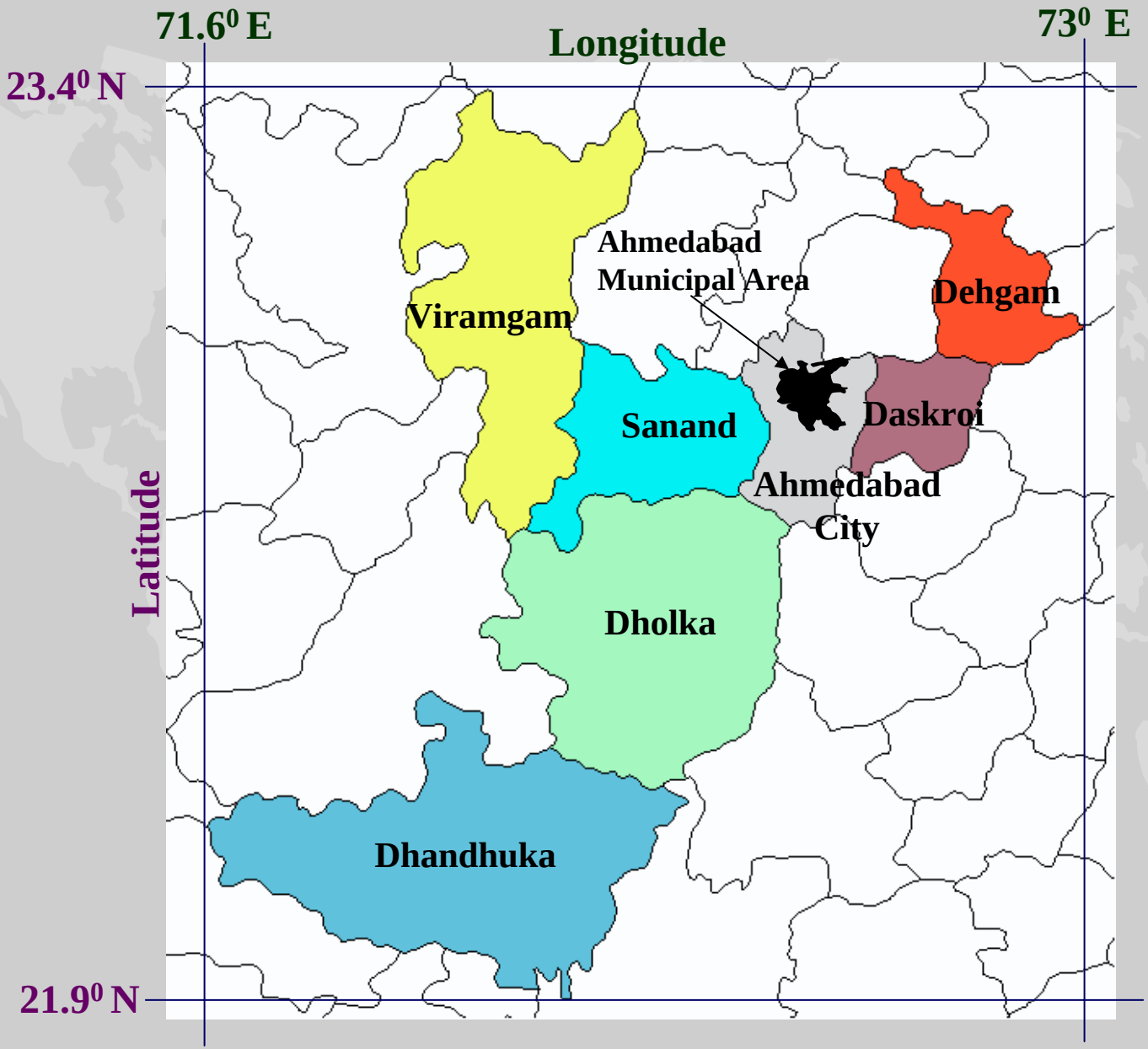
Ahmedabad District



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Ahmedabad District Profile

Taluka	Area Sq. Kms.	Population Thousands	Households Thousands
Ahmedabad City	292 (83)	3250 (99)	629 (99)
Daskroi	664 (5)	338 (28)	68 (29)
Dholka	1788 (2)	307 (26)	57 (25)
Dhandhuka	2683 (4)	252 (21)	42 (22)
Sanand	791 (5)	162 (16)	30 (16)
Viramgam	1714 (4)	278 (22)	54 (22)
Dehgam	620 (4)	214 (15)	41 (15)

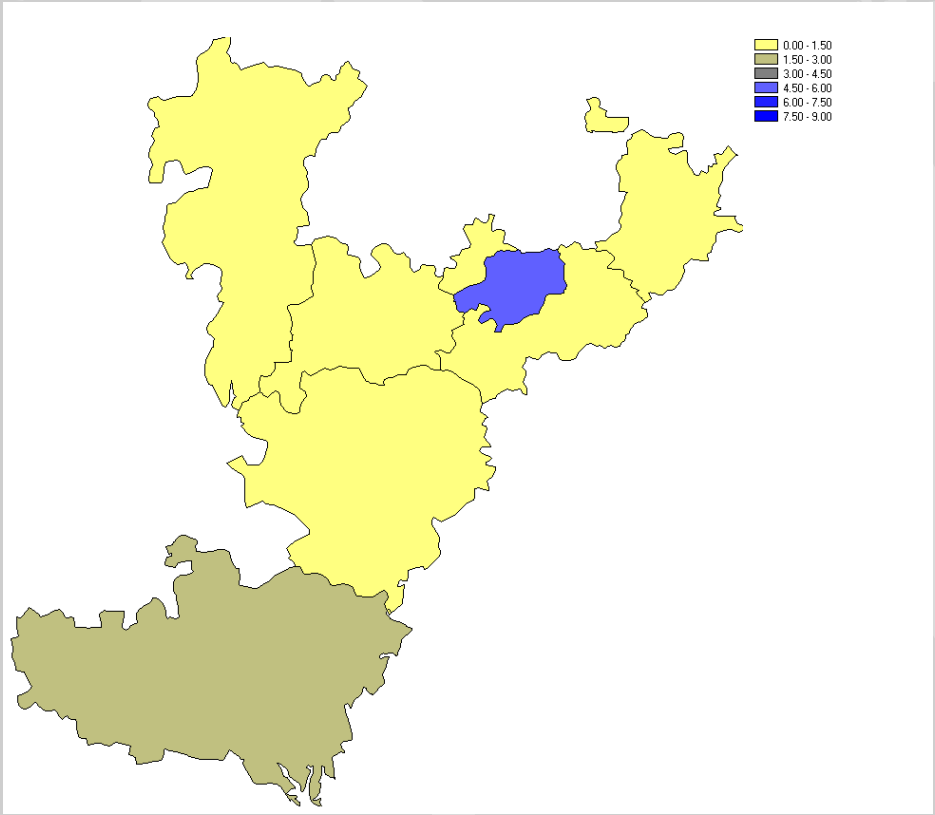
Note: Figures in brackets show % Urban share

LPS Coverage for Ahmedabad

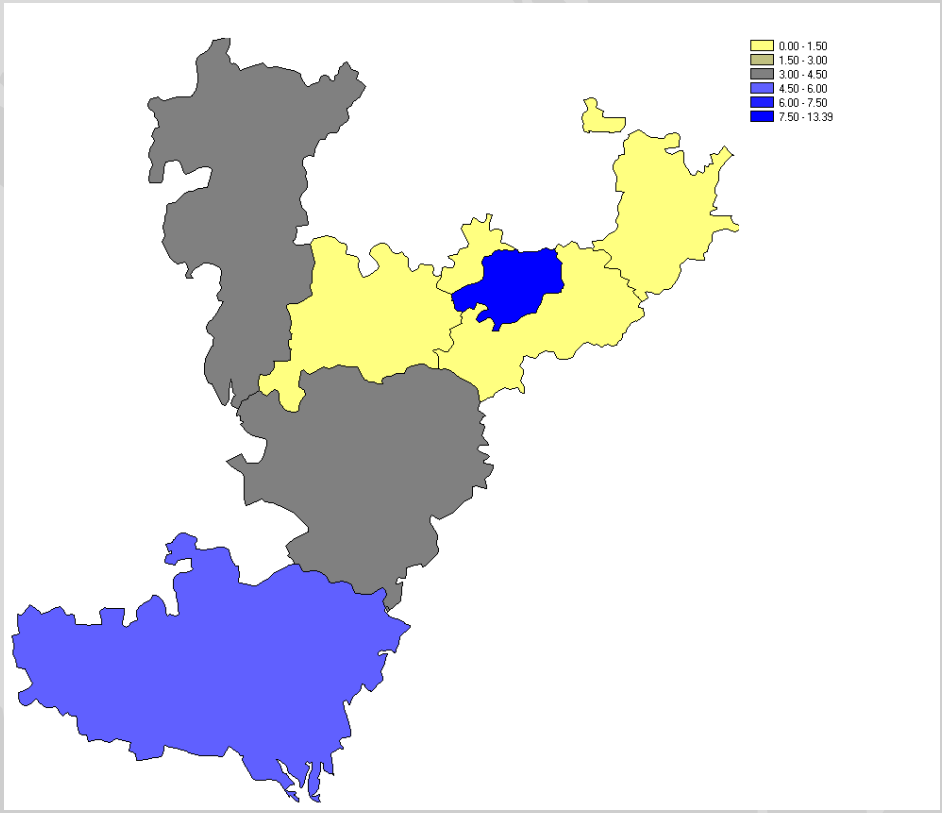
Industry	LPS Covered	Major Emissions
Chemicals Manufacturing	66	CO_2, SO_2, NO_x
Dyes Manufacturing	25	CO_2, SO_2
Others Industries	9	CO_2, SO_2
Pharmaceuticals	2	CO_2, SO_2, NO_x
Steel Foundries and Fabrication	94	CO_2, SO_2
Textile Mills	4	CO_2, SO_2, NO_x
Textile Processing and Dyeing	17	CO_2, SO_2

CO_2 Emissions

2000

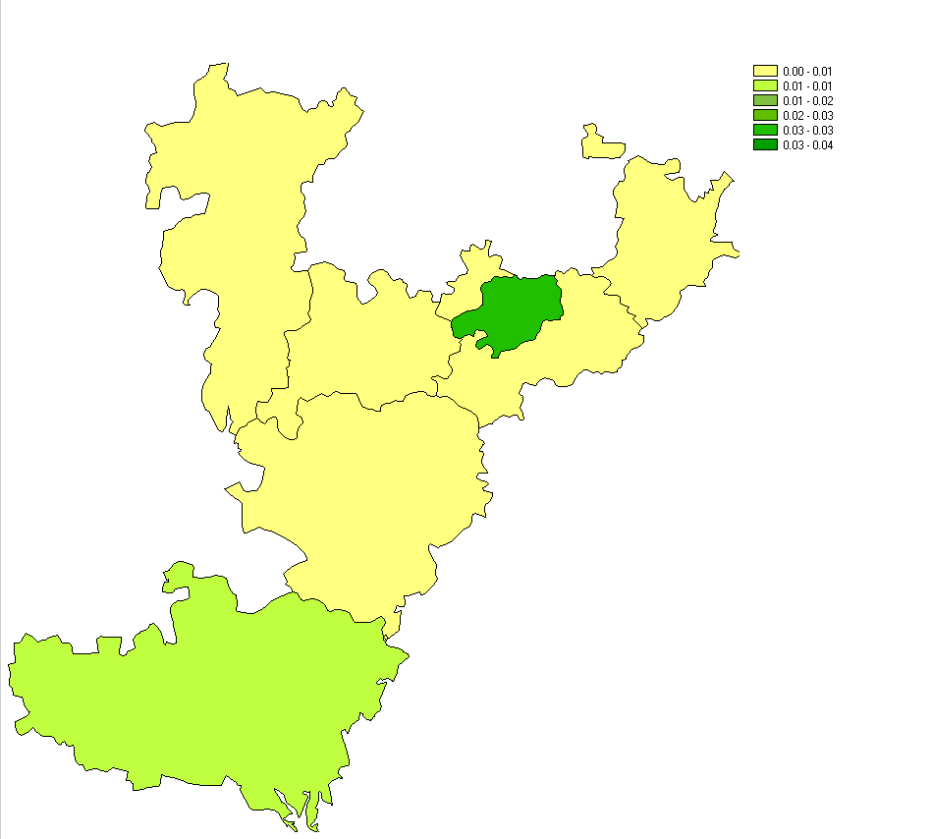


2030

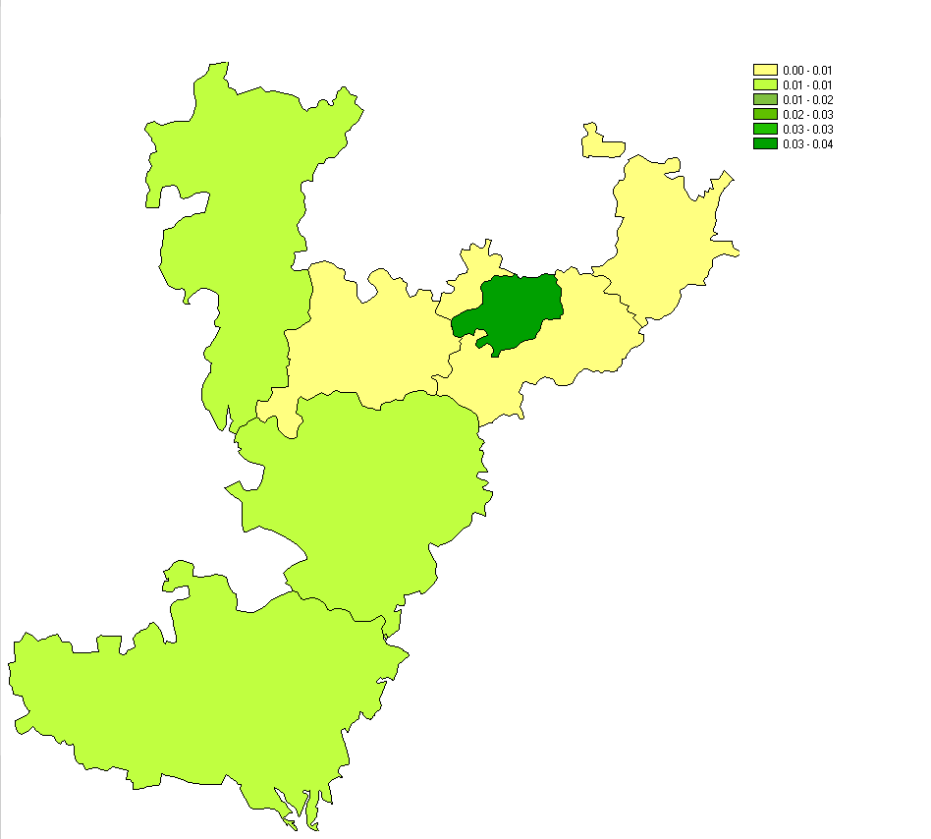


SO_2 Emissions

2000



2030



Conclusions

- Disjoint between future GHG and local emissions
- LPS emissions continue to dominate national emissions, thus providing focused mitigation possibilities
- AIM/Local a suitable tool for District/City level emission analysis