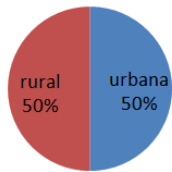


Cities characteristics impact in GHG emissions

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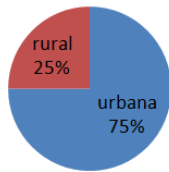
Introduction

- Cities – urban areas



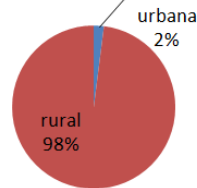
a)

% world population
(Gaube and Remesch, 2013; Yin et al., 2013)



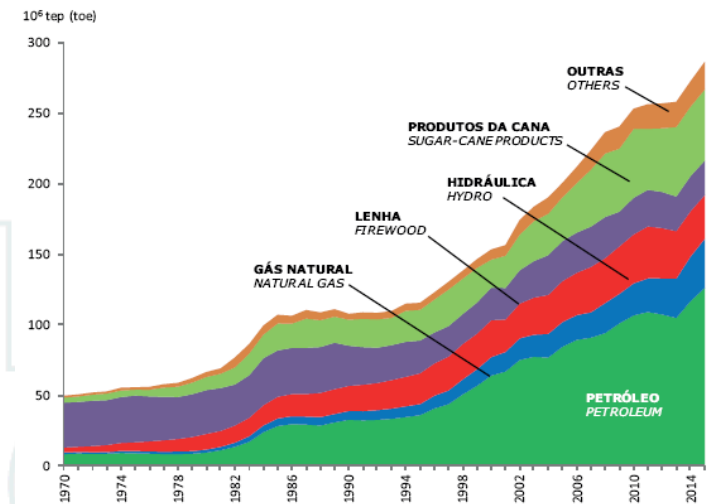
b)

% energy consumption
(DHAKAL, 2009)



c)

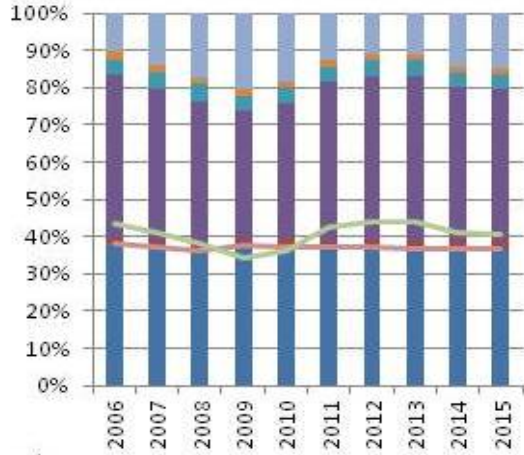
% mundial covered area
(Un, 2015)



Primary energy production in Brazil
(EPE, 2014)

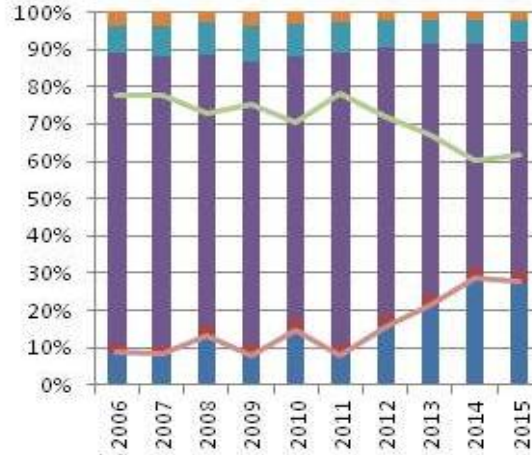
Introduction

- Cities – urban areas



a)

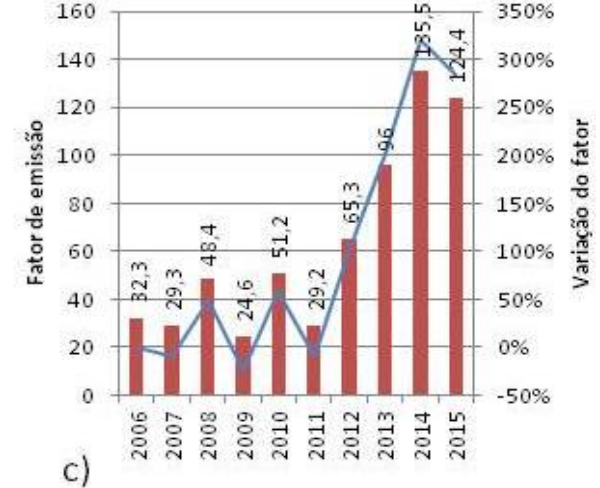
ENERGIA ELÉTRICA
GASOLINA
ETANOL
GN
ÓLEO DIESEL
ENERGIA ELÉTRICA



b)

GN - AUTOMOTIVO
GLP
GASOLINA

b) emissions profile
(SÃO PAULO, 2016a; SÃO PAULO, 2016b)



c)

g/kWh
variação %

c) Brazilian electricity emission factor

Method

- Top 10 population cities of São Paulo (IBGE, 2017);
- $I = P \times A \times T$ (Ehrlich and Holdren, 1971)
 - \rightarrow STIRPAT (York et al., 2003)

$$I_i = aP_i^b \times A_i^c \times T_i^d \times e_i$$

- OLS – Ordinary least squares

Where:

“I” is the impact (emissions);
“a” model constant;
“b”, “c” e “d” are exponents
population (P), affluences (A) and
technology (T);
“e” is error term.

Results

MUNICÍPIO	MODELO 1	MODELO 2									
	TODOS	São Paulo	Guarulhos	Campinas	SBC	Santo Andre	Osasco	SJC	Sorocaba	Mauá	SJRP
		Coeficientes									
Interseção	-3,905	14,507	15,725	-3,604	9,635	-9,510	19,095	-134,22	13,101	-12,764	18,132
POPULAÇÃO	0,996	0,729	0,340	1,319	0,442	1,576	0,175	8,436	0,616	1,293	0,569
PIB PERCAPITA	0,161	1,080	0,703	0,318	0,515	-0,099	0,460	-2,203	0,341	-1,116	1,212
CONSUMO DIRETO ELETRICIDADE PERCAPITA	0,481	-0,290	-0,247	0,073	-0,181	0,380	-0,601	3,346	-0,098	1,218	-0,476
POLOS ATRADORES/KM ²	-0,018	-0,192	0,053	-0,015	-0,018	-0,014	-0,021	0,122	-1,650	0,246	-0,023
EMISSÕES DIRETAS POR RESIDÊNCIA	0,846	-0,234	0,394	0,680	0,646	0,871	0,819	2,282	0,366	1,716	-0,076
INTENSIDADE ENERGÉTICA (CONSUMO DIRETO DE ENERGIA)	0,186	1,377	1,191	0,637	0,701	-0,099	0,129	-5,278	0,609	-1,415	1,884
INTENSIDADE ENERGÉTICA (ENERGIA TOTAL)	-0,216	-2,147	-1,733	-0,861	-1,057	-0,264	-1,048	6,484	-1,104	0,869	-2,830
CO ₂ /PIB	0,200	1,780	1,240	0,511	0,675	0,123	1,024	-2,718	0,512	-0,599	1,968
FATOR DE EMISSÃO ELETRICIDADE	0,017	-0,035	-0,050	-0,012	-0,041	0,005	-0,070	0,255	0,014	-0,028	0,005

Conclusions

- **Population** is the principal factor influences the emissions;
- GDP, **direct energy consumption**, direct energy intensity and carbon intensity have positive feedback in emissions.
- **Attractions points**, and energy intensity have negative feedback in emissions.

Conclusions

- Population, direct energy consumption, and attractions points are associated variables with cities characteristics.
- Stakeholders decisions can lead changes in cities characteristics and, therefore, result in emissions changes.

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