



# Drivers of Air Pollution in South Africa

## Session 3.1

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# Presentation Scope

- International trends (US, UK, EU and China)
- What are the air pollution drivers in South Africa?
- What has been the trends of these drivers?
- How are these driver/trends influencing emission trends?
- Can NEMAQA influence/impact these drivers? If so how?
- How can these influences/impacts be measured?
- How can the AQ regulatory framework be strengthened to effect the influence/impacts?





- Population growth, urbanisation migration
- Economic Indices
- Transportation (road, rail, shipping)
- Energy use
- Biomass burning
- Mining activities
- Residential fuel use

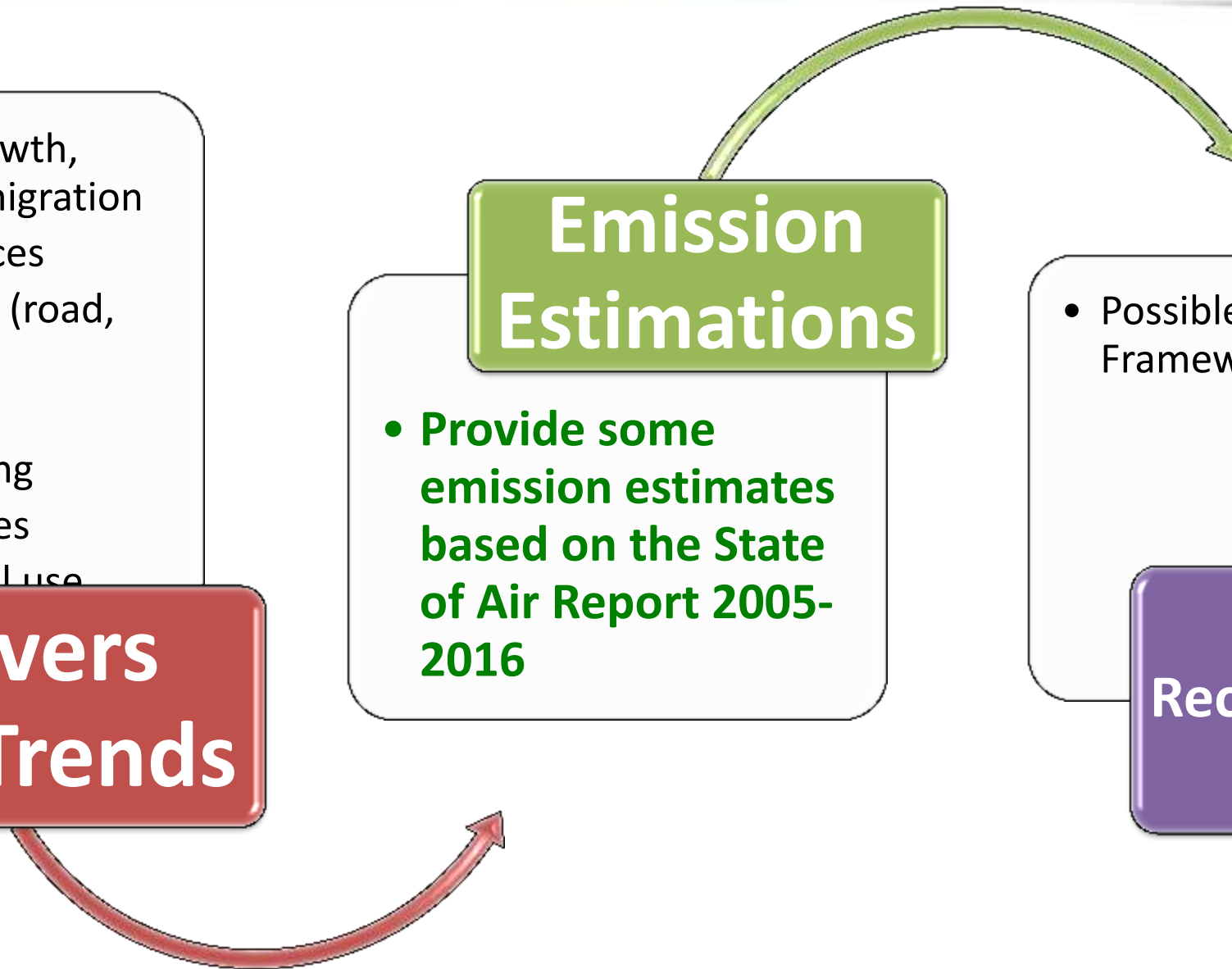
## Drivers and Trends

## Emission Estimations

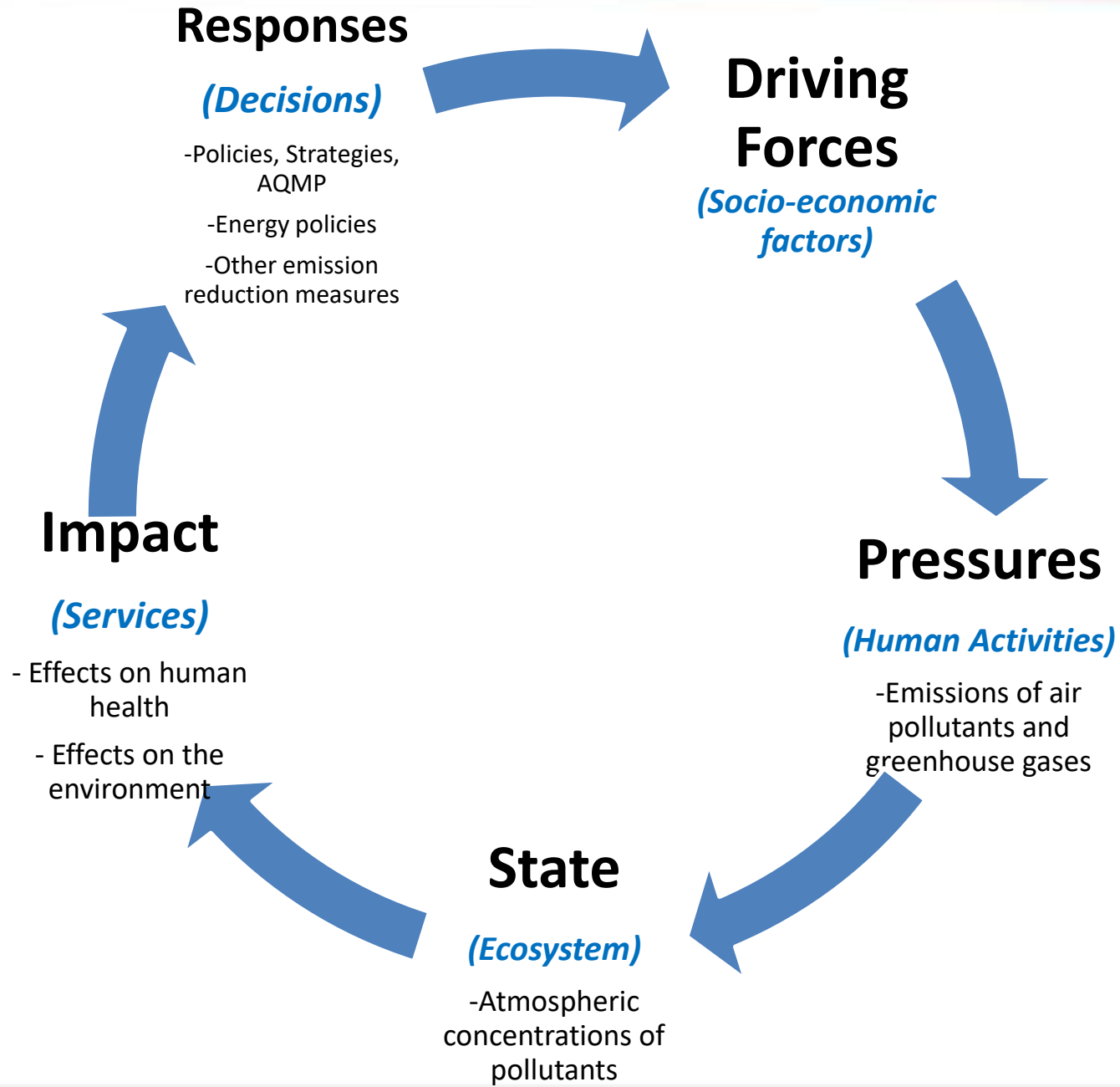
- **Provide some emission estimates based on the State of Air Report 2005-2016**

- Possible Regulatory Framework

## Recommendations



# DPSIR Framework



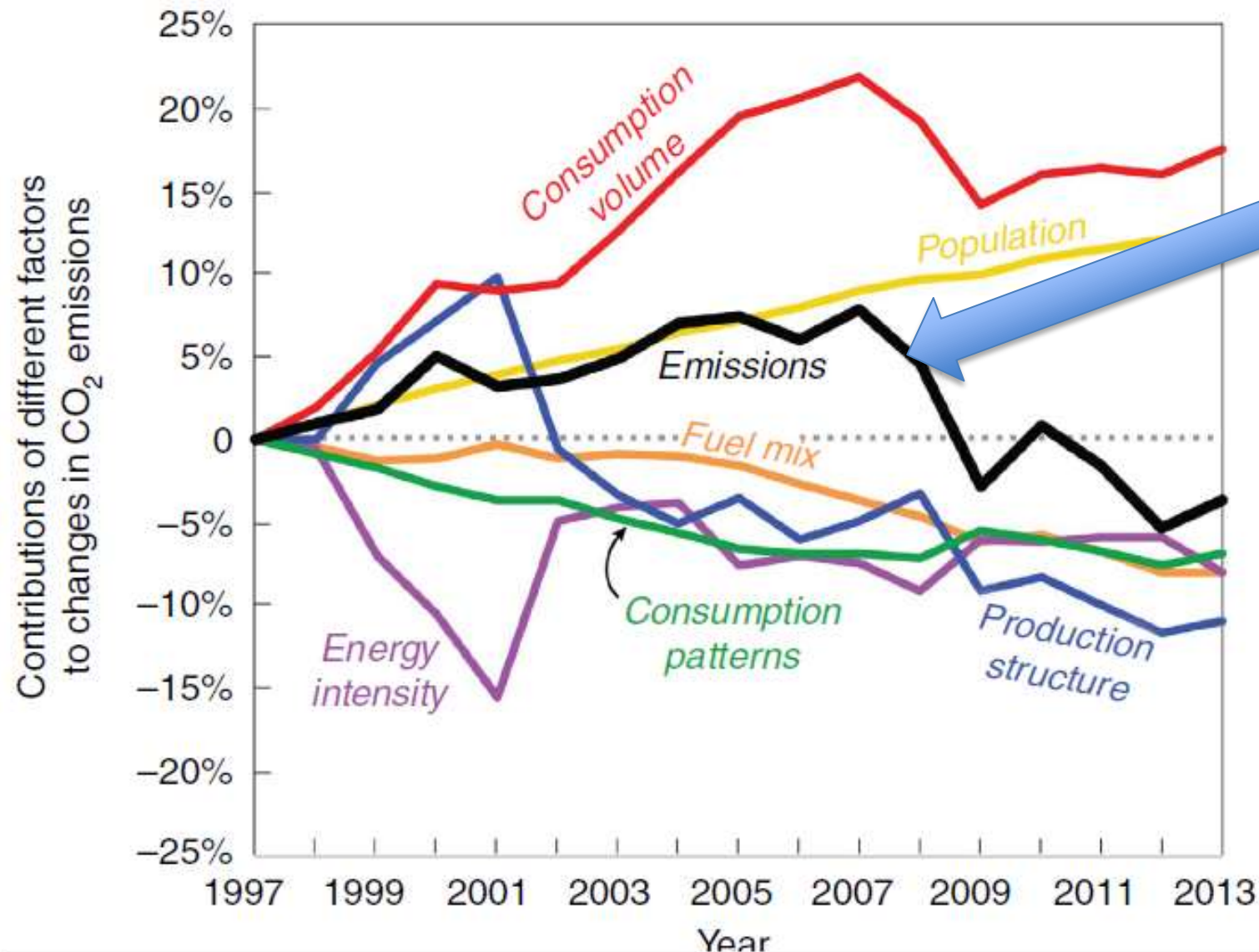
## Driving Forces

- Energy Consumption
- Mining
- Transport
- Residential Fuel Use
- Industrial Production and Consumption
- Biomass Burning
- Waste Management
- Land Cover and Land Use

# **International Trends – US, EU, UK and China**



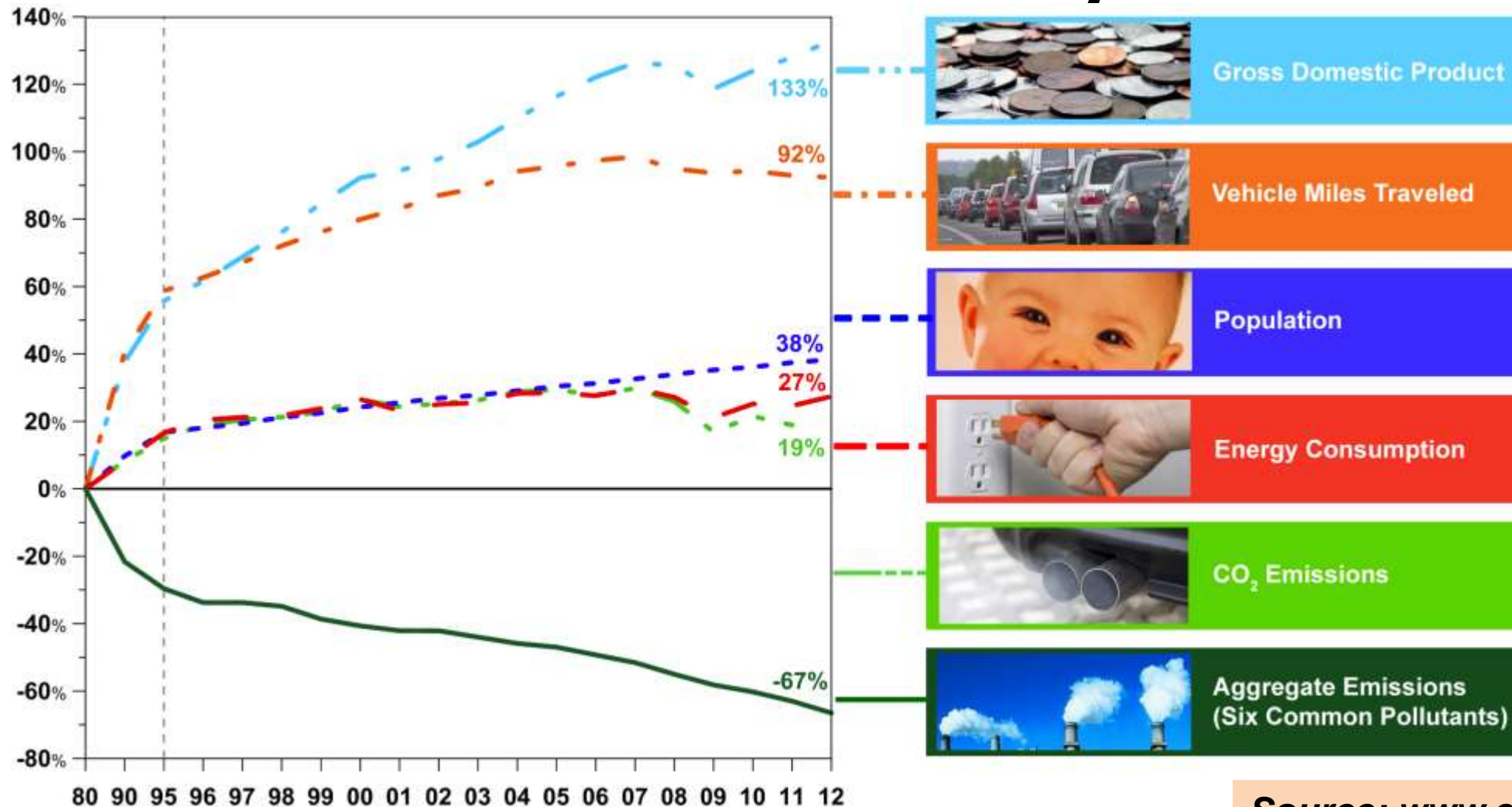
# Contributing Factors to Emission Changes: US



- **Rising emissions until 2007 primarily driven by economic growth.**
- **After 2007, decrease in emissions driven by economic recession, and mildly due to change in energy mix**

Source: Kuishuang Feng et al, Nature 2015

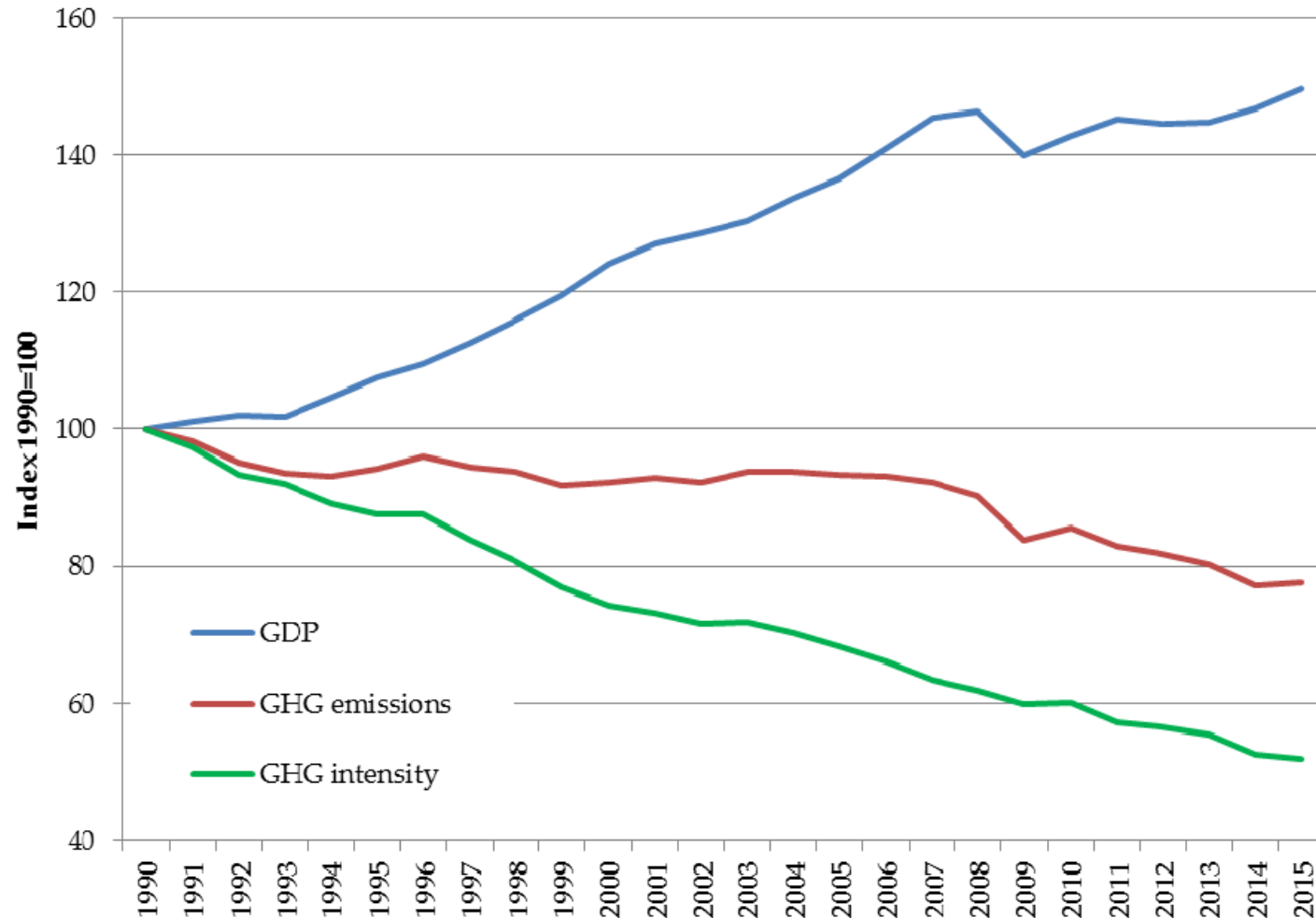
# 1990 to 2012: Air Pollution in the U.S. Declines while the Economy Grows



Source: [www.epa.gov/airtrends](http://www.epa.gov/airtrends)



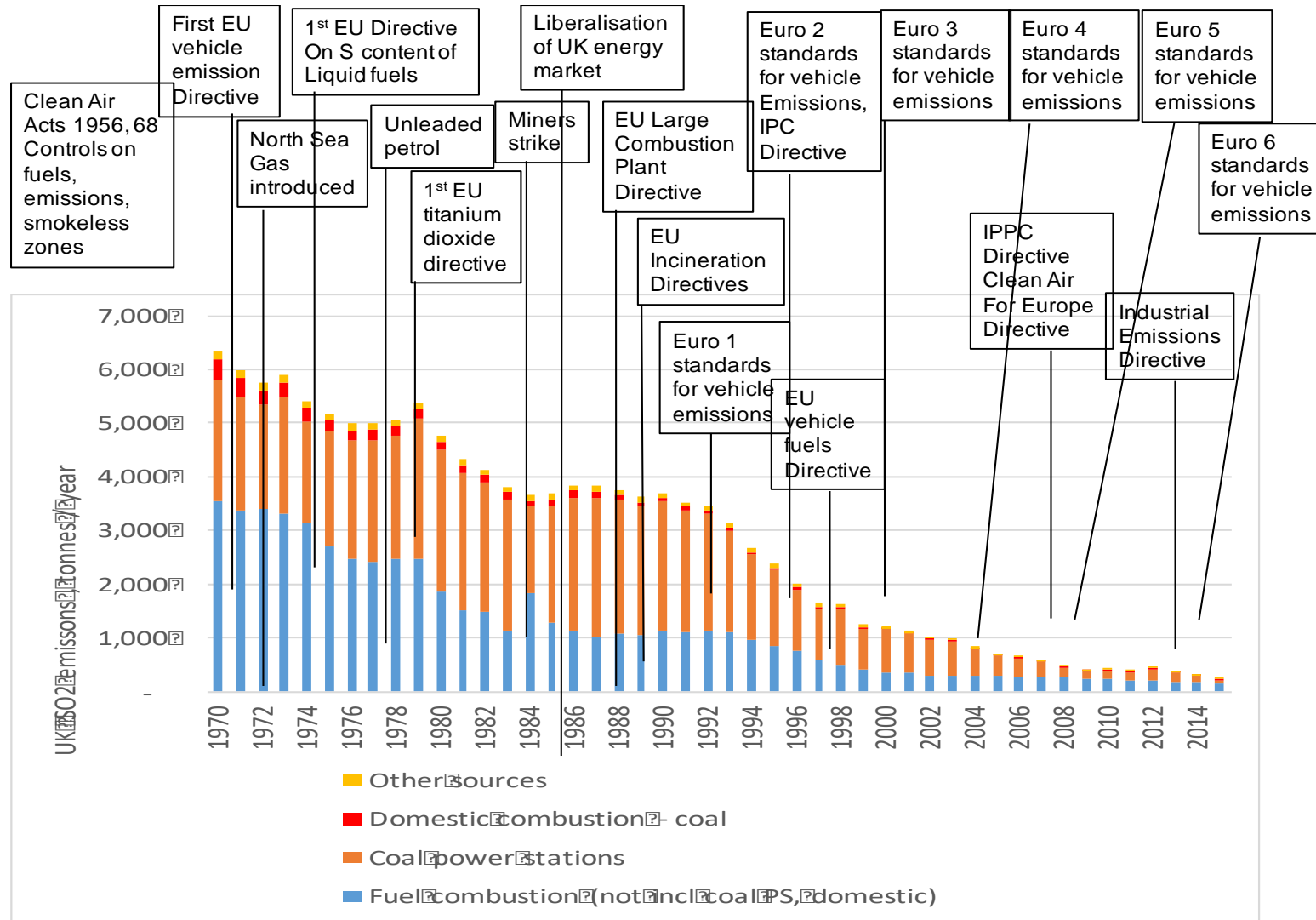
# EU Emission Reduction Toward 2030 Target



- EU GDP grew by 50% between 1990 and 2015
- EU emissions went down by 22% by 2015 compared to 1990

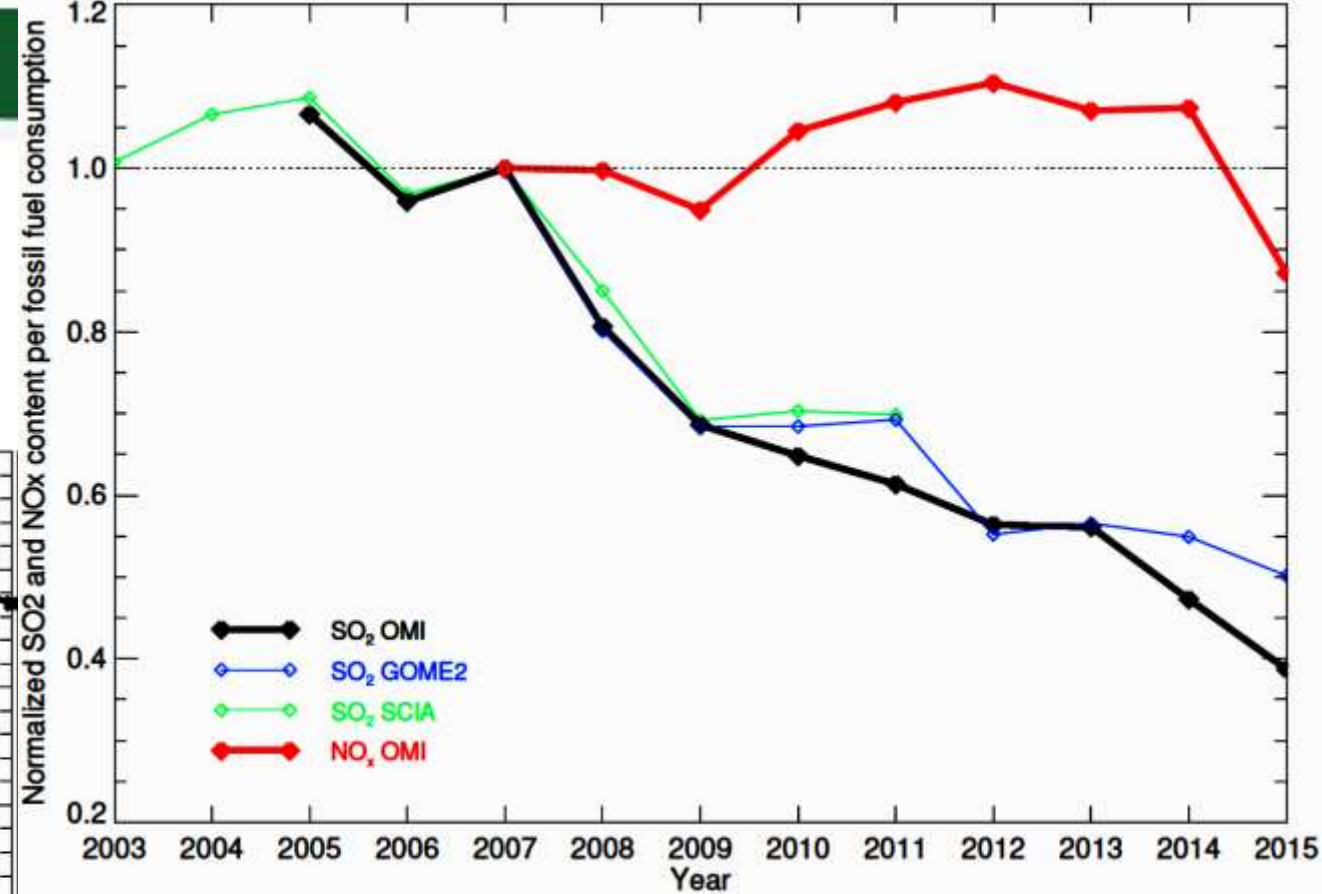
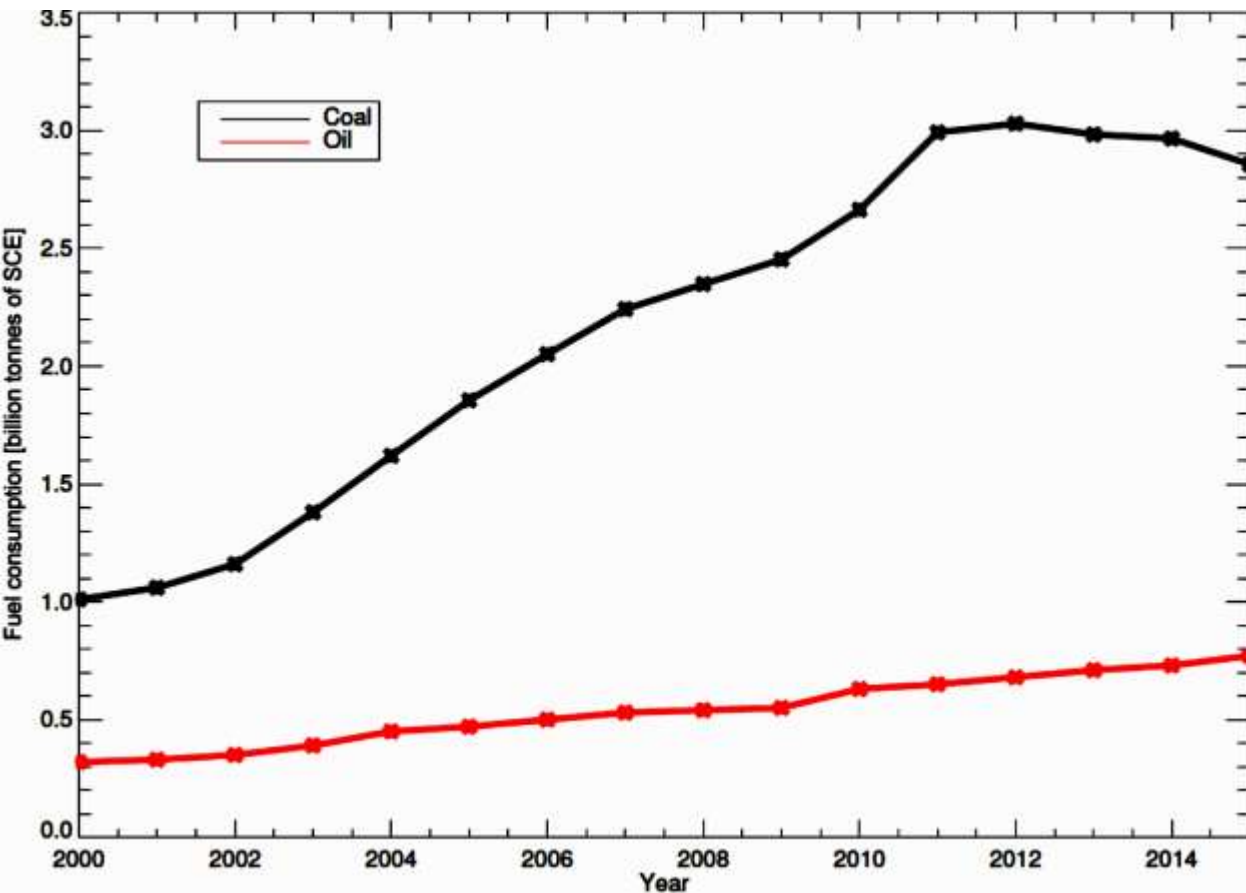
*Source: European Commission Report*

# UK SO<sub>2</sub> Energy Emission Reduction and Policy Interventions



1. Implementation of the Clean Air Act
2. Legislation on climate change
3. Liberalisation of the energy sector

# China Energy Consumption Trends



- Implementation of desulfurization installations in the power generation sector
- NO<sub>x</sub> reduction programs in place, since 2015

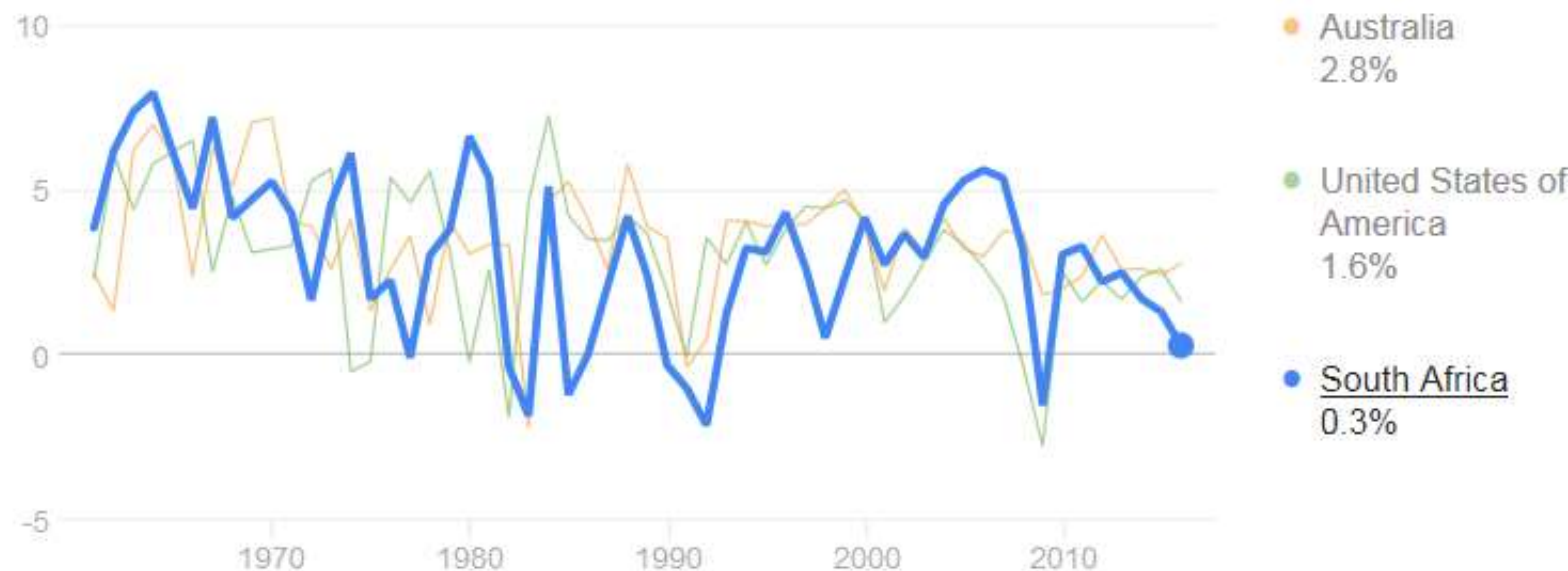
Source: van der A, Atmos-Chem-Phys, 2017

# **South African Trend 1: Population**

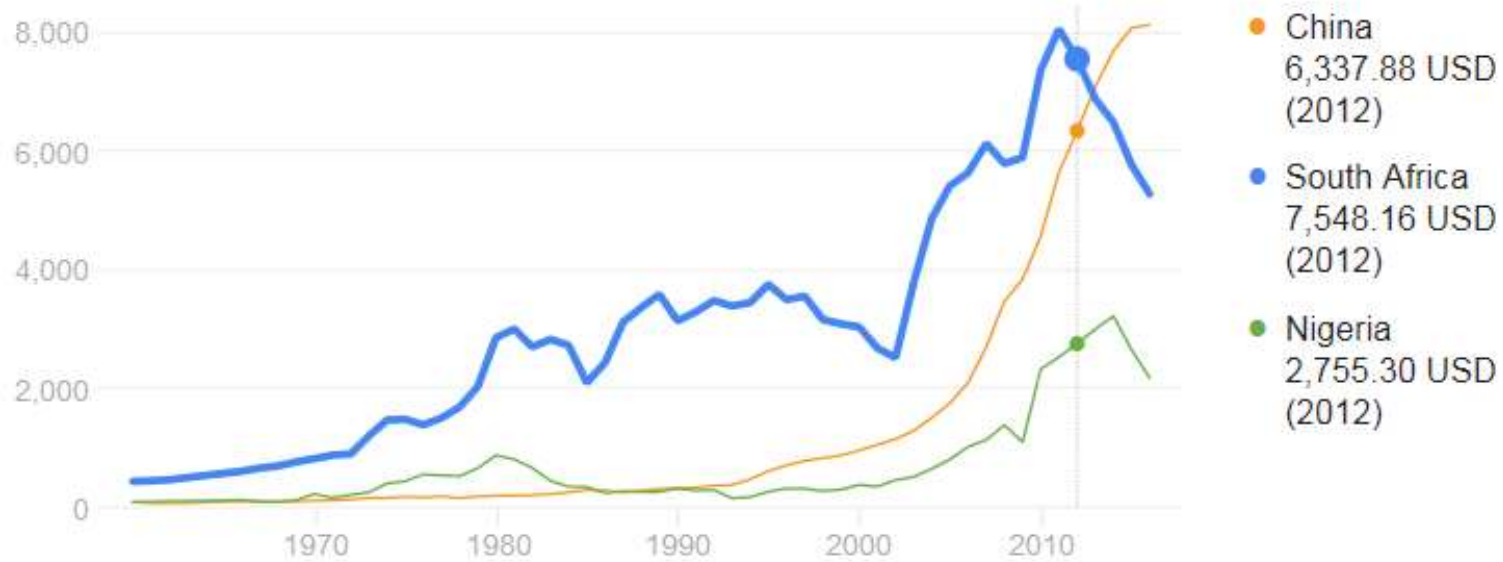


# SA GDP and GDP Per Capita

0.3% annual change (2016)



5,273.59 USD (2016)

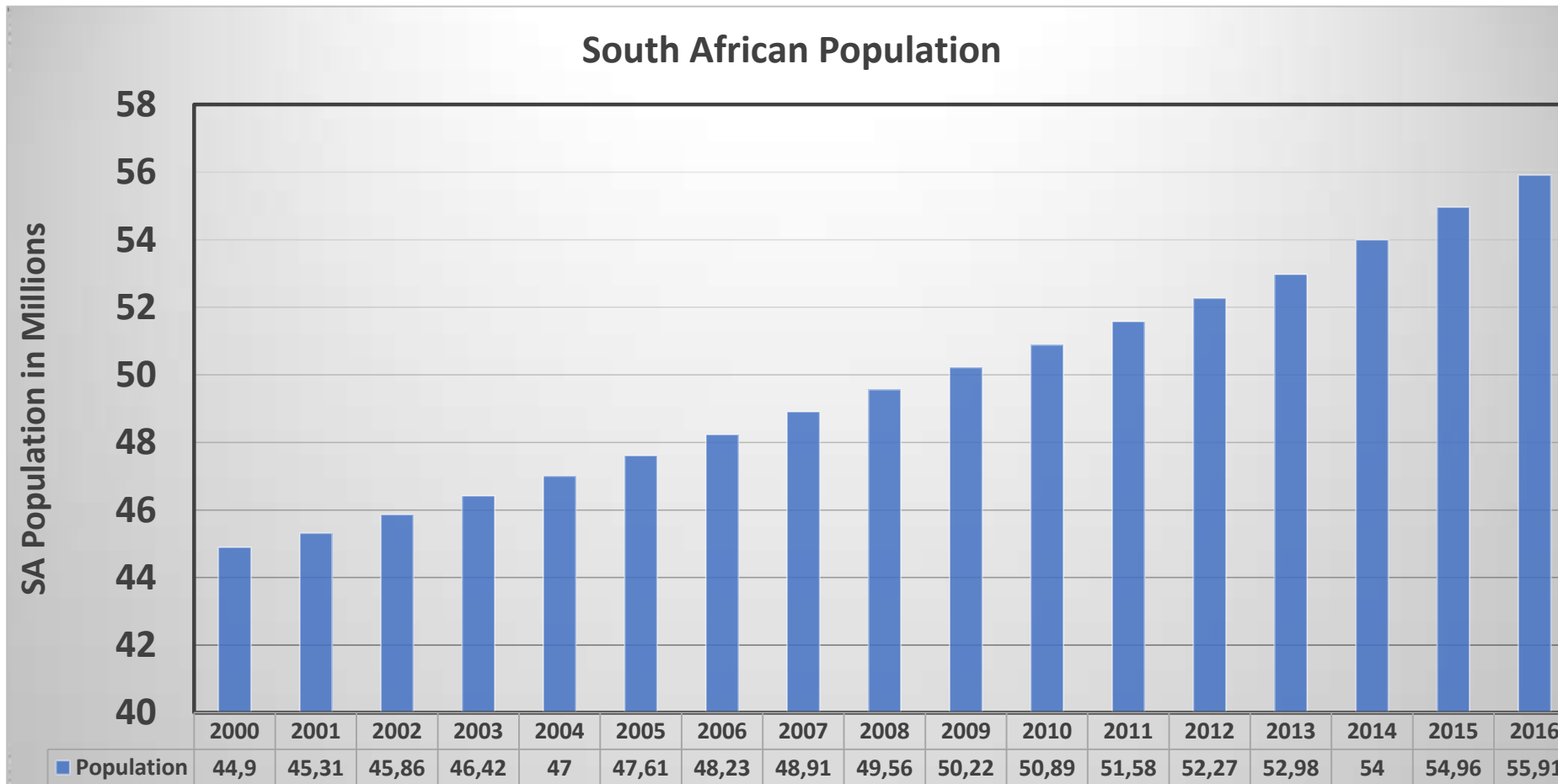


Source: World Bank

# Population Trends Observations

- Estimated that the population of Sub-Sahara 2010 will double by 2050, and that 40% of the SADC's population will be living in urban areas by 2030
- Increase in population of 25% in 2016 since 2000
- Increased
  - Urbanisation - intensive economic and social activities, typically linked to excessive energy consumption
  - Migration both internal and external for socio-economic reasons
  - Access to resources - financial
  - Changes in consumption volumes – the middle class is the most carbon intense

# Population Trends in South Africa



**Increase in  
population of  
25% in 2016  
since 2000**

*Source: Stats SA, 2017*

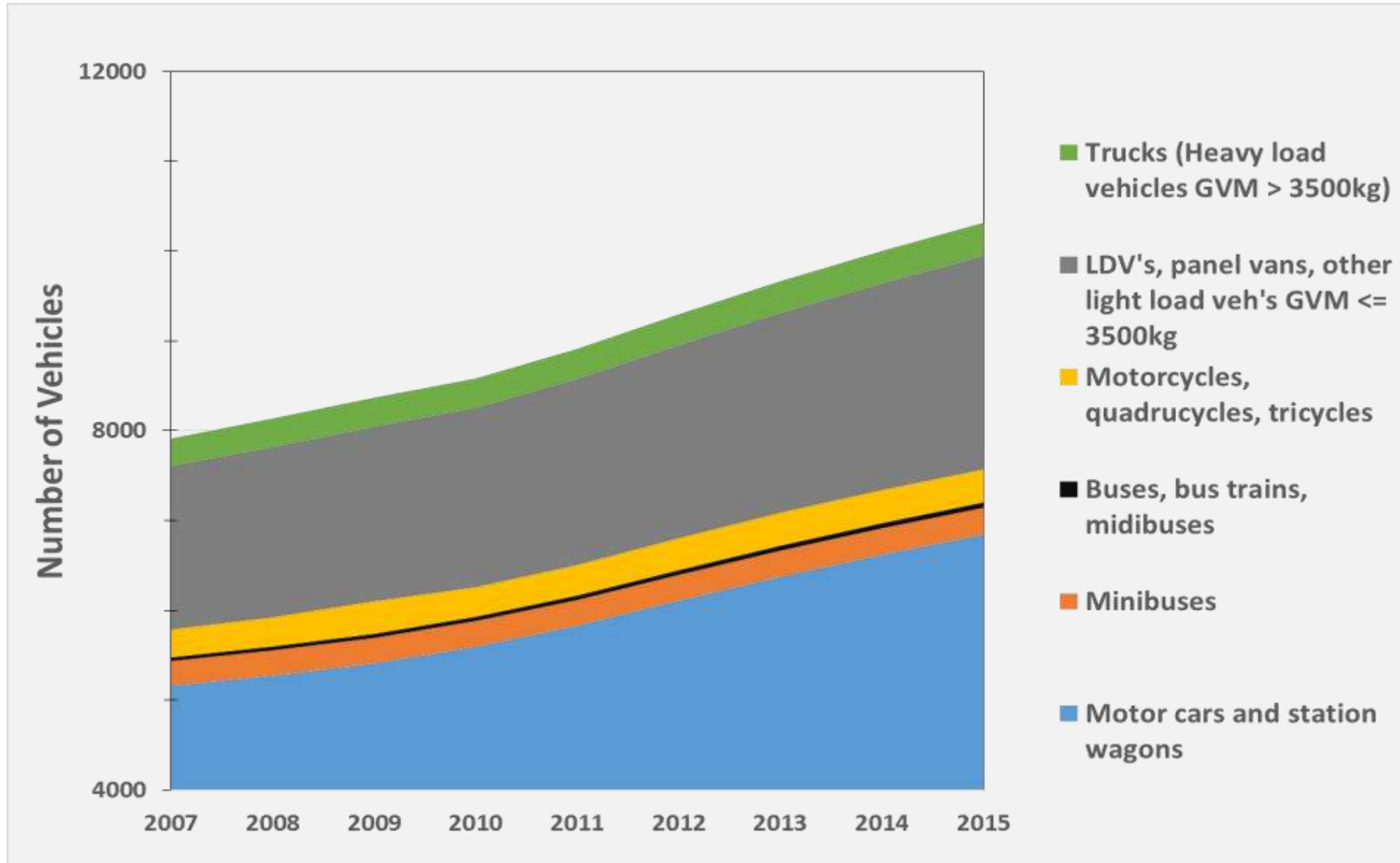
# **Transport Sector- Road, Rail, Aviation and Shipping**



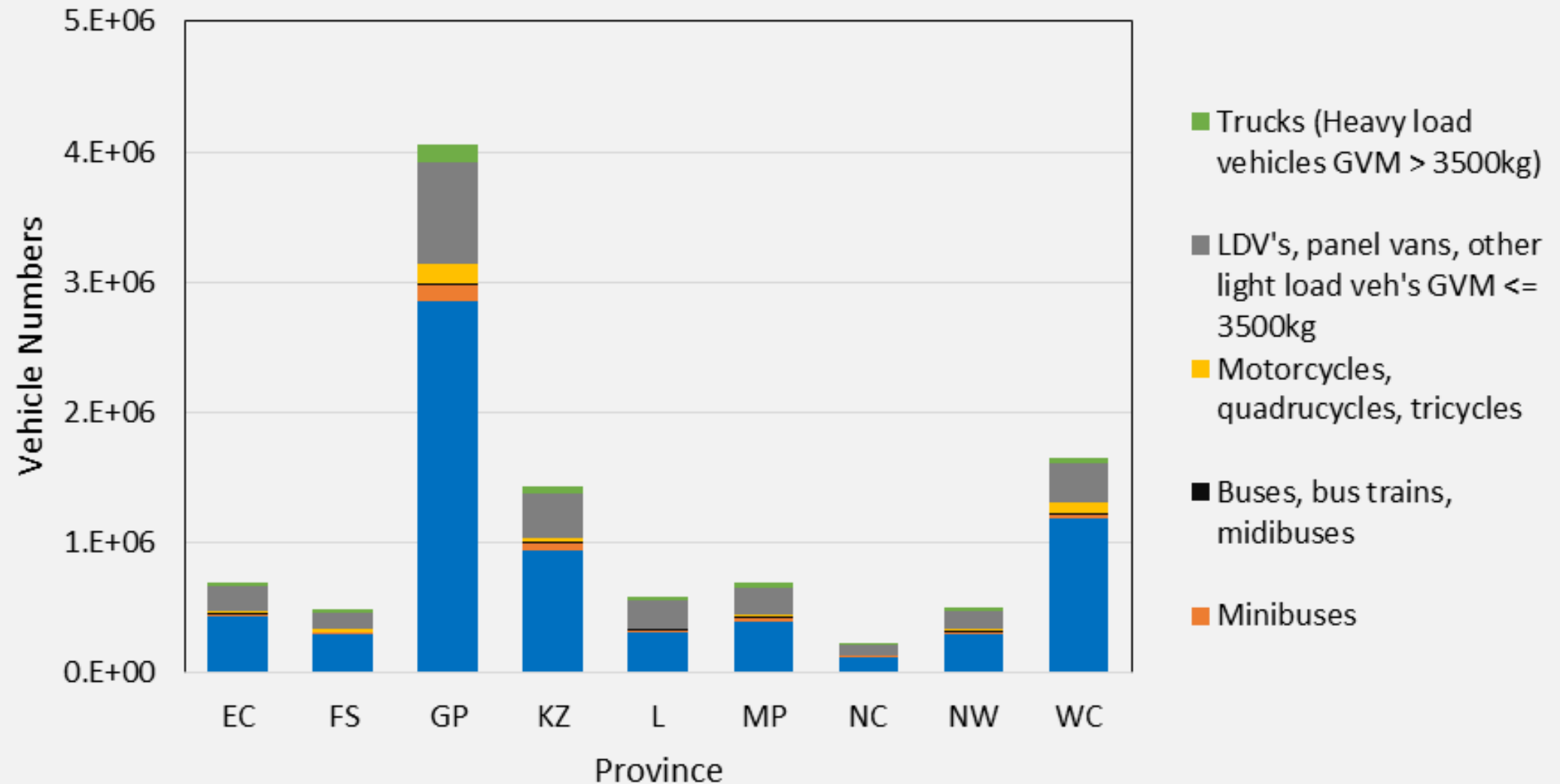
# Road Transport

- Dominant mode of transport in the country
- 80% of good and 90% of passengers mode of transport
- Fastest growing source of emissions in the country
- Largest source of urban air pollution
- Largest source of transport sector emissions - 92% GHG in 2010 from the transport sector
- Aviation, rail and shipping are also transport sectors with significant emissions
- **Policy interventions in lead and SO2 reductions**
- **Implementation of the Vehicle Emissions Strategy**

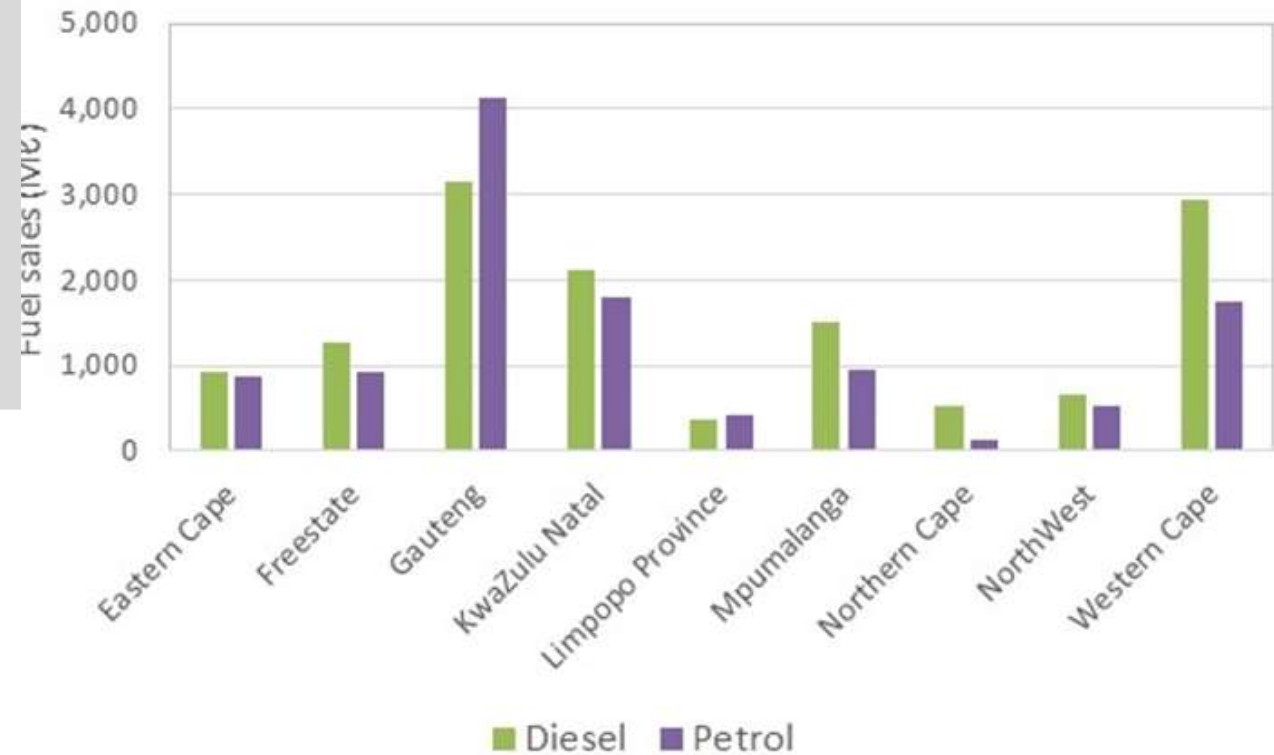
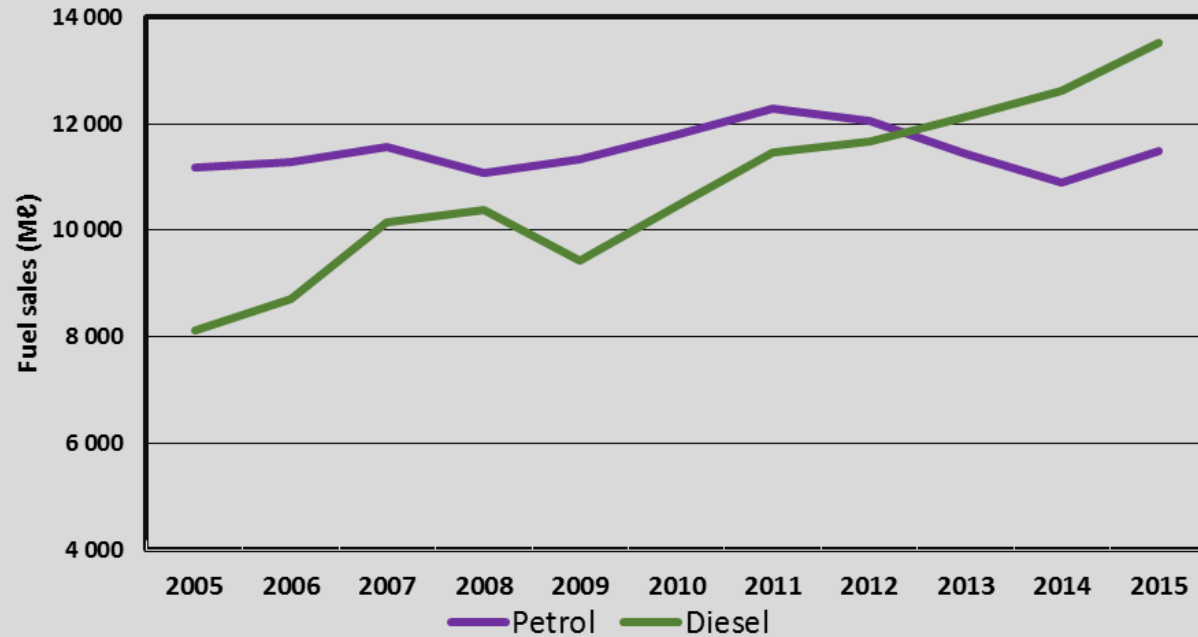
# Transportation Statistics – Number of Vehicles



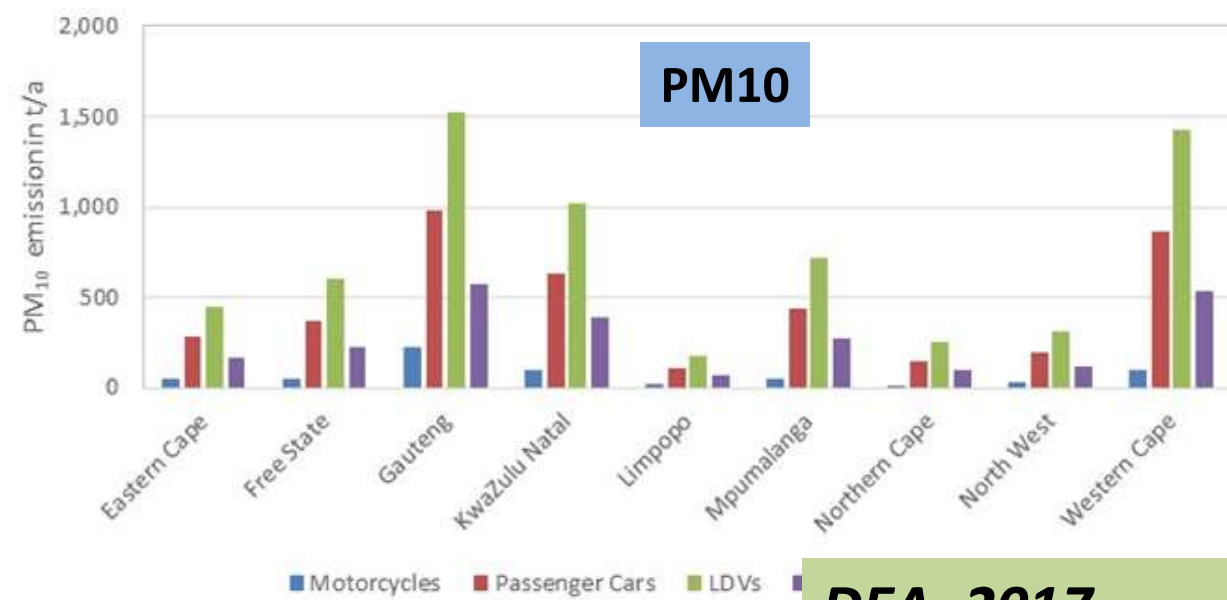
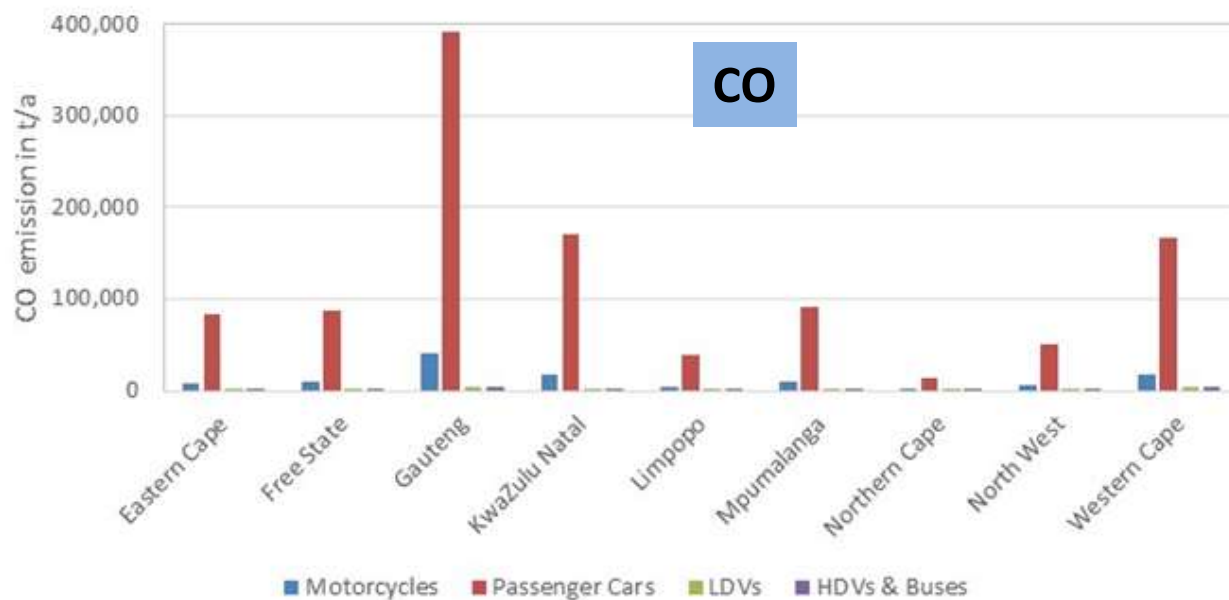
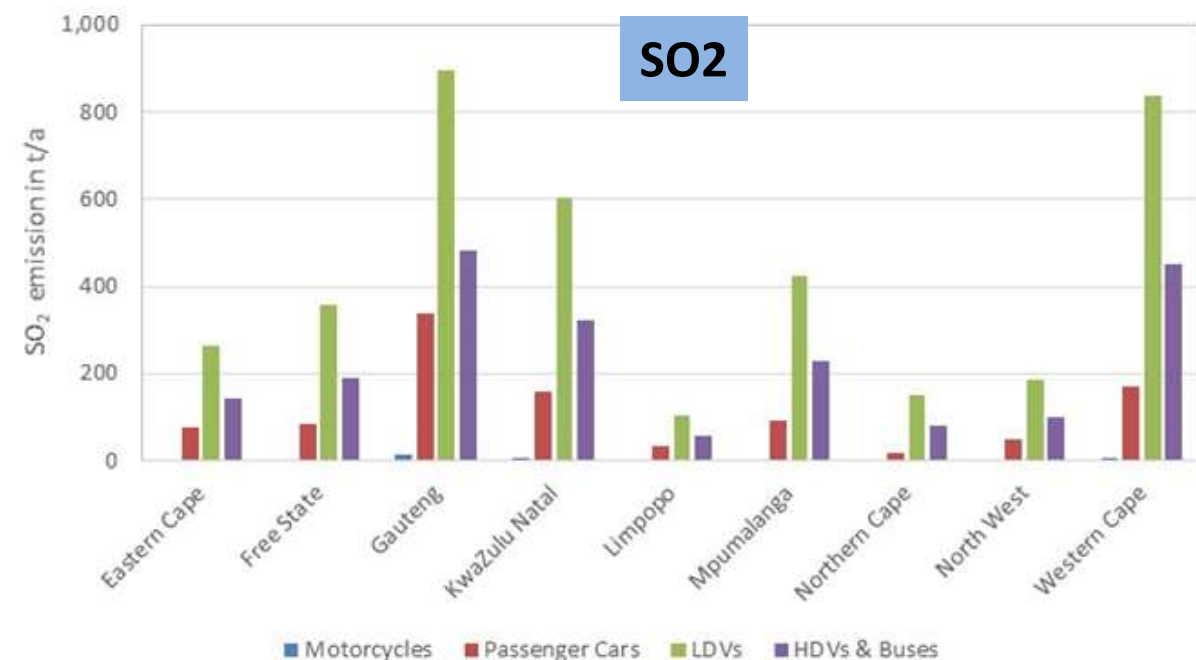
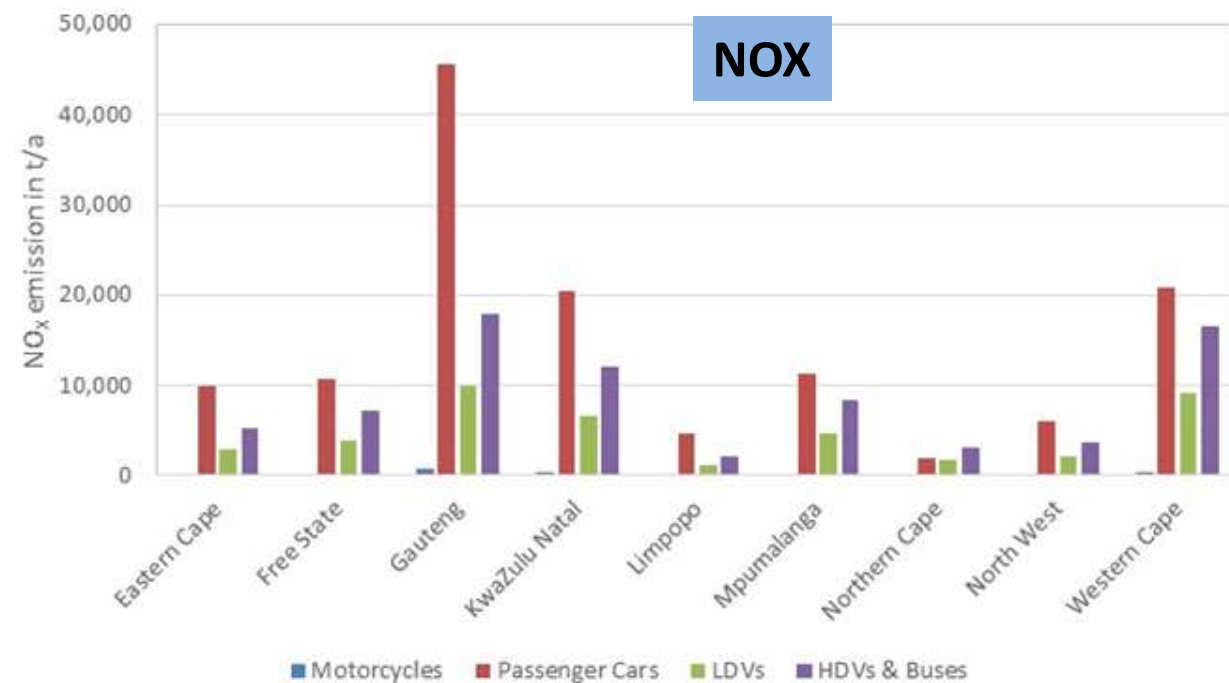
# Vehicle Fleet by Provinces



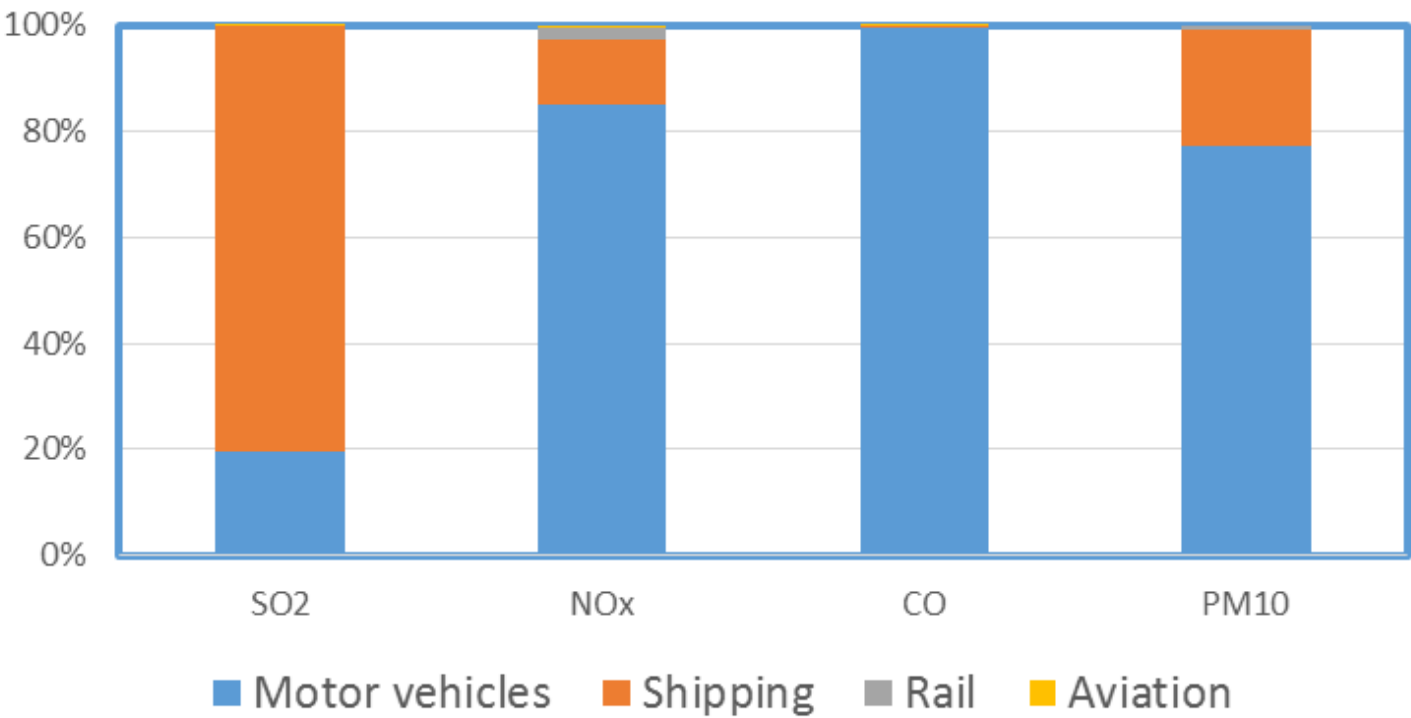
# Transportation – Fuel Sales







Contributions to Transport Emissions



# Transportation Sector Emissions

	SO2	NOx	CO	PM10	VOC
Motor vehicles	6 952	251 390	1 241 295	13 646	184 480
Shipping	28 207	36 480	2 802	3 848	2 820
Rail	4	6 767	803	188	259
Aviation	118	1 435	1 337		55
Total	35 280	296 073	1 246 237	17 682	187 614

# Energy Use

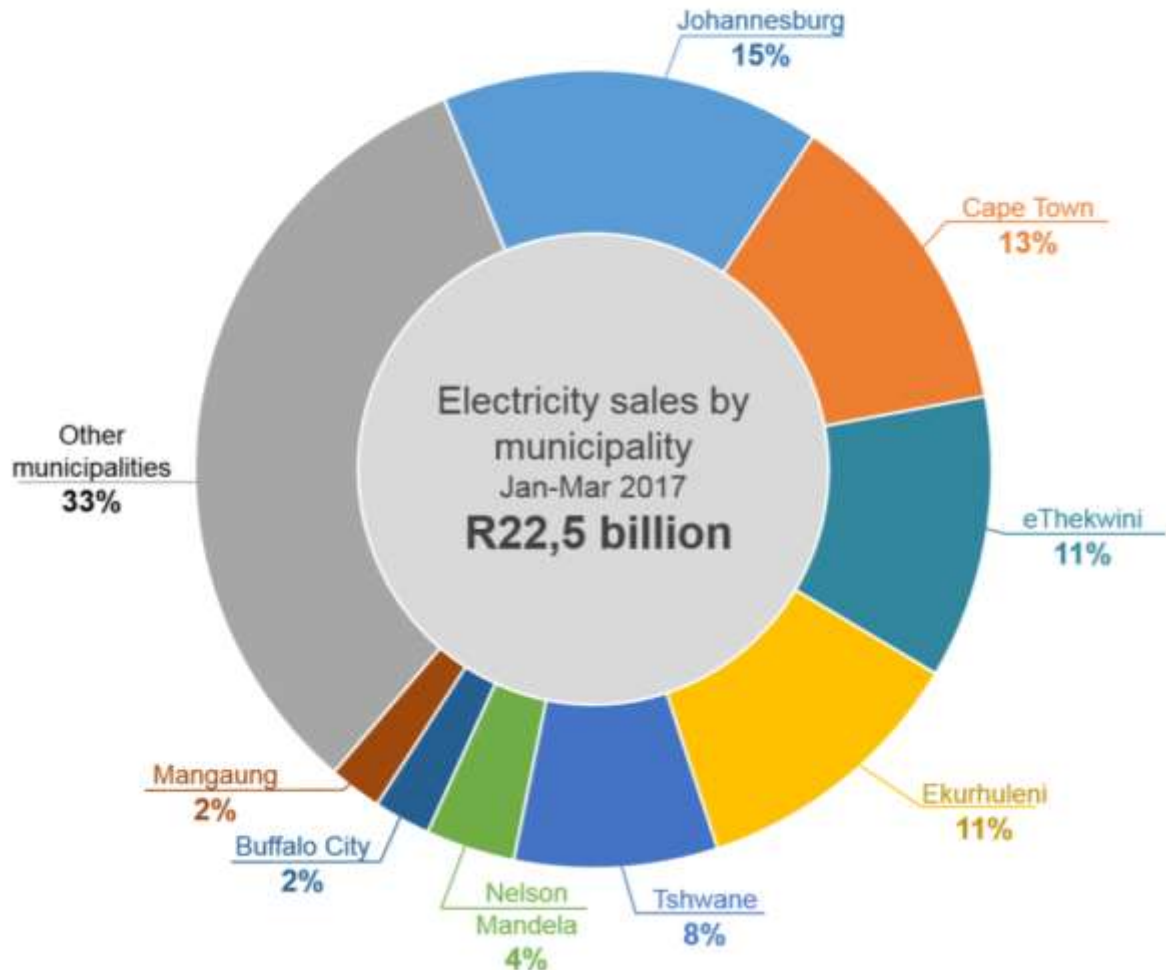
- Coal and petroleum are the key commercial energy fuels used in electricity generation and transport sectors
- Power generation from coal is major source of emissions in the country
- SA energy mix will continue to be driven by coal for some time to come
- Improved technology in emission reduction as well as reduction dependency on fossil fuel

# **Energy Use – Electricity Use**



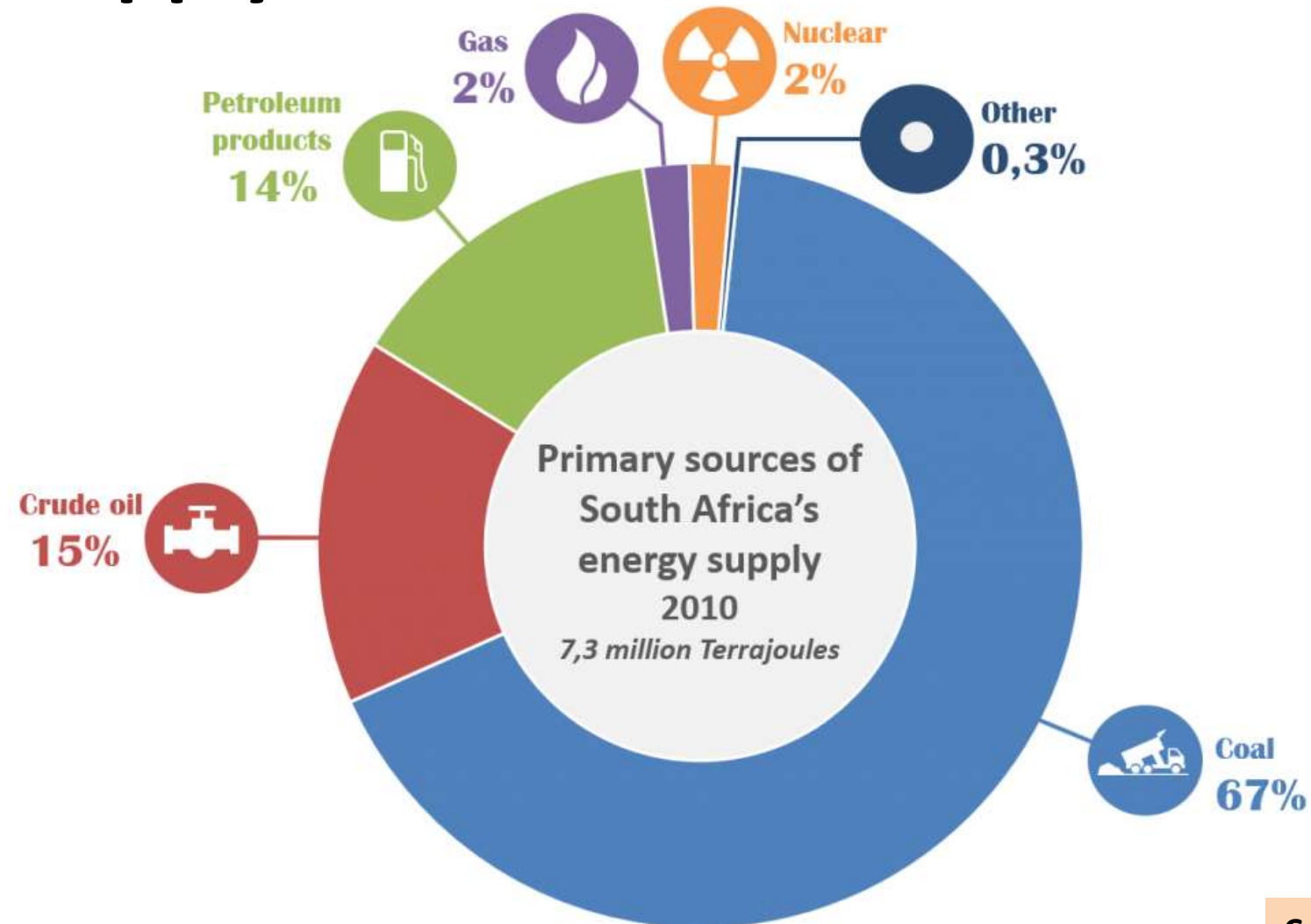
# Energy Use Summary

Which municipalities sell the most electricity?

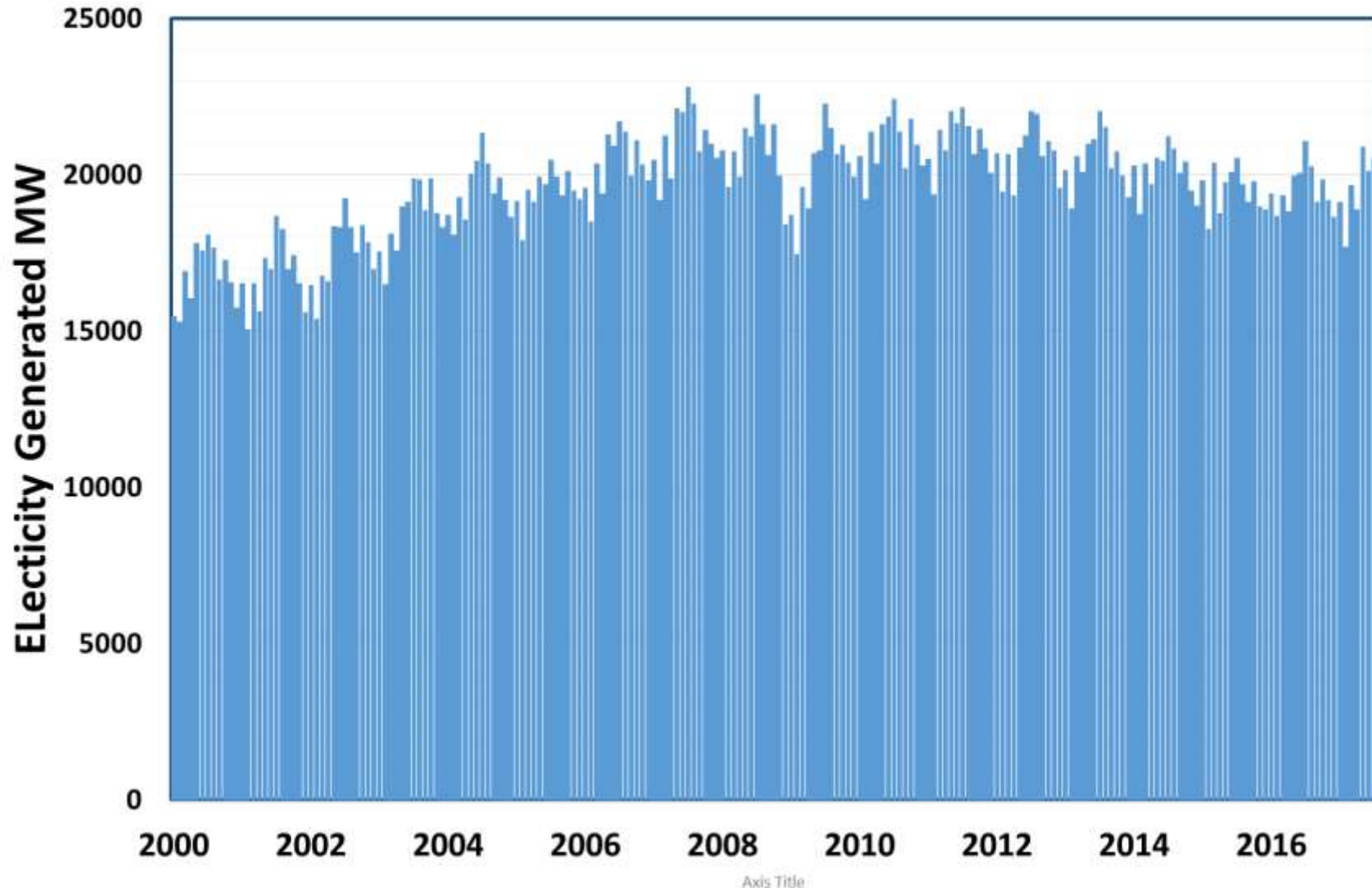


- Dependence on fossil fuel for energy as a country
- Both residential and commercial use

# South African Primary Energy Supply



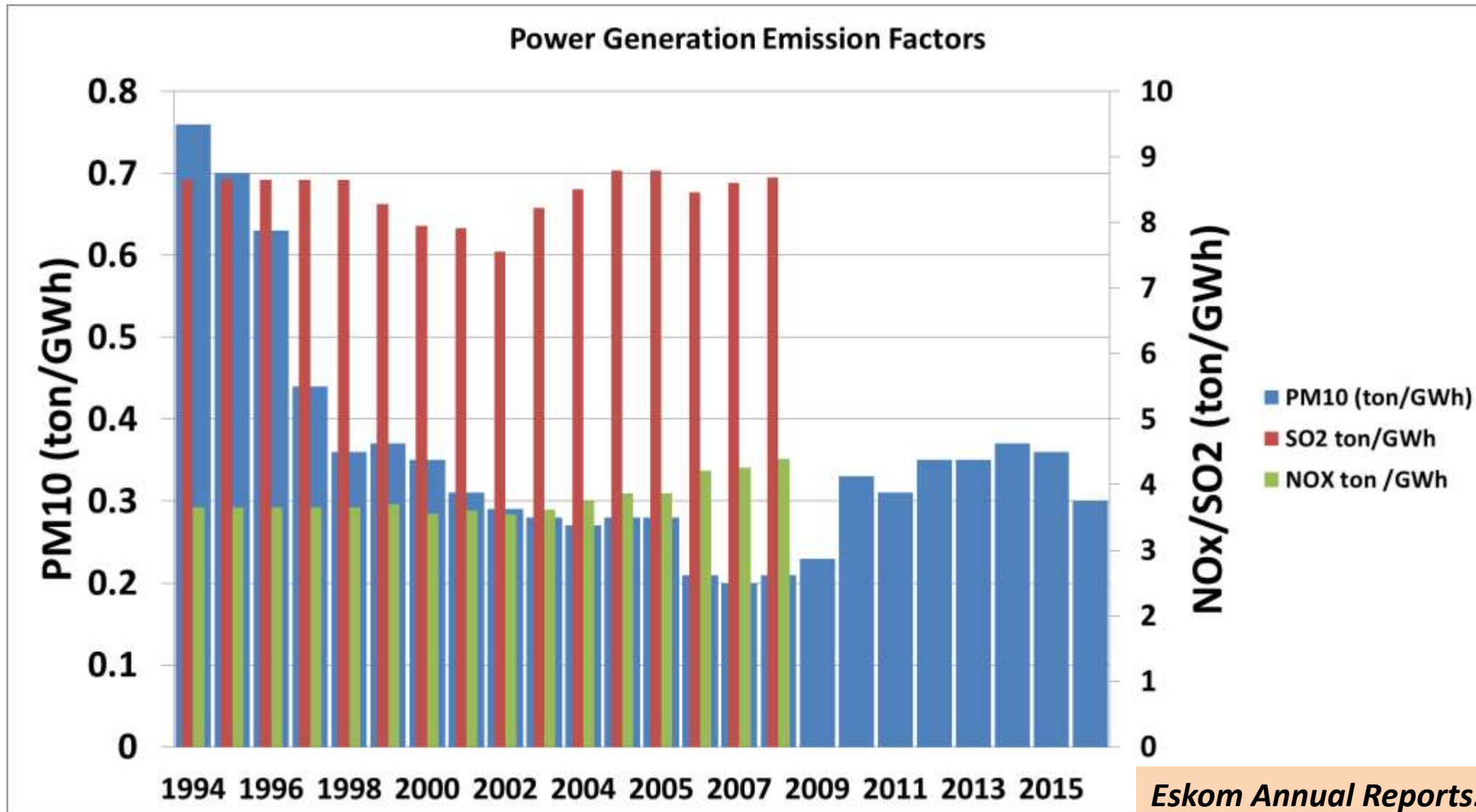
# Electricity Generation: Eskom since 2000



- Annual production of 31000-38000 MW
- Annual cycle with maximum in June-July and min in Dec

*Source: Stats SA, 2017*

# Eskom Emission Factor Trends



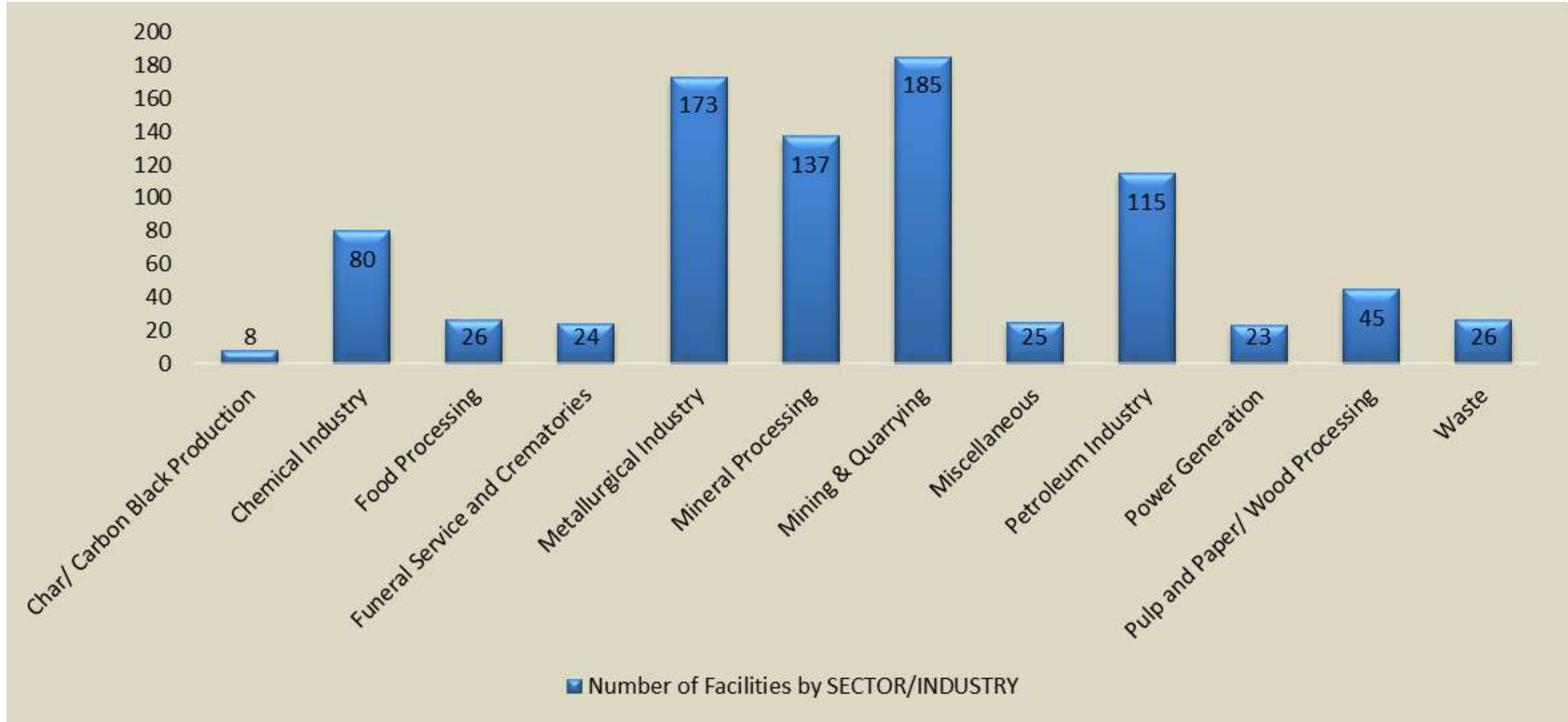
# Emission Trends from Power Generation

- 2007/2008 Eskom could achieve better control of PM
- Target of 0.3kg/GWh for 2017 is below the 0.28kg/GWh 2001 emission factor – before NEMAQA came into effect
- Based on the power utility performance since 1994, where has NEMAQA influenced the utility emission reduction programs?
- How is the Integrated Resources Plan (IRP) going to impact the trend of SA energy emissions (vehicles and electricity)?
- What will be the co-benefits from the carbon tax regime once implemented?

# **Industrial Emissions**



# Economic Sectors Reporting to NAEIS



Grey – Section 21  
Orange – Mines that  
reported to NAEIS

Namibia

Botswana

Gaborone

Maputo

Swaziland

Johannesburg

Bloemfontein

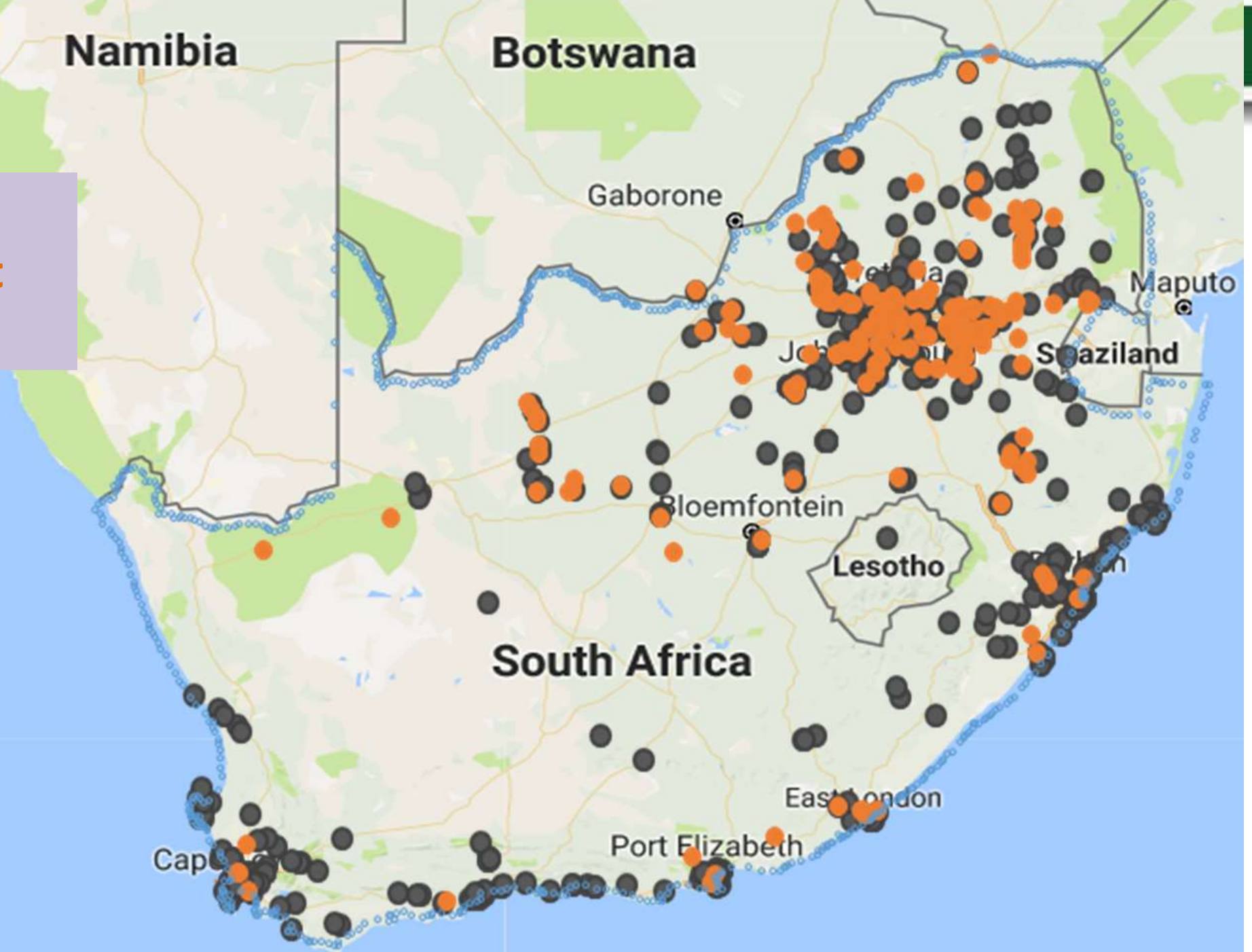
Lesotho

South Africa

East London

Port Elizabeth

Cape Town



# **Emissions from Industrial Sources**

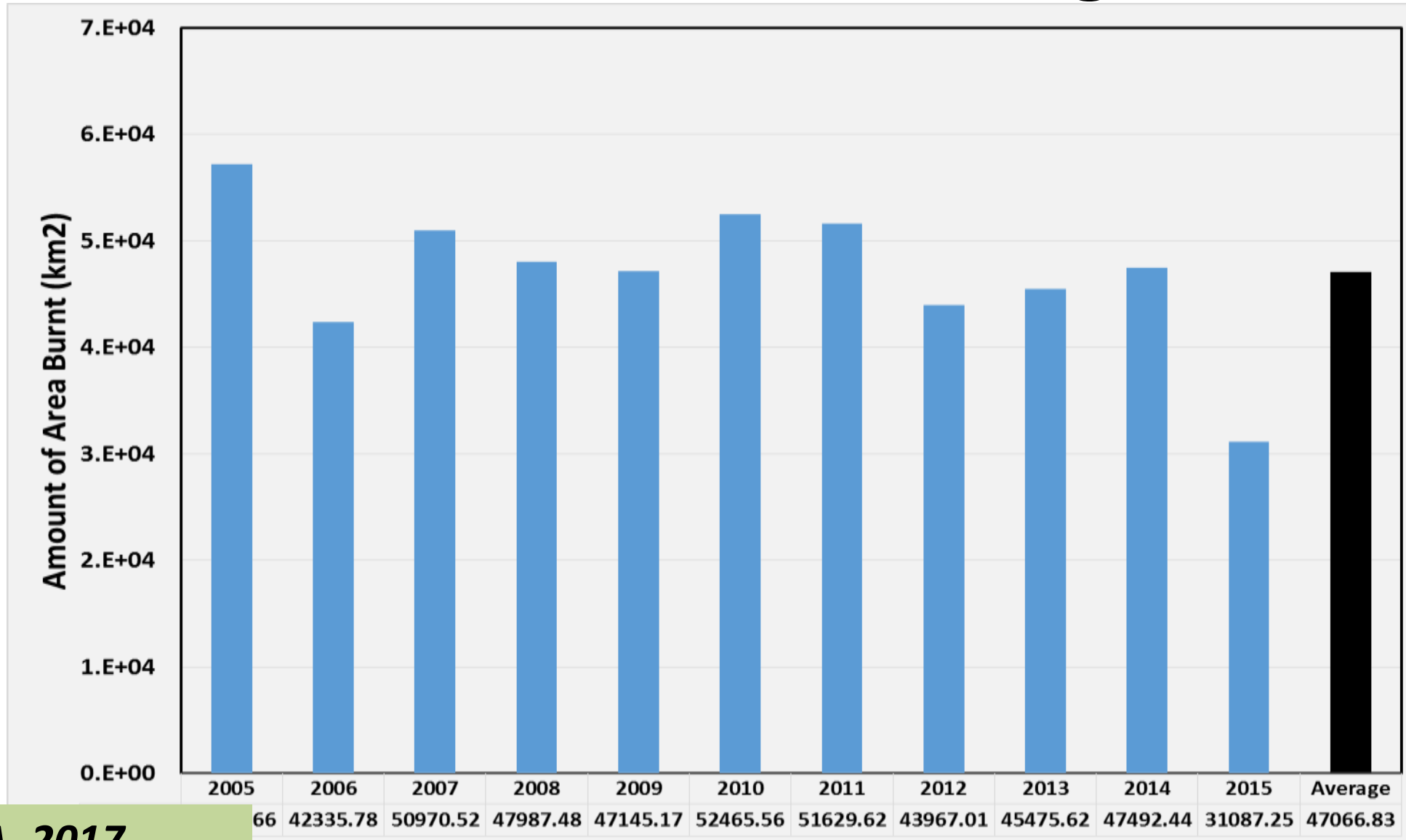
- National Emission Inventory from Industrial Sources in Presentation Session 5.2

# **Biomass Burning Trends**

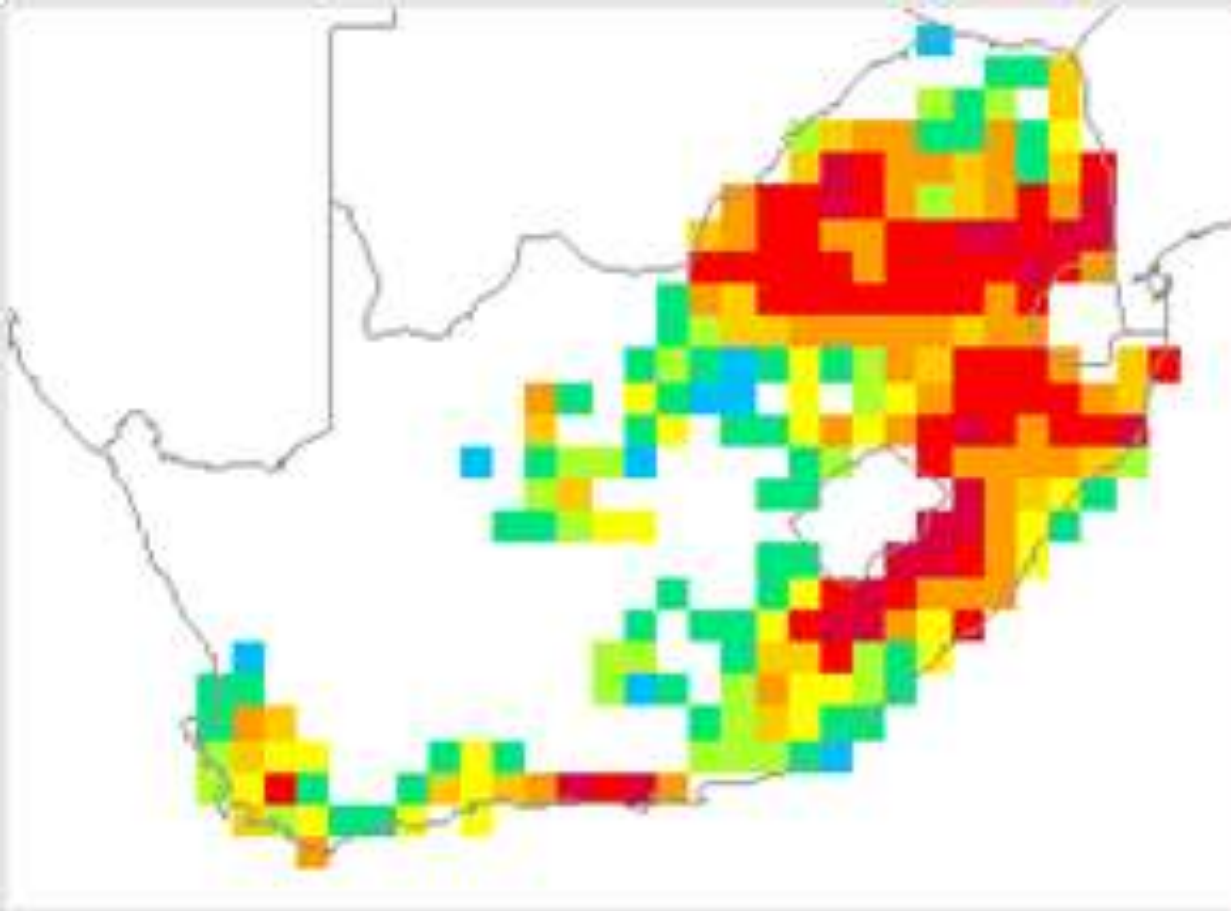
# Biomass Burning Emissions

- Burning almost exclusively the result of human activities
  - Burning of forested areas for land clearing
  - Agricultural residues e.g., sugar cane burning
  - Natural grasslands
  - Savannas to sustain shifting cultivation
  - Largest source of emissions in the Africa

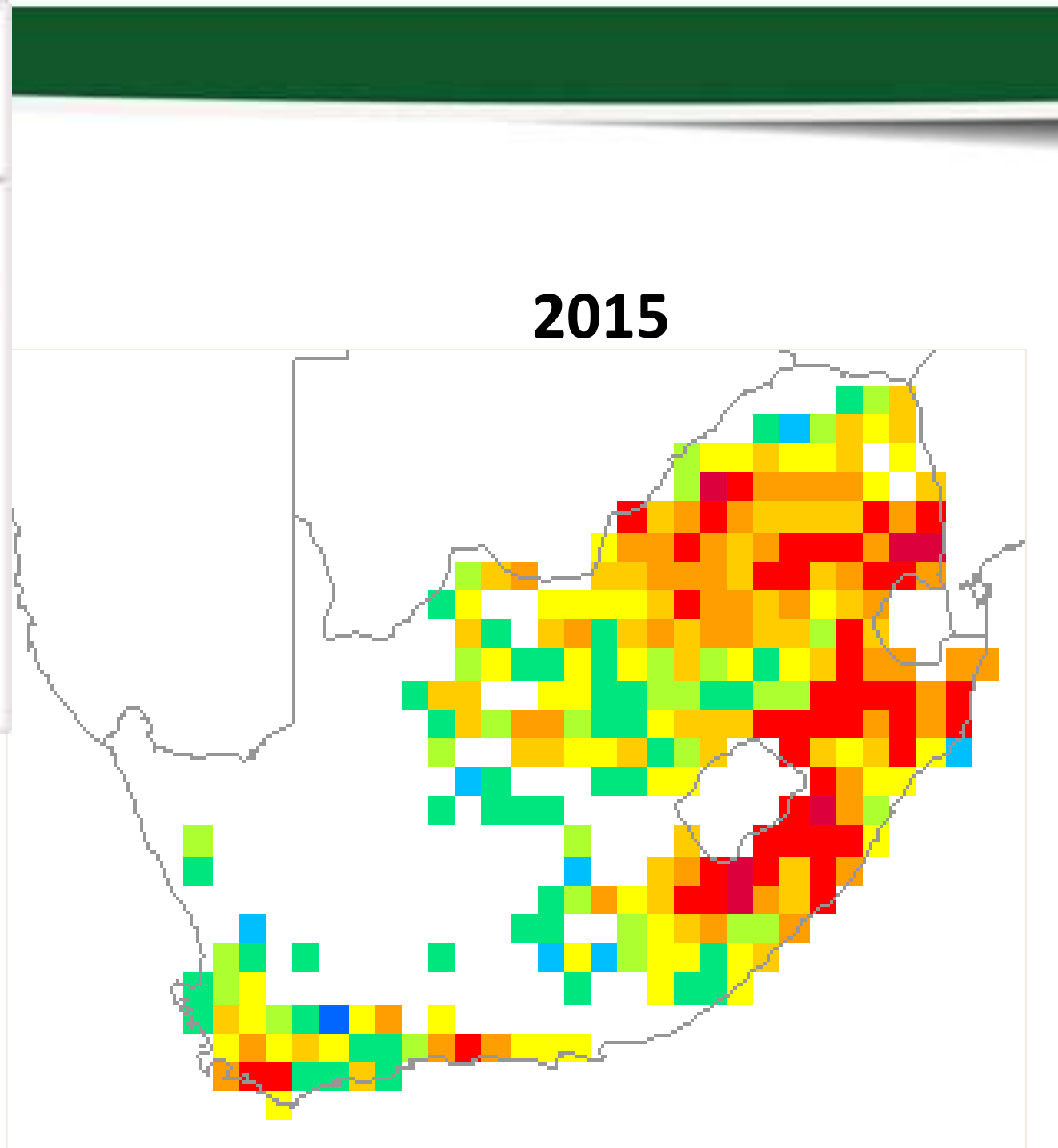
# Biomass burning





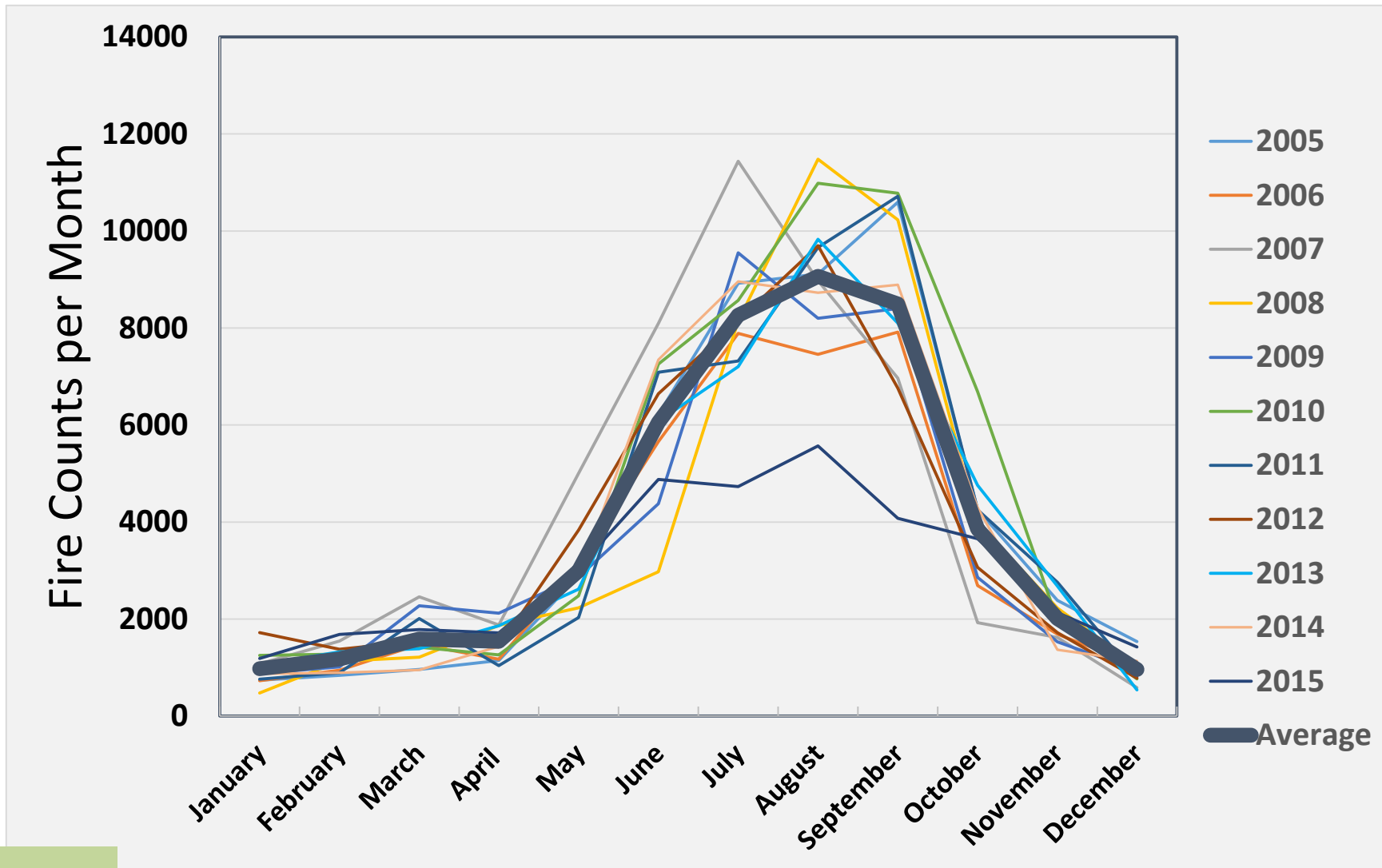


**2009**



**2015**

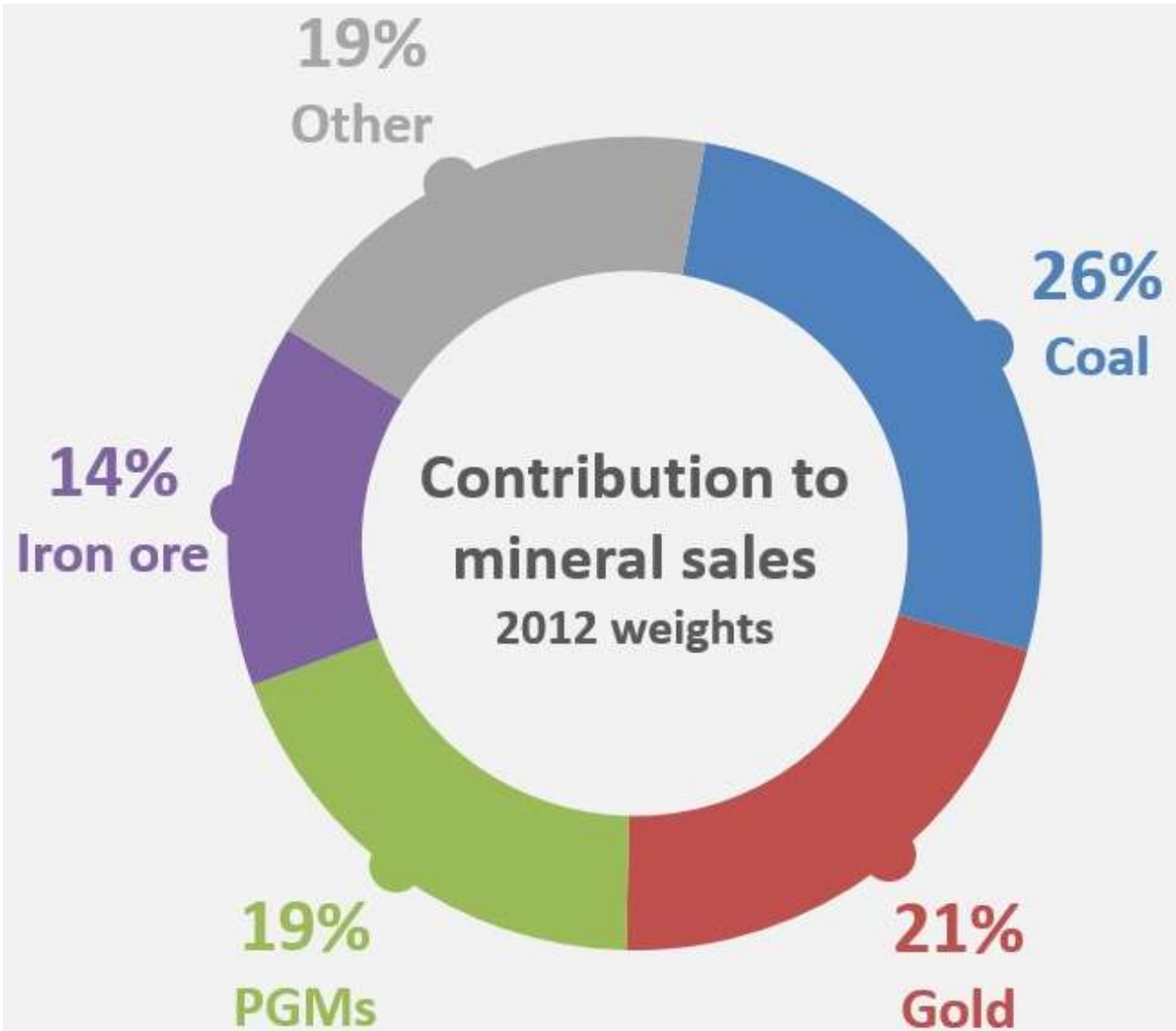
# Monthly Variability of Fire Counts



# Biomass Burning Emissions Legislation

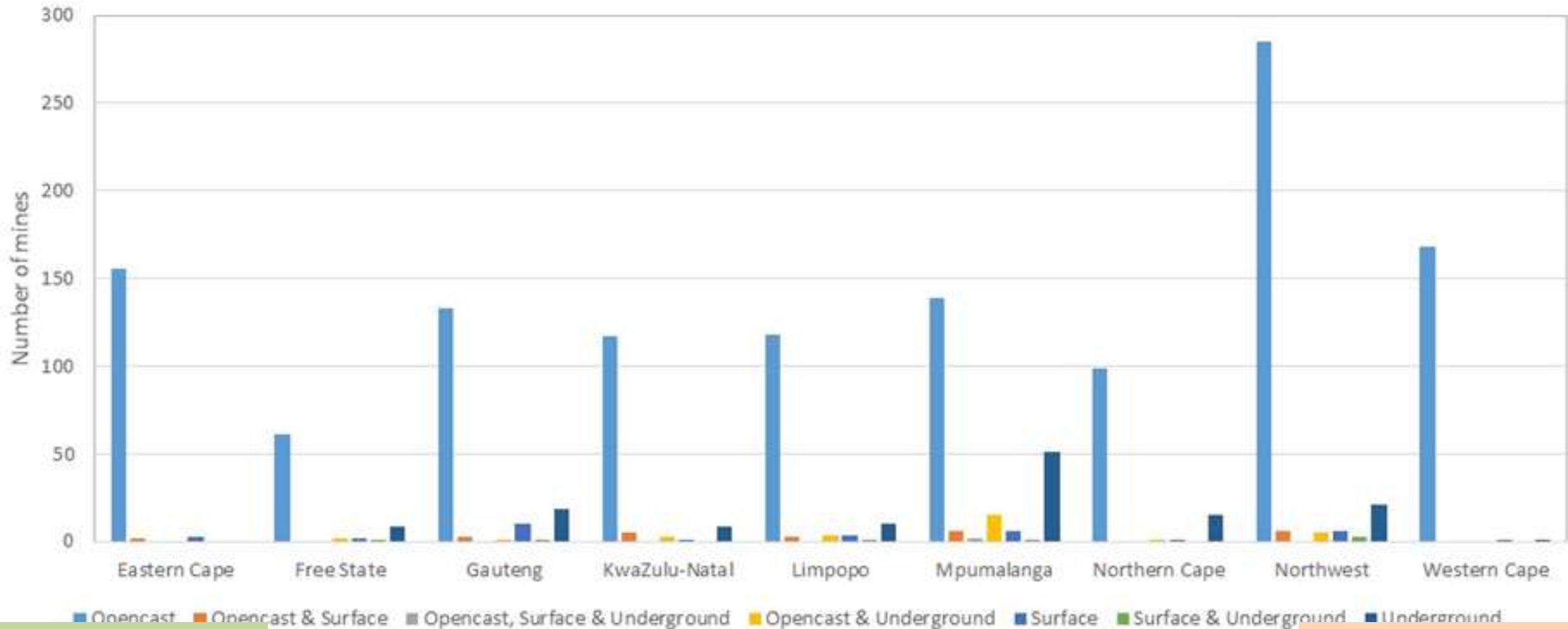
- National Forest and Fire Laws Amendment Act No. 12 of 2001 – administered by the Department of Water Affairs and Forestry
- City of Cape Town: Air Quality Management By-law, 2010
- **“Since smoke from veldfires is a concern in some municipalities, this Bill (NEMAQA) once enacted would require from the Department of Water Affairs and Forestry its effective participation in the development of the national framework and its preparation of an air quality management plan for veldfire emissions that together provide a fair and workable regulatory environment for veldfire management”**
- **An AQMP for Veldfire Emissions**

# Mining Activities in SA

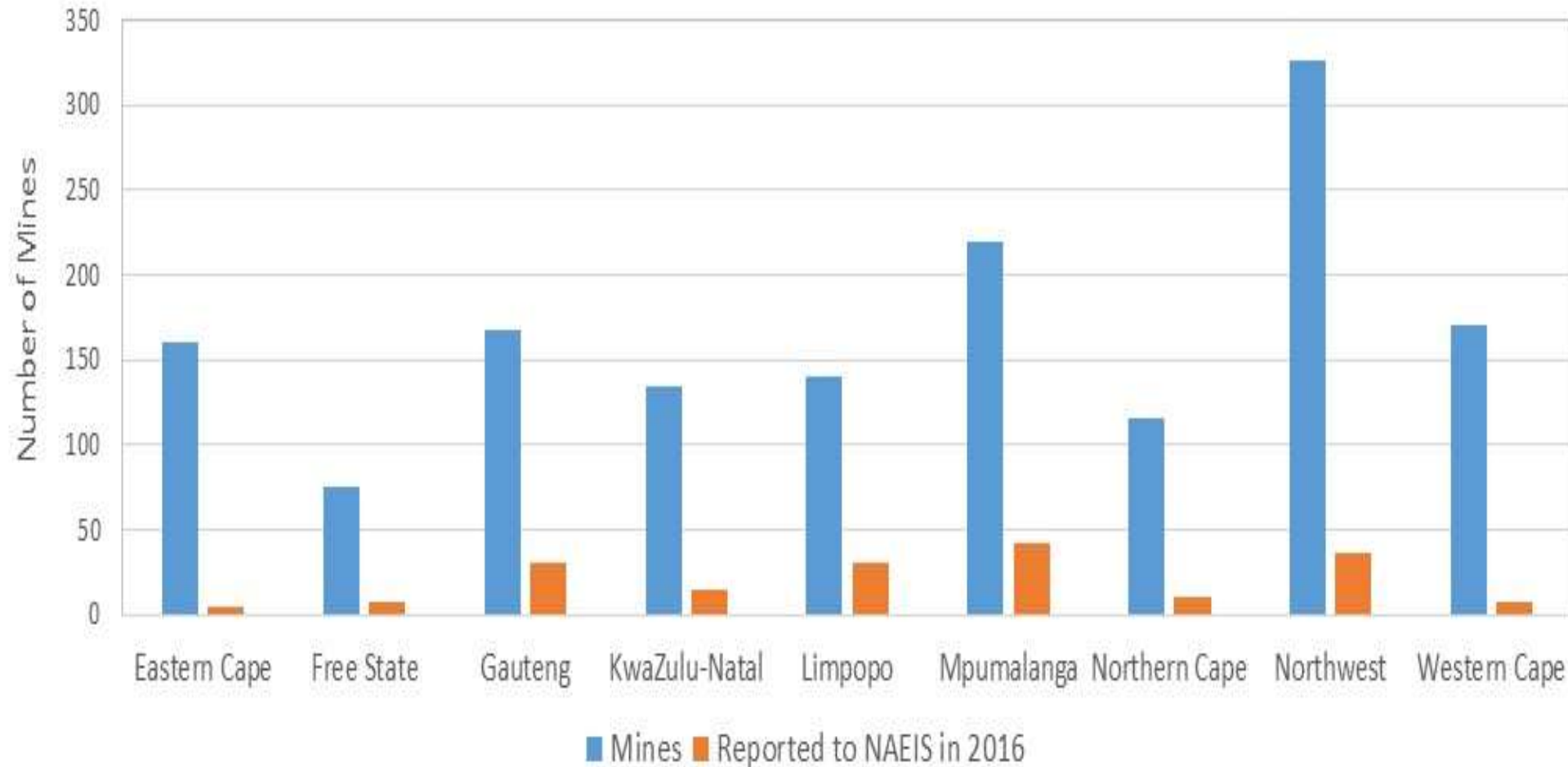


- Driving force in SA economy
- 5<sup>th</sup> world producer of gold
- 1<sup>st</sup> world producer of chrome, manganese, platinum, vanadium and vermiculite.
- 2<sup>nd</sup> world producer of ilmenite, palladium, rutile and zirconium
- 3<sup>rd</sup> world exporter of coal

# Mining Statistics by Provinces



# Compliance of Mining Facilities to NAEIS Reporting

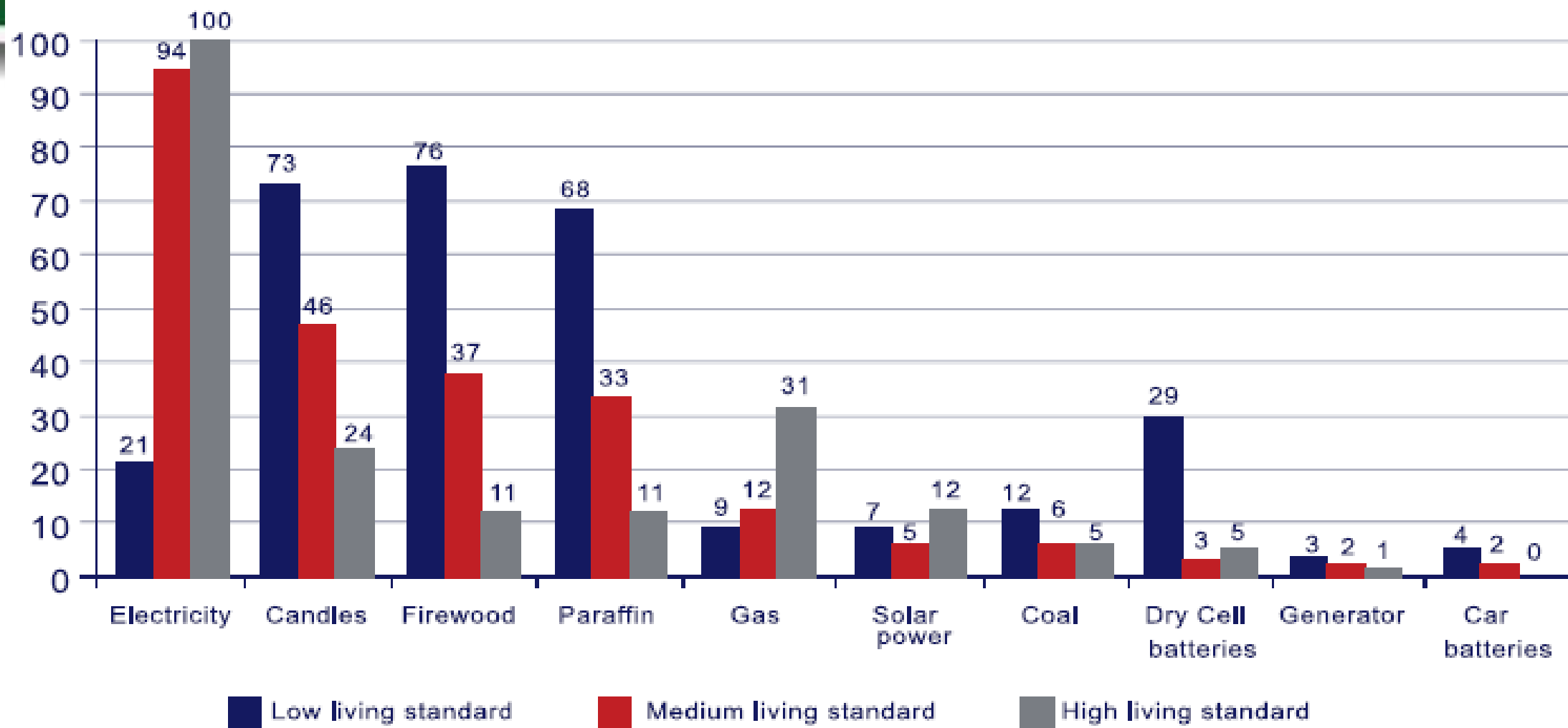




# Managing Mining Activities

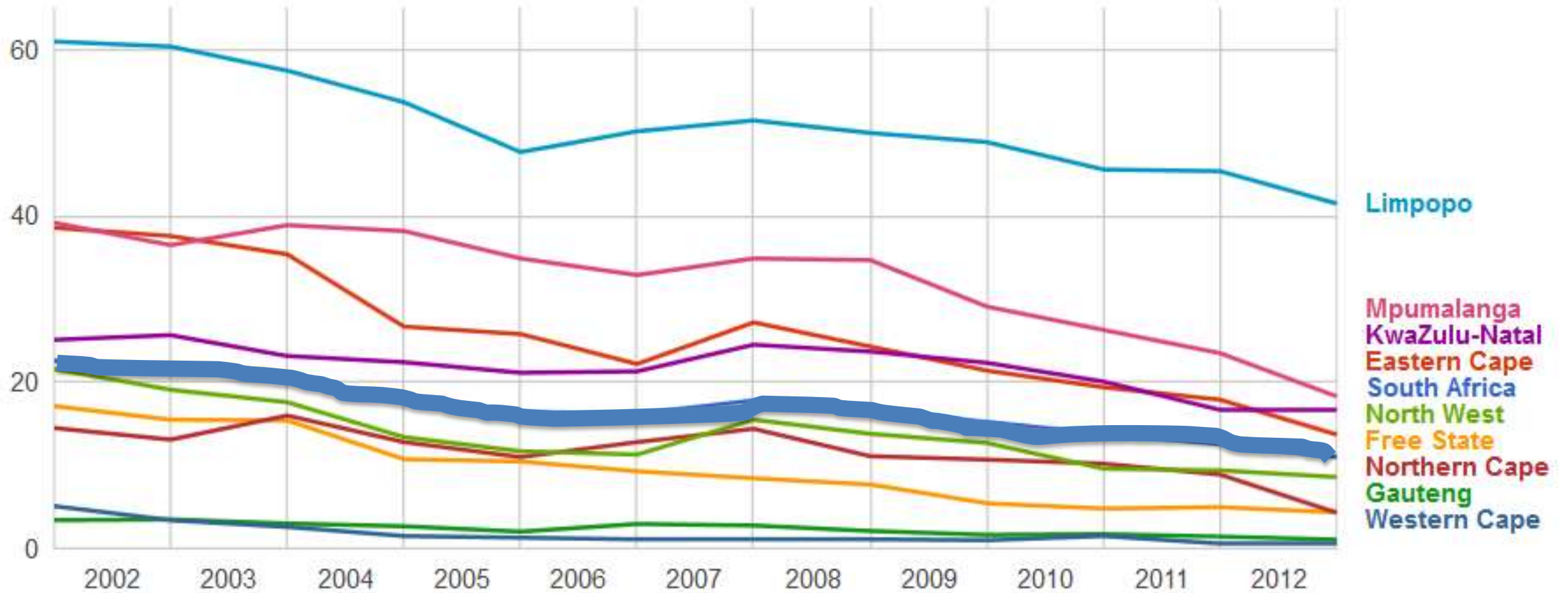
- Even though only 11% of mine reported to NAEIS, the contribution of PM10 and TSP is significant
- Are the dust regulations sufficient in managing nuisance dust and PM10?
- How do we work with DMR to ensure effective environmental compliance?

# ential I Use



- 2012 National use of a mix of energy sources
- Choice also depends on household income, connection to electricity

# Residential Fuel Use Trends

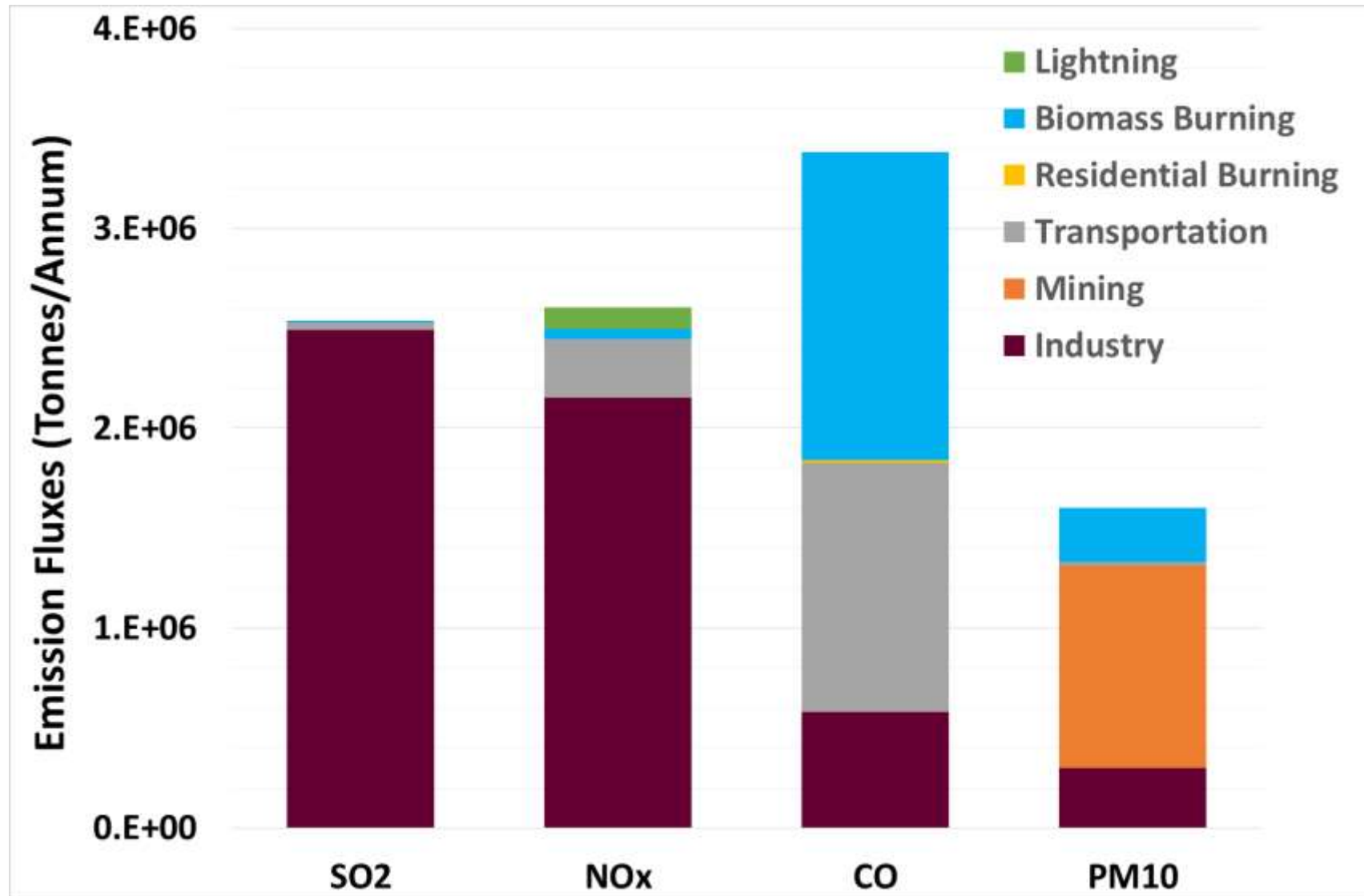


# **Other Drivers – State of Air 2005-2016**

**These are the sectors also included in the State of Air Report 2005-2016**

- Waste Management
- Biogenic Emissions
- Lightning Emissions

# National Emission Profile (Draft)



# Concluding Remarks

- Overview on SA air pollution drivers
- Nationally four sectors are driving air emissions - Industrial sources, mining activities, transportation, biomass burning
- **Command and Control mechanism for managing most of the industrial sources (including Section 23 sources) – 2020 MES**
- How do we use the AQA to manage the remaining major sources?
  - **Transport Policy – Vehicle Emission Strategy?**
  - Biomass Burning Management initiatives?
  - Mining (including dumps) Emissions Reduction initiatives?
  - Integrated Resource Plan, NDP?
- National Framework??



**Thank You!**

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