Canadian Fuels ASSOCIATION | ASSOCIATION canadienne des carburants

The new CPPI.

*We'll take you there*

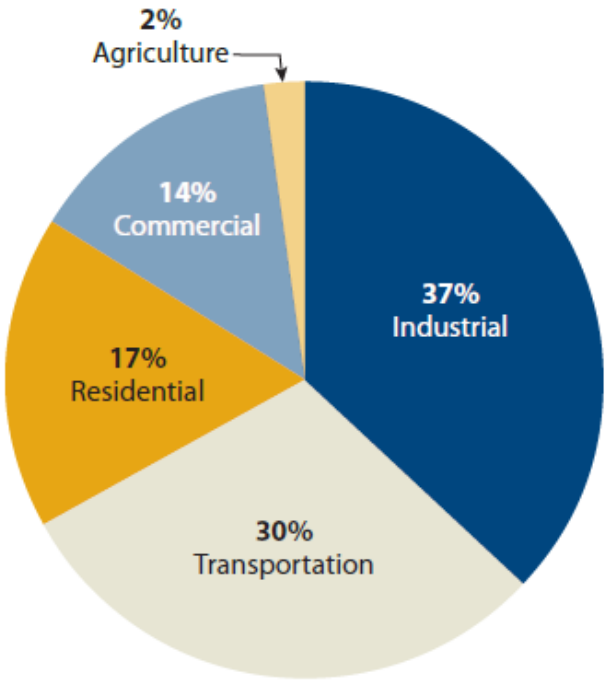
# Clean Air Strategic Alliance

## Non-point Source - Transportation Fuels Perspective

**Gilles Morel**
**Director - Fuels**
**22-Oct 2013**

# Transportation Fuels Underpin our Economy

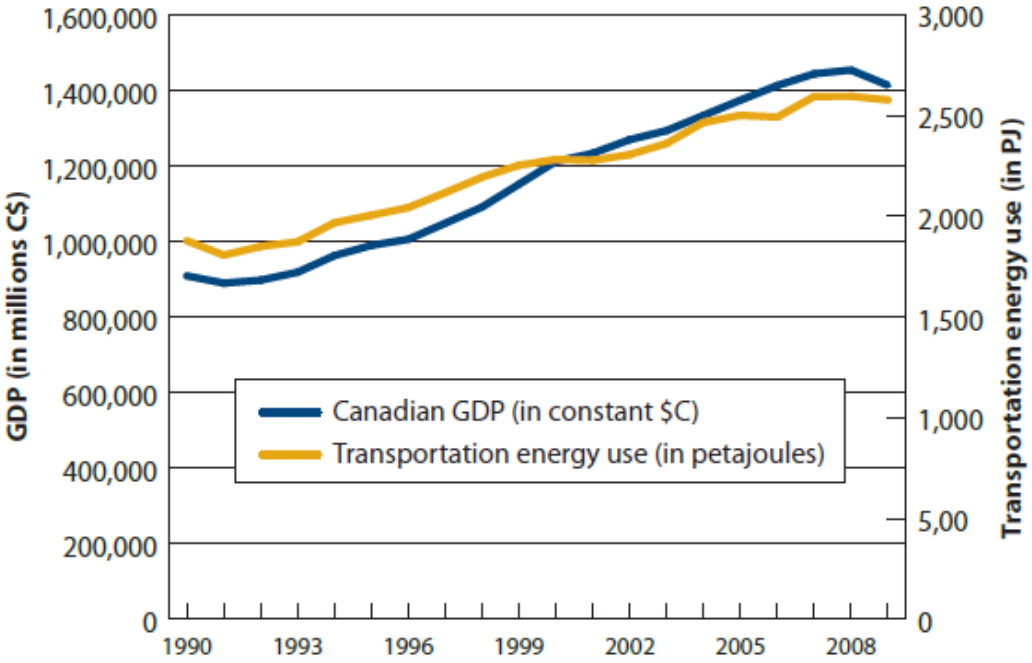
**Energy use in economic sectors, 2009**




*Thirty percent of the energy Canadians use powers transportation.*

Source: Natural Resources Canada

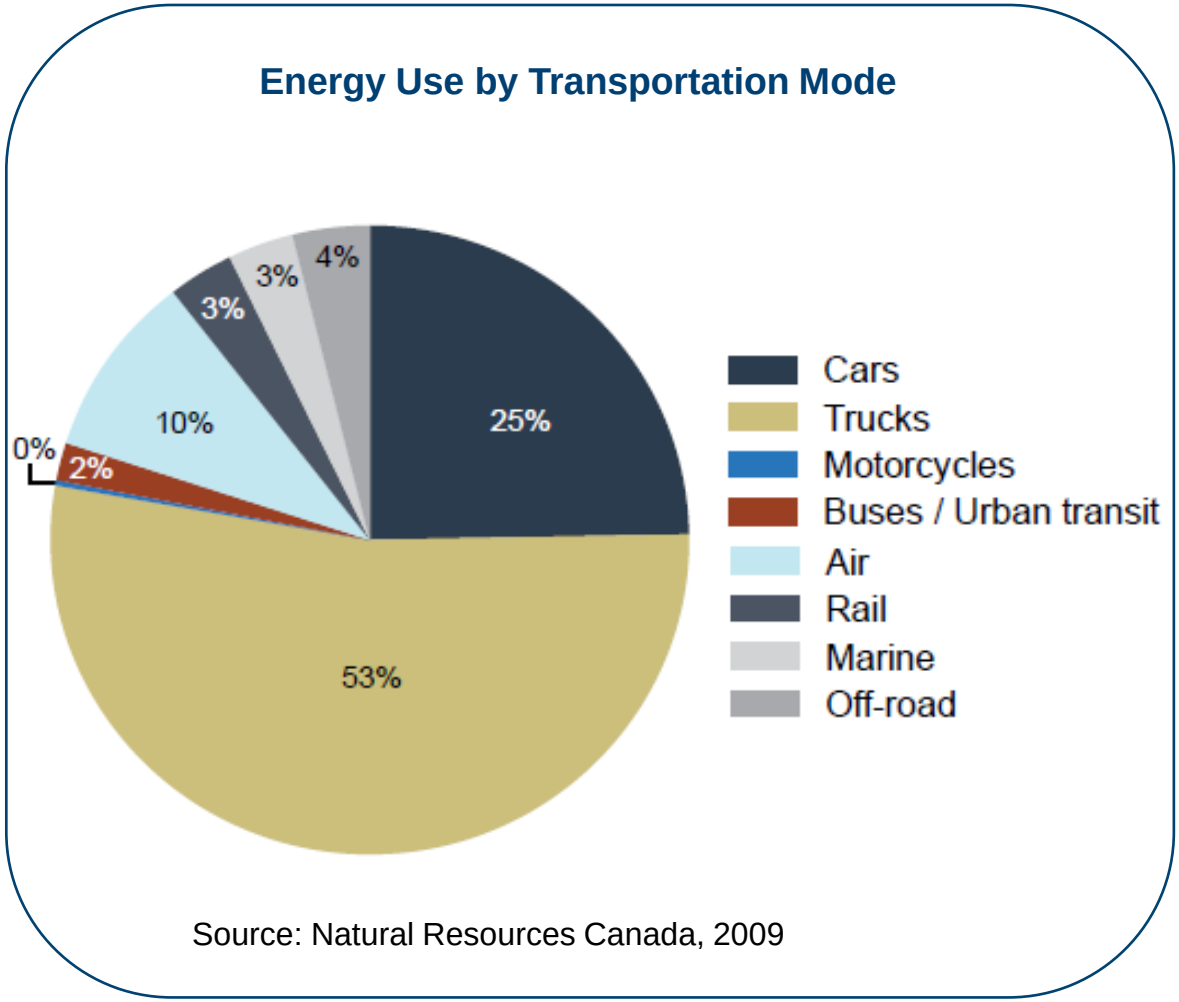
**Canadian transportation energy use and GDP**




*As Canada's economy grows, so does the demand for transportation energy.*

Source: Natural Resources Canada, The World Bank

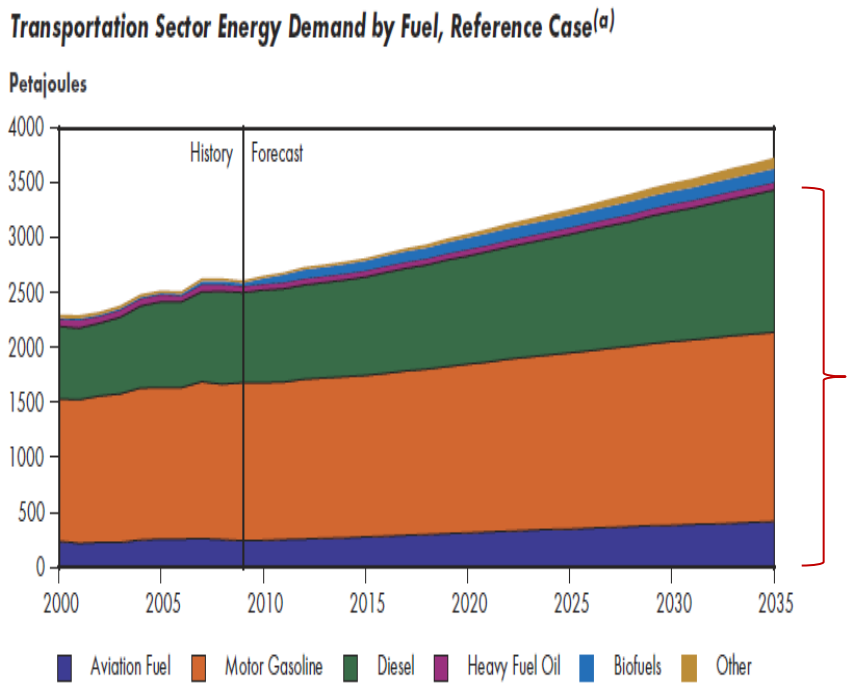
# Transportation Fuels Underpin Mobility




Source: Natural Resources Canada, 2009

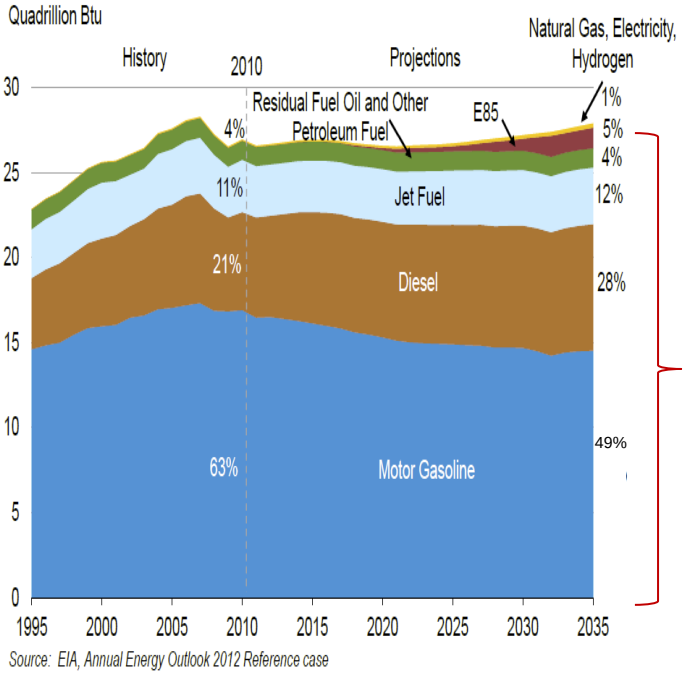
# Perspective on the Future of Petroleum Fuels

## For the Foreseeable Future, Transport Fuel Demand Met Predominantly by Oil




**In 2035, 92 percent of total Canadian transportation will run on liquid petroleum-based fuels.**

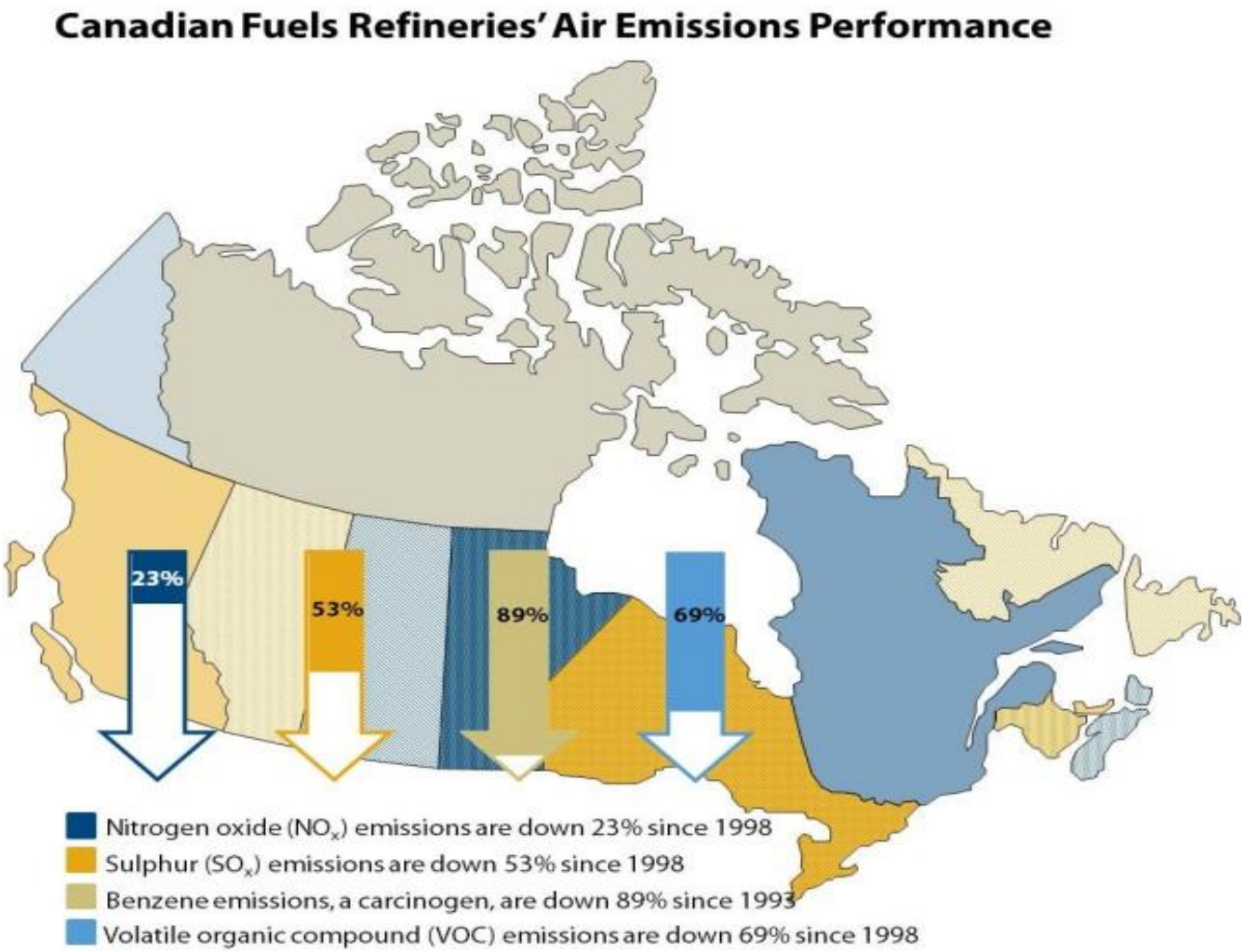
National Energy Board: Canada's Energy Future: Projections to 2035



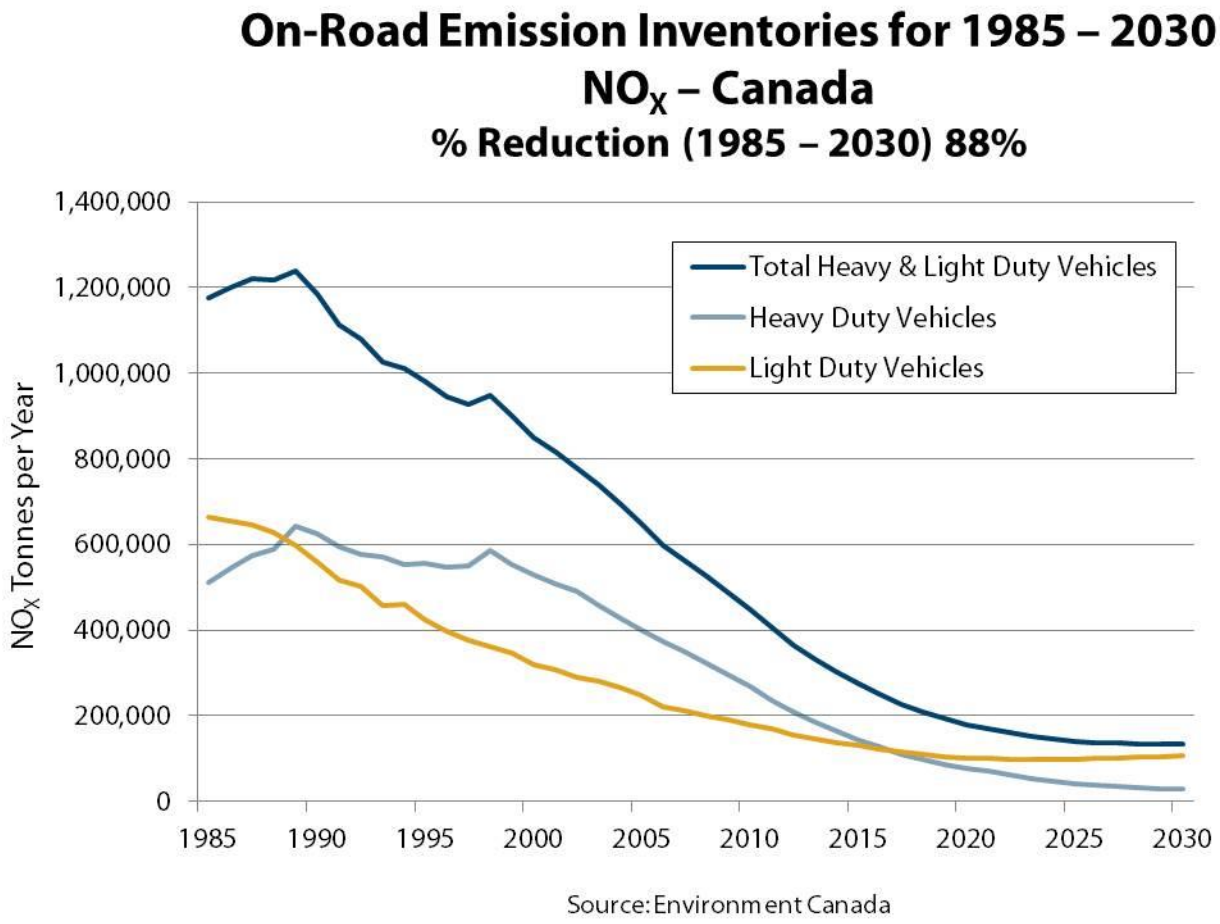

**In 2035, 93 percent of total US transportation will run on liquid petroleum-based fuels.**

US Energy Information Administration: Annual Energy outlook 2012

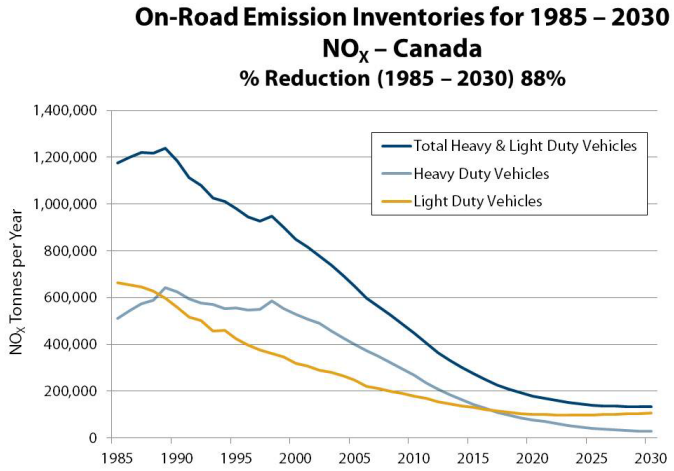
# Continuous Improvement to the Environment…

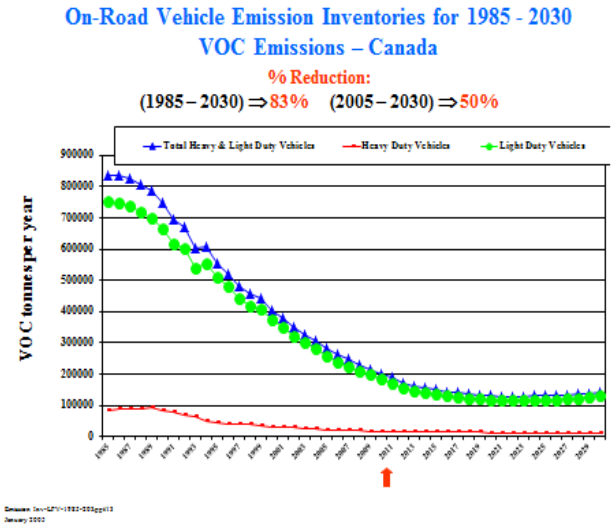


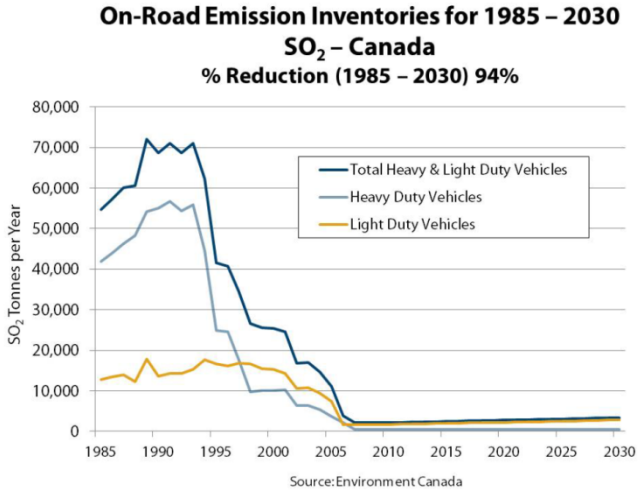
# Impressive Environmental Performance

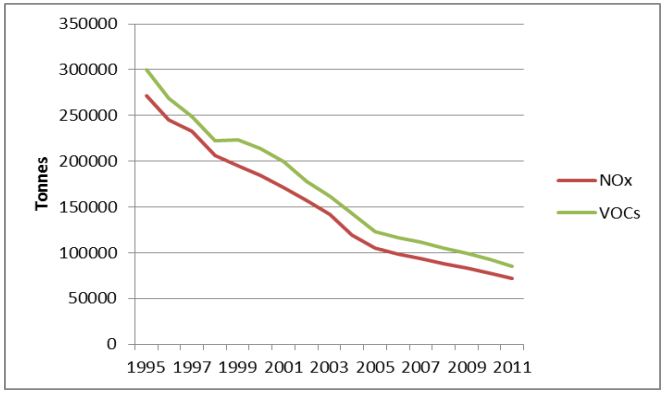


# Tier 2 vehicle-fuel environmental benefits expected to continue, as fleet renewal continues



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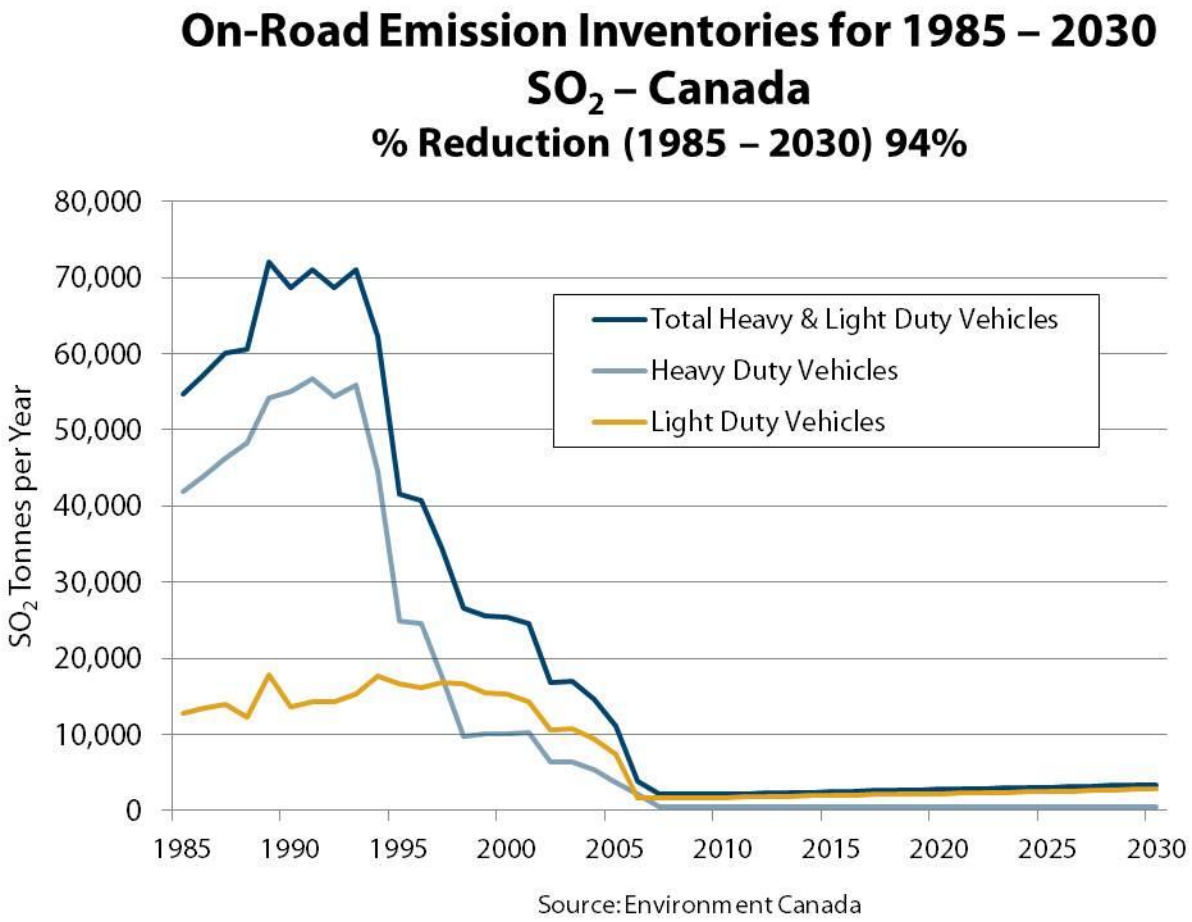
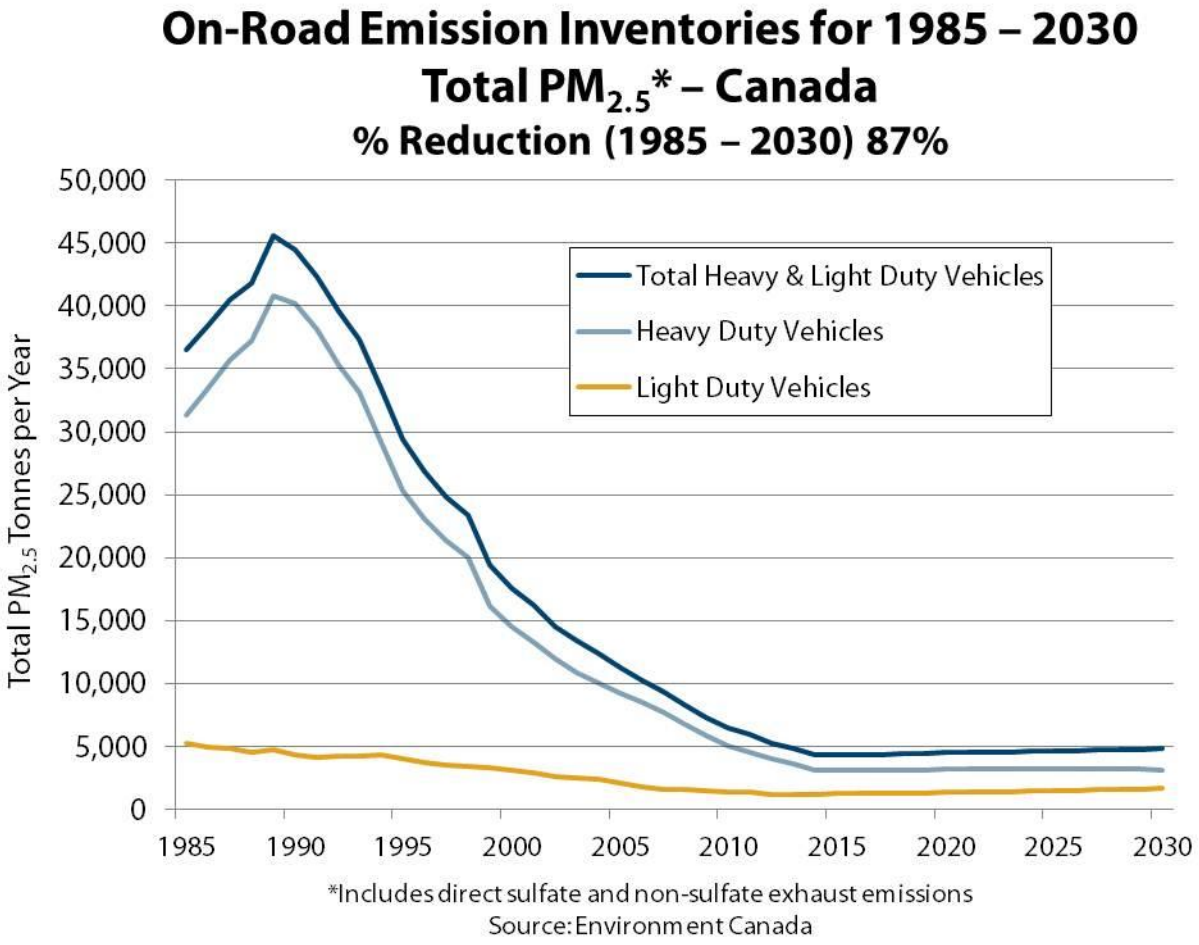


# Impressive Environmental Performance



# Summary

**Last decade brought significant improvements of Air Quality in Canada via a series of targeted actions**

- Systemic approach to treat Mobile equipment/vehicle and fuel as a system
- Progress and improvements to continue as fleet/equipment turnovers

**New announced measures will lead to further improvements**

- ECA – >90% reduction in NOx, SOx and PM from marine sector
- LD and HD vehicle GHG regulations will further reduce CAC footprint
- Lower Sulphur gasoline (Tier 3) announced June 7, 2013

**Further action if needed to be carefully evaluated**:

- Policy choices should be:
  - based on clearly stated policy objectives
  - supported by objective, science-based data
  - validated by rigorous economic, environmental and social analyses that demonstrate net benefits to Canadians
- Policy agenda should be
  - Prioritized and appropriately paced
  - Harmonized with competing jurisdictions
- Policy instruments should be
  - Outcome driven – provide industry with flexibility to develop and implement the most cost-effective options to achieve compliance
  - Supported by viable compliance pathways

# Next steps – future considerations

- Much progress has been accomplished based on past measures and assessments.
- Newer measures impact not yet well integrated into future projections/impact
- Consider formation of multi-stakeholders group (EPWG), in light of new models (MOVES), known measures (ECA, Tier 2 and 3, Fuel Economy/GHG regulations) to advise policy makers
- Promote coordinated (Fed.-Prov) approach to avoid duplication and overlap of measures where possible

# Additional Back-up and data

# Canadian Refineries are among the most efficient in the the world…

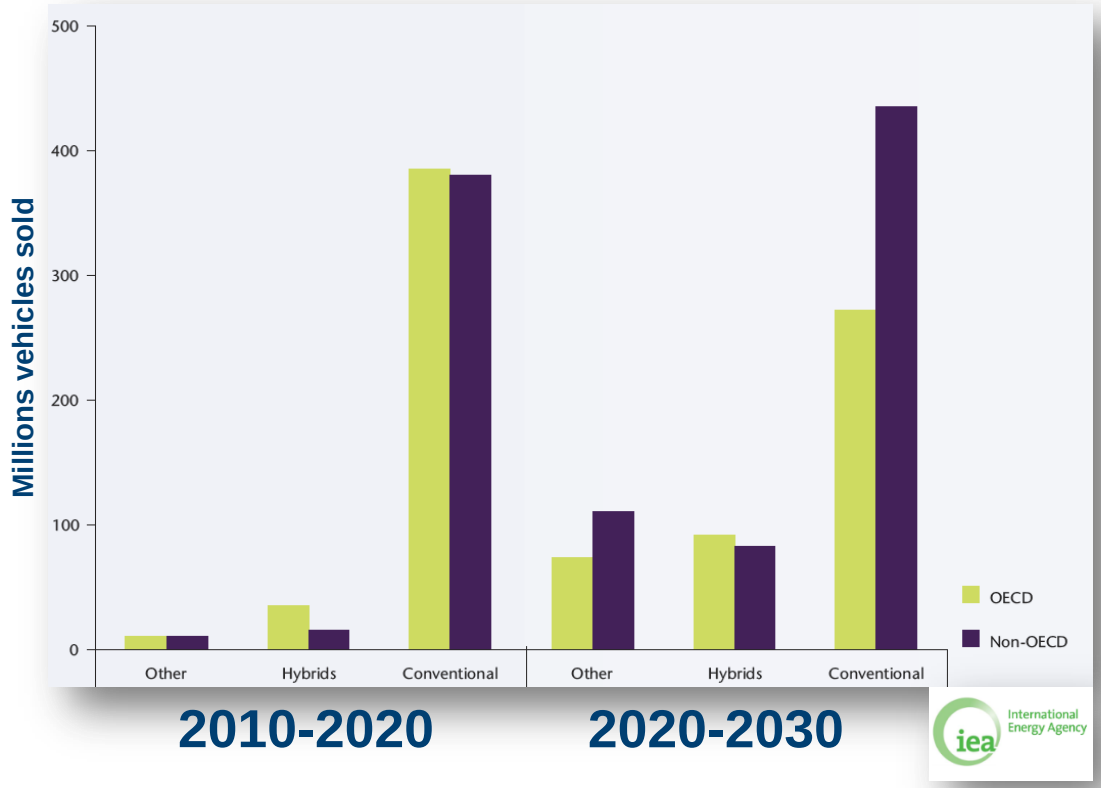
## Summary

### $CO_2e$ Emissions Performance by Peer Group in 2006–2010

| | kg $CO_2e$/CWB | | | |
|---|---|---|---|---|
| | 10% | 50% | 90% | N |
| **2006** | | | | |
| Canada Ex Upgraders | 3.8 | 4.5 | 5.6 | 13 |
| OECD | 4.1 | 4.9 | 6.0 | 236 |
| US | 4.2 | 4.9 | 5.7 | 88 |
| EU-27 (+Norway) | 4.1 | 4.9 | 5.9 | 91 |
| California | 4.2 | 4.6 | 5.4 | 12 |
| **2008** | | | | |
| Canada Ex Upgraders | 4.0 | 4.6 | 5.7 | 11 |
| OECD | 4.2 | 4.9 | 5.9 | 235 |
| US | 4.2 | 4.9 | 5.7 | 87 |
| EU-27 (+Norway) | 4.2 | 4.9 | 5.8 | 84 |
| California | 4.1 | 4.6 | 5.2 | 13 |
| **2010** | | | | |
| Canada Ex Upgraders | 3.9 | 4.4 | 5.6 | 12 |
| OECD | 4.1 | 4.7 | 5.9 | 230 |
| US | 4.2 | 4.8 | 5.7 | 86 |
| EU-27 (+Norway) | 4.1 | 4.7 | 5.7 | 85 |
| California | 4.2 | 4.9 | 5.3 | 13 |

# The Challenge to the Internal Combustion Engine (ICE)

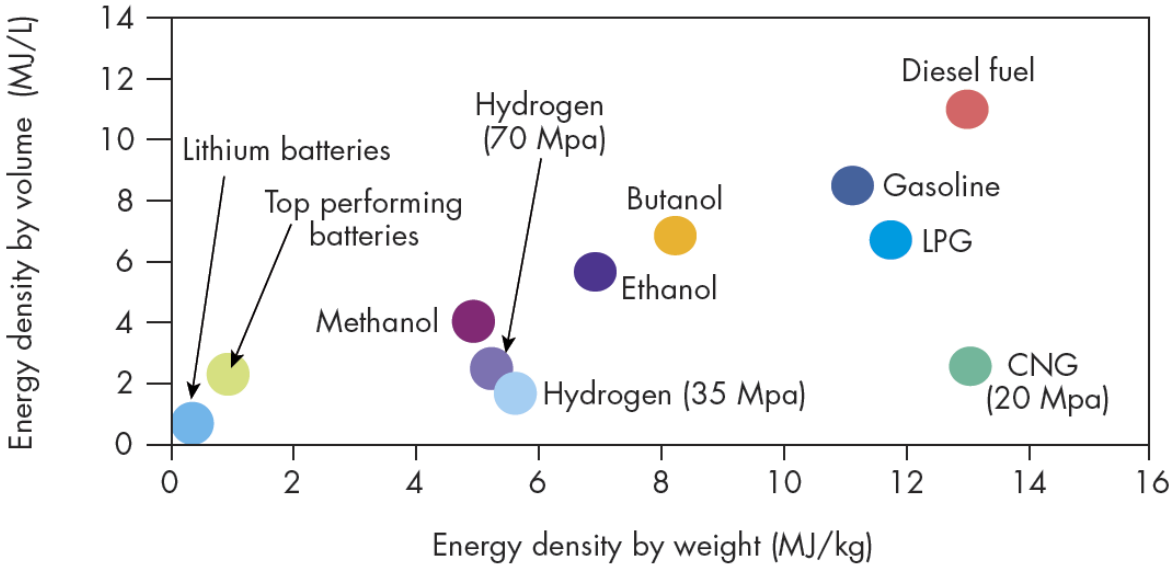
## Importance of ICE Engines in Future Sales




- Improvements in technology as well as costs/benefits will continue to make the petroleum-based ICE attractive for many years.
- Improvements could/will double fuel efficiency compare to current fleet making ICE attractive for many years.

# Energy density matters

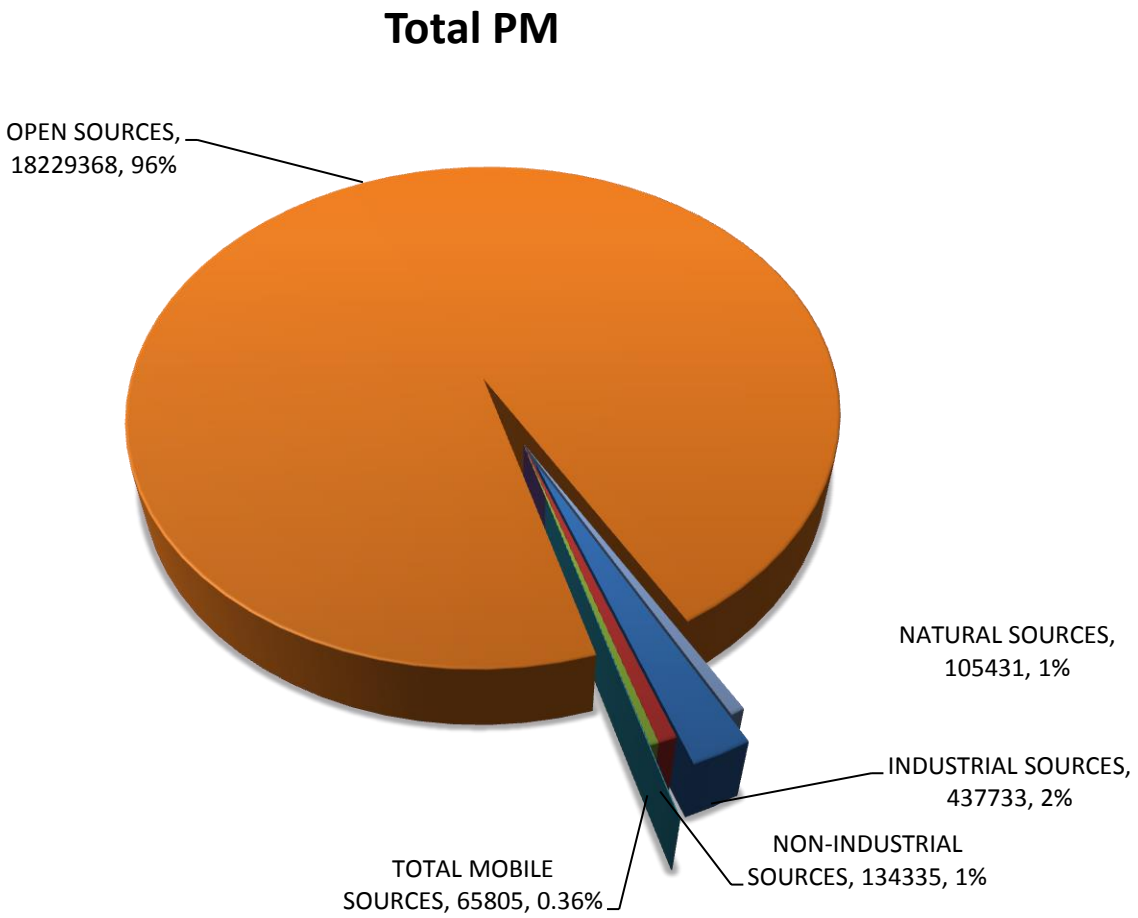
**Figure 2.13 ▶ Energy density of batteries and liquid fuels**



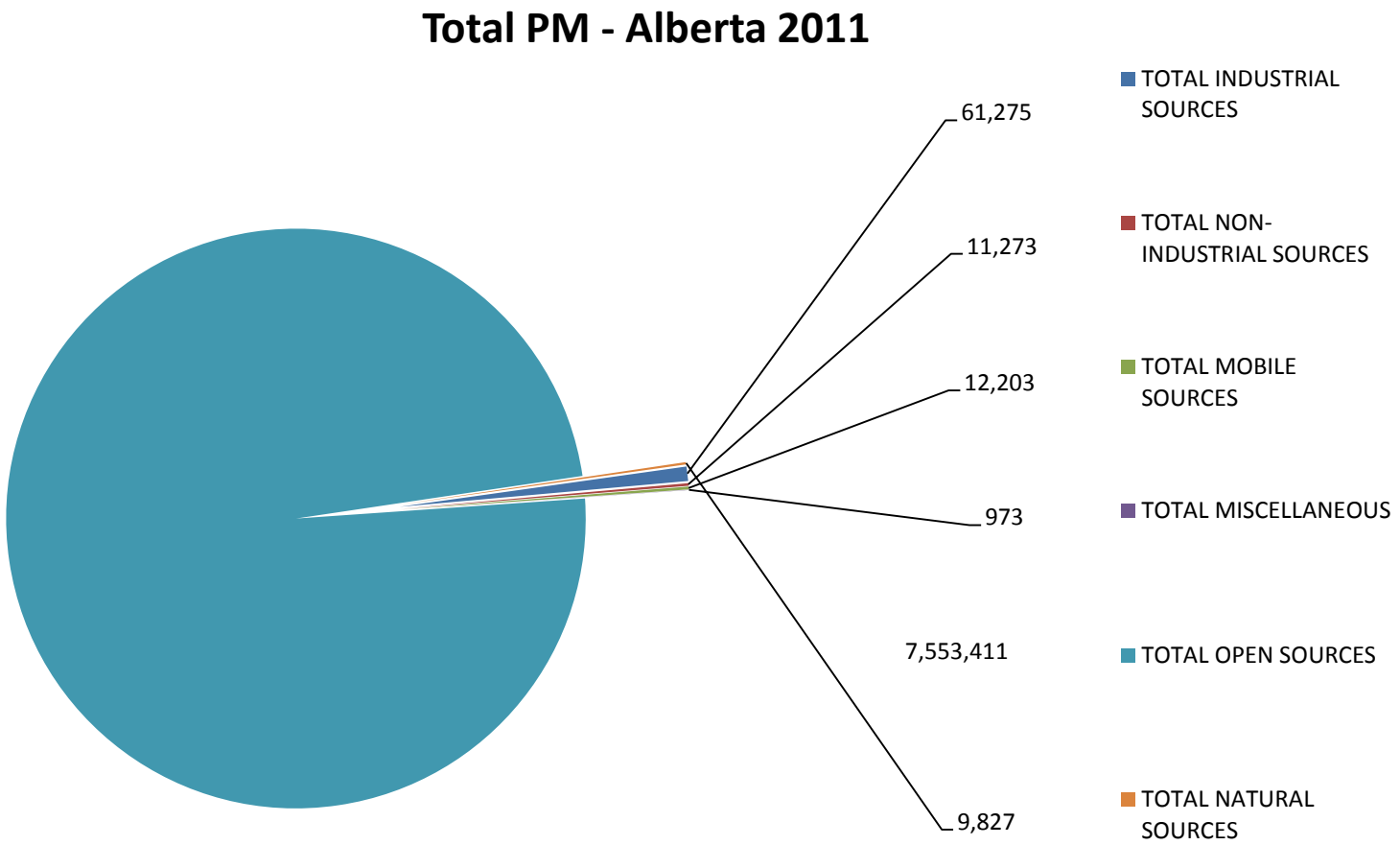

*Sources:* Various, including IEA data on the relationship between volumetric and mass density of batteries and IEA assumptions on the efficiencies of engines (25% to 30% for internal combustion engines), fuel cell systems (75%) and electric motors (90% to 95%).

- **Energy density by weight and volume are important technological challenges for sources of energy competing to replace petroleum fuels.**

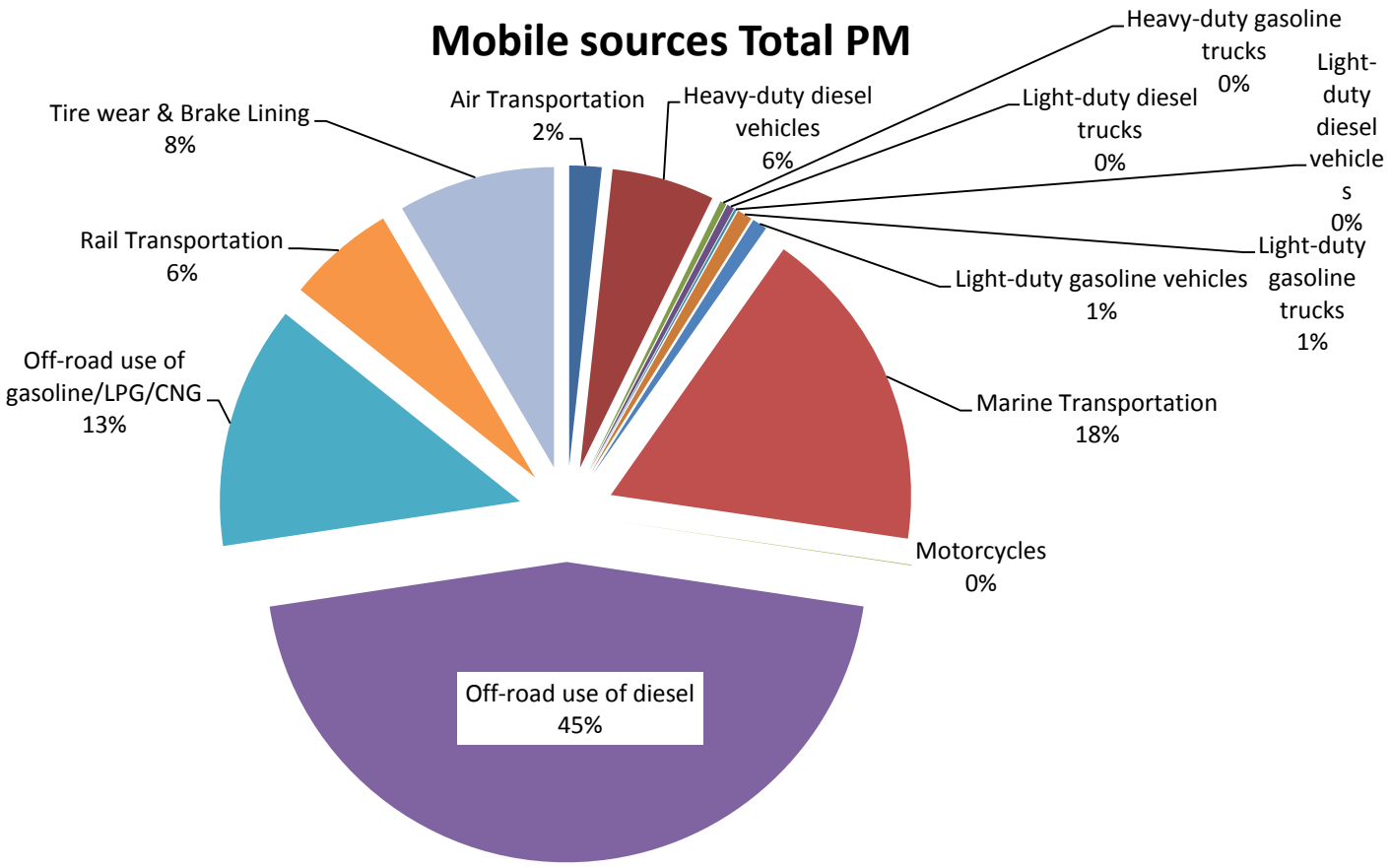
# Open sources dominate PM



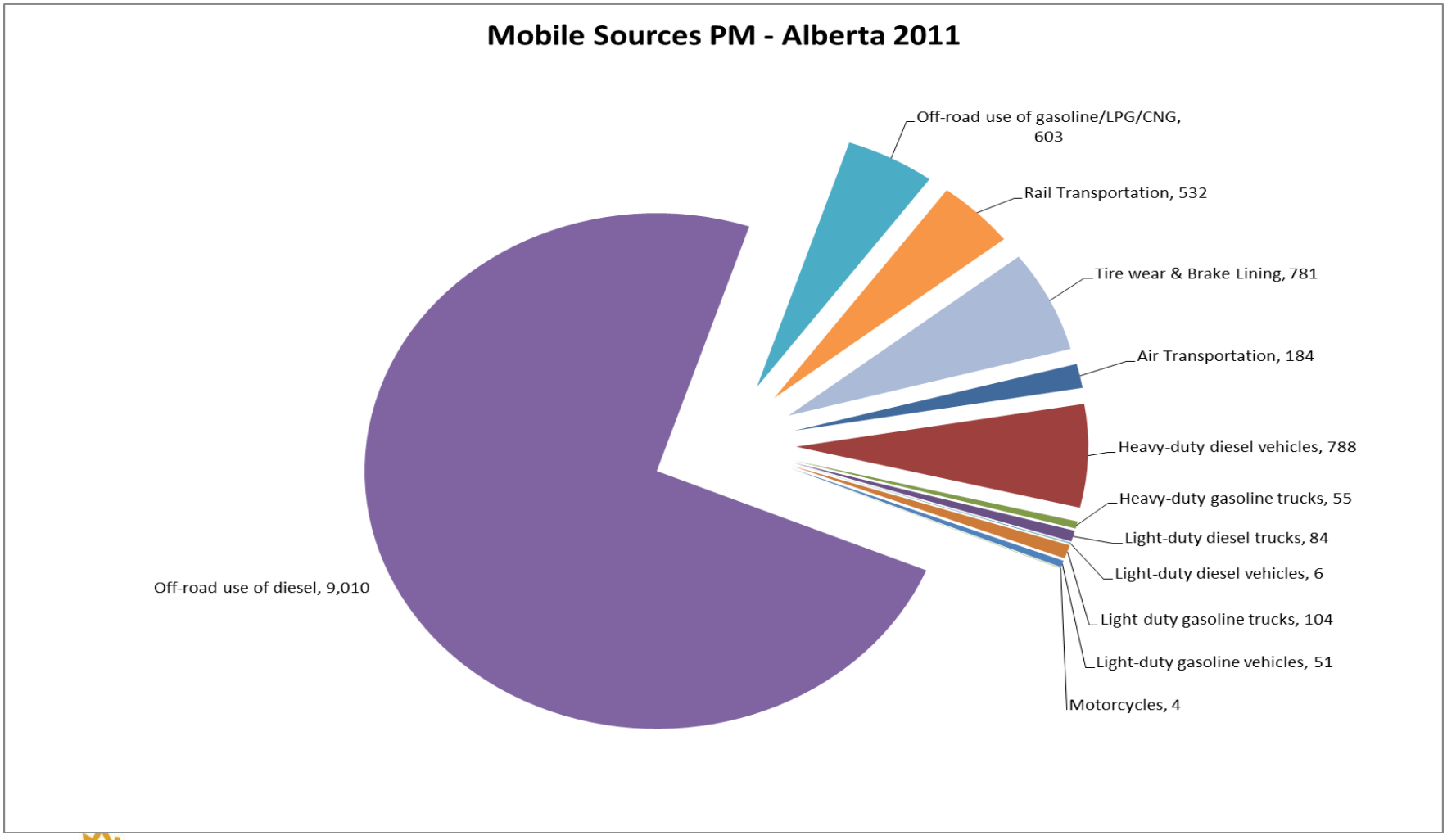
# Open sources dominate PM



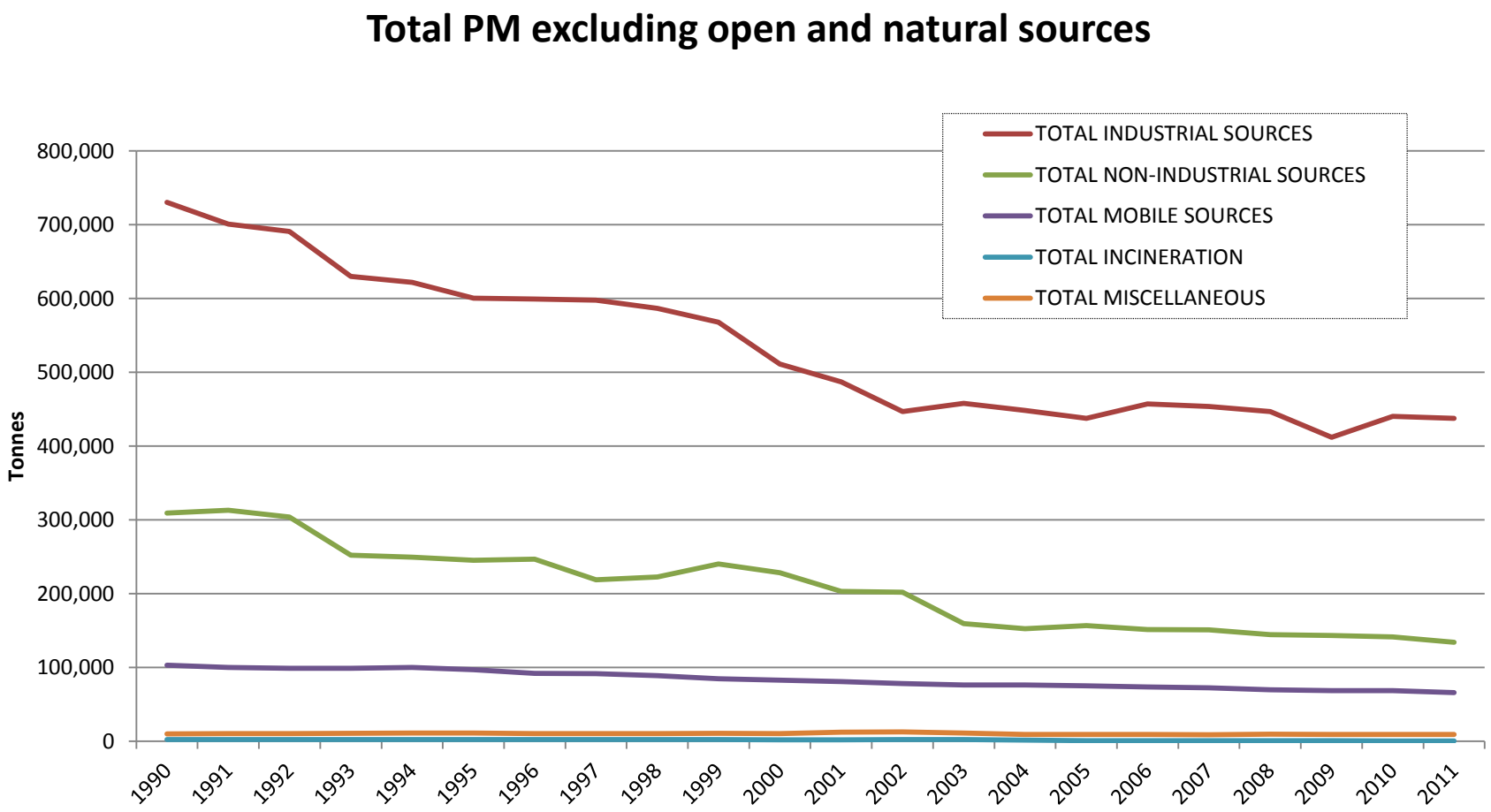
# PM sources


Mobile sources Total PM
Heavy-duty gasoline trucks 0%
Light-duty diesel trucks 0%
Light-duty diesel vehicles 0%
Light-duty gasoline trucks 1%
Light-duty gasoline vehicles 1%
Heavy-duty diesel vehicles 6%
Air Transportation 2%
Tire wear & Brake Lining 8%
Rail Transportation 6%
Off-road use of gasoline/LPG/CNG 13%
Marine Transportation 18%
Motorcycles 0%
Off-road use of diesel 45%

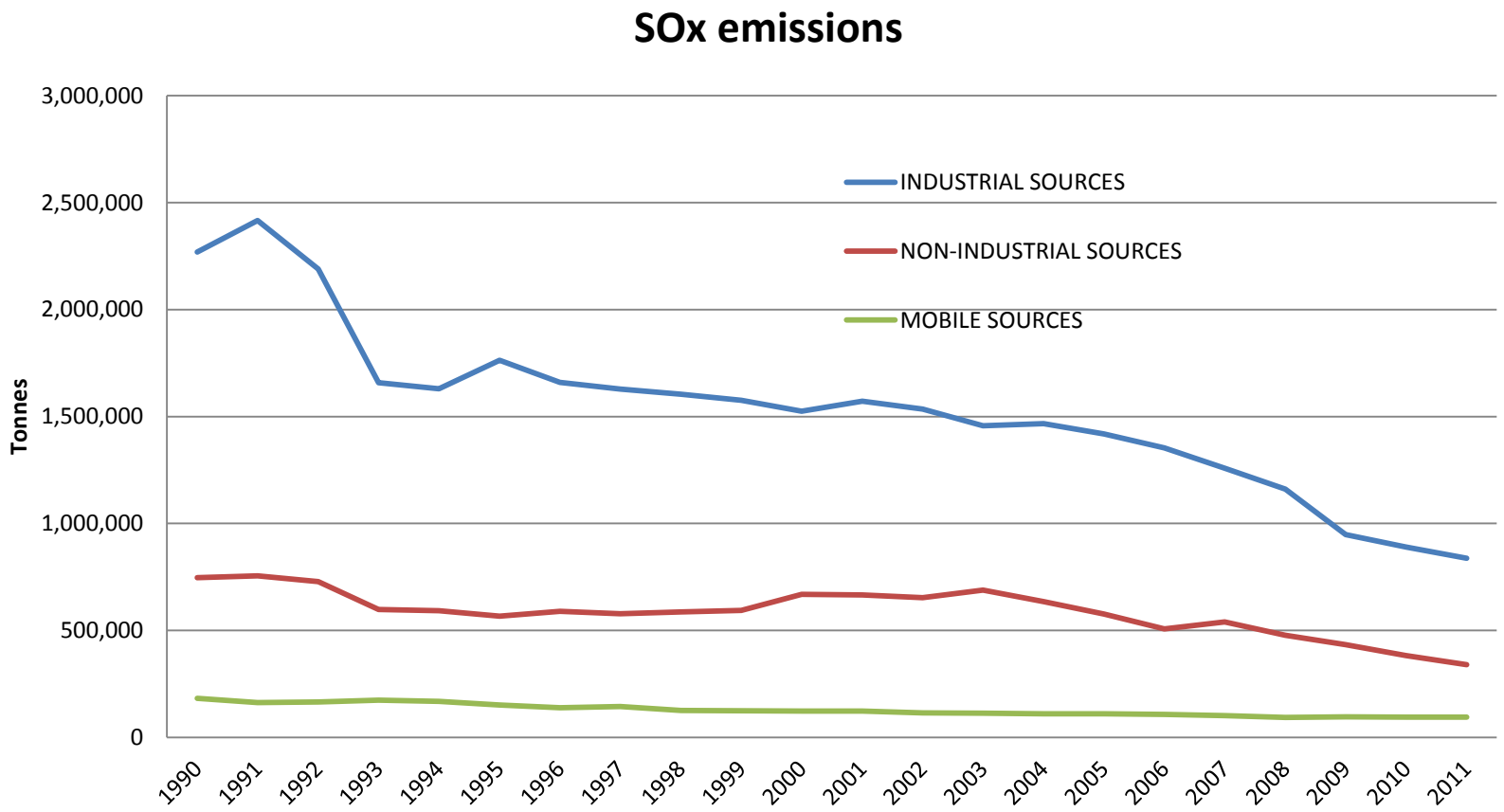
# Mobile PM sources - Tonnes



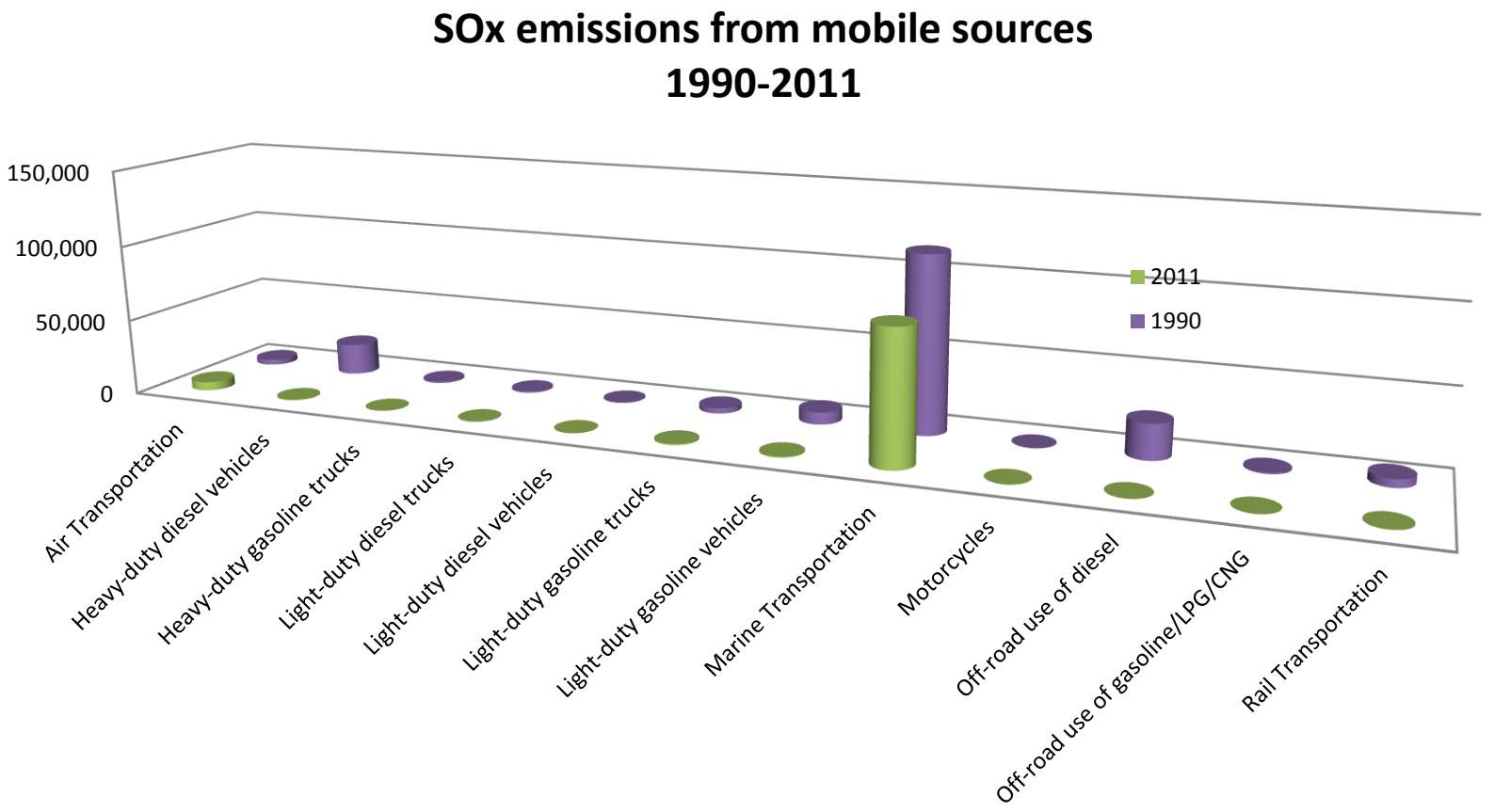
# PM reductions from Mobile sources



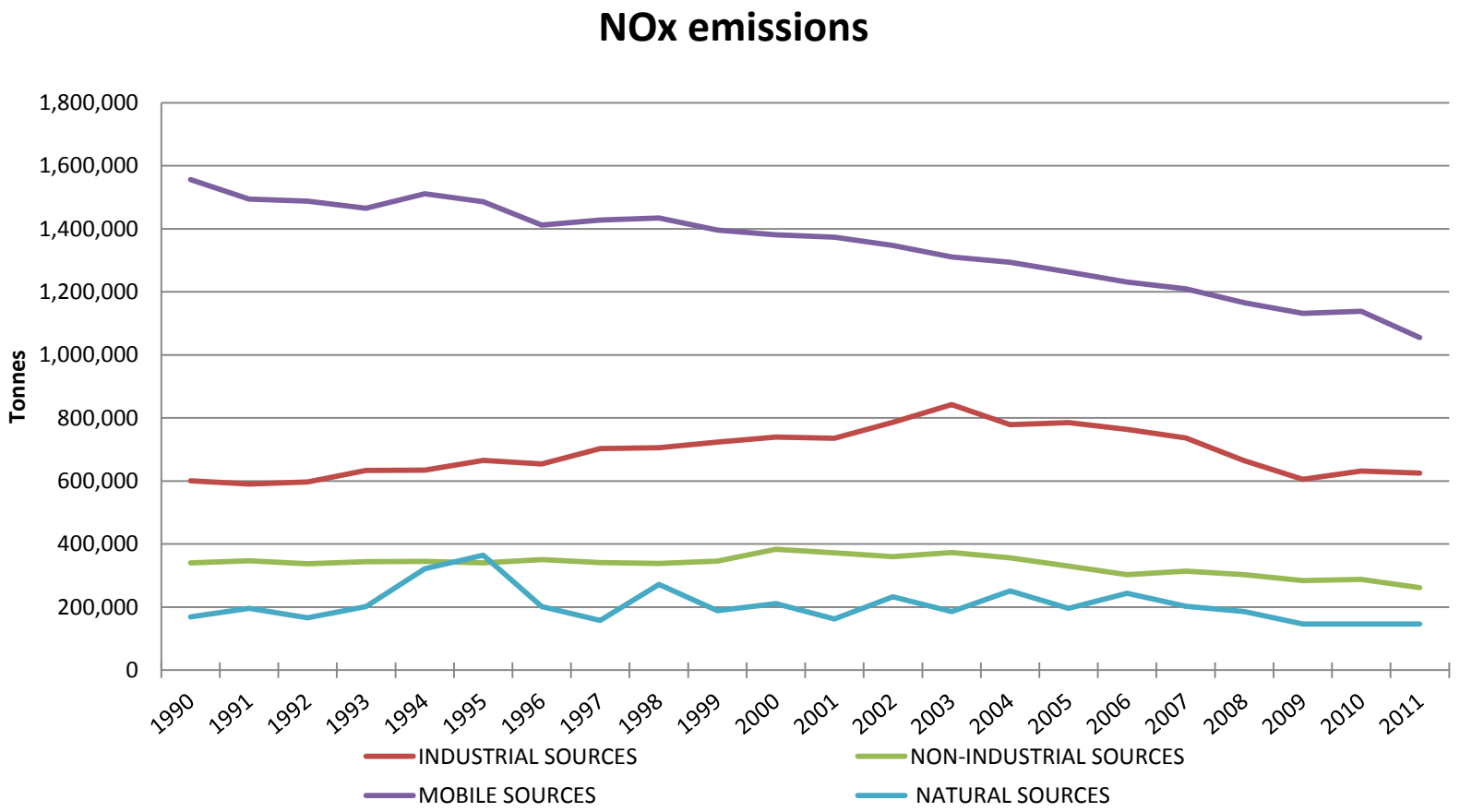
# Mobile not major source of Sox emissions



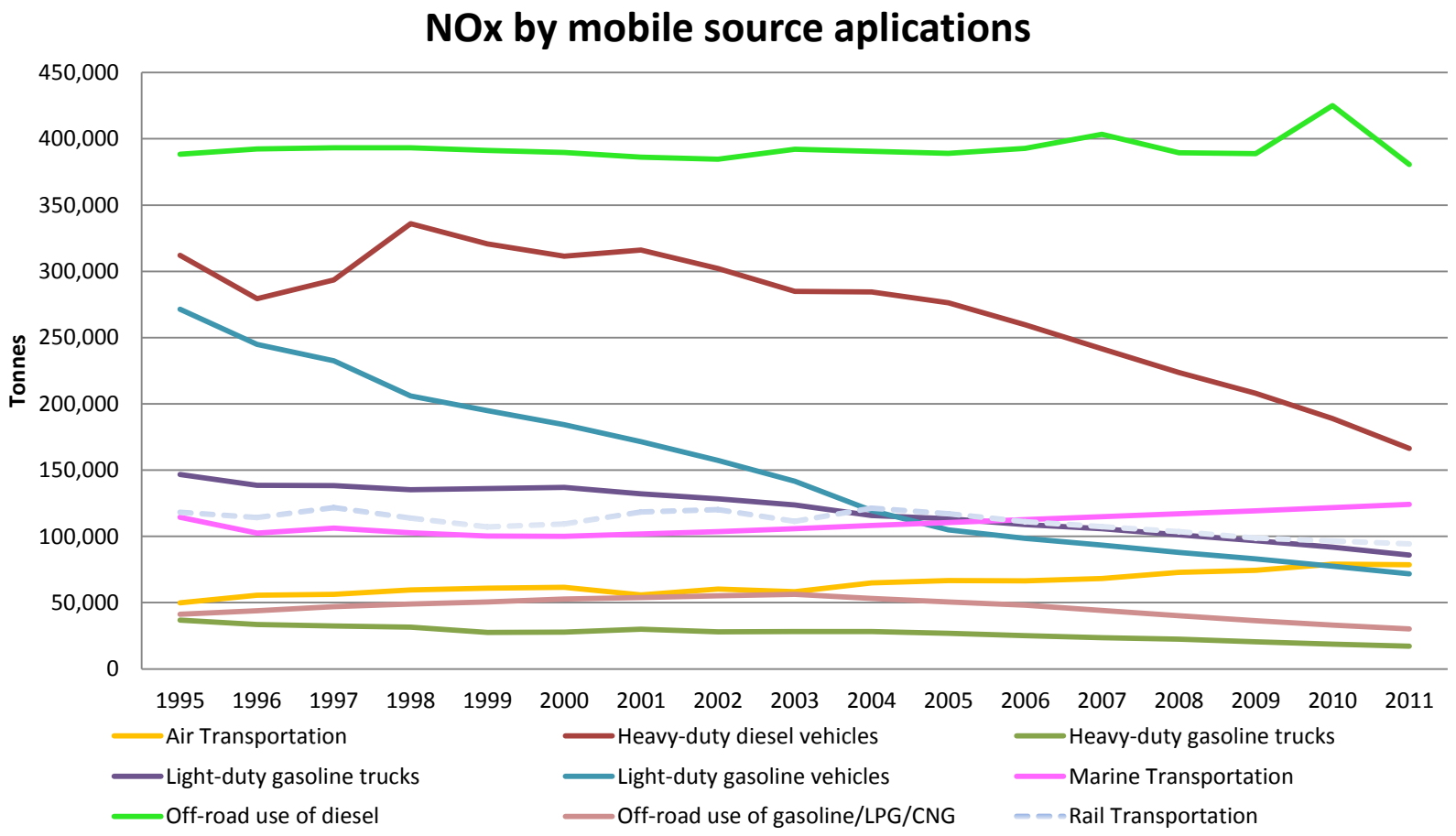
# Sox emissions reductions 1990-2011



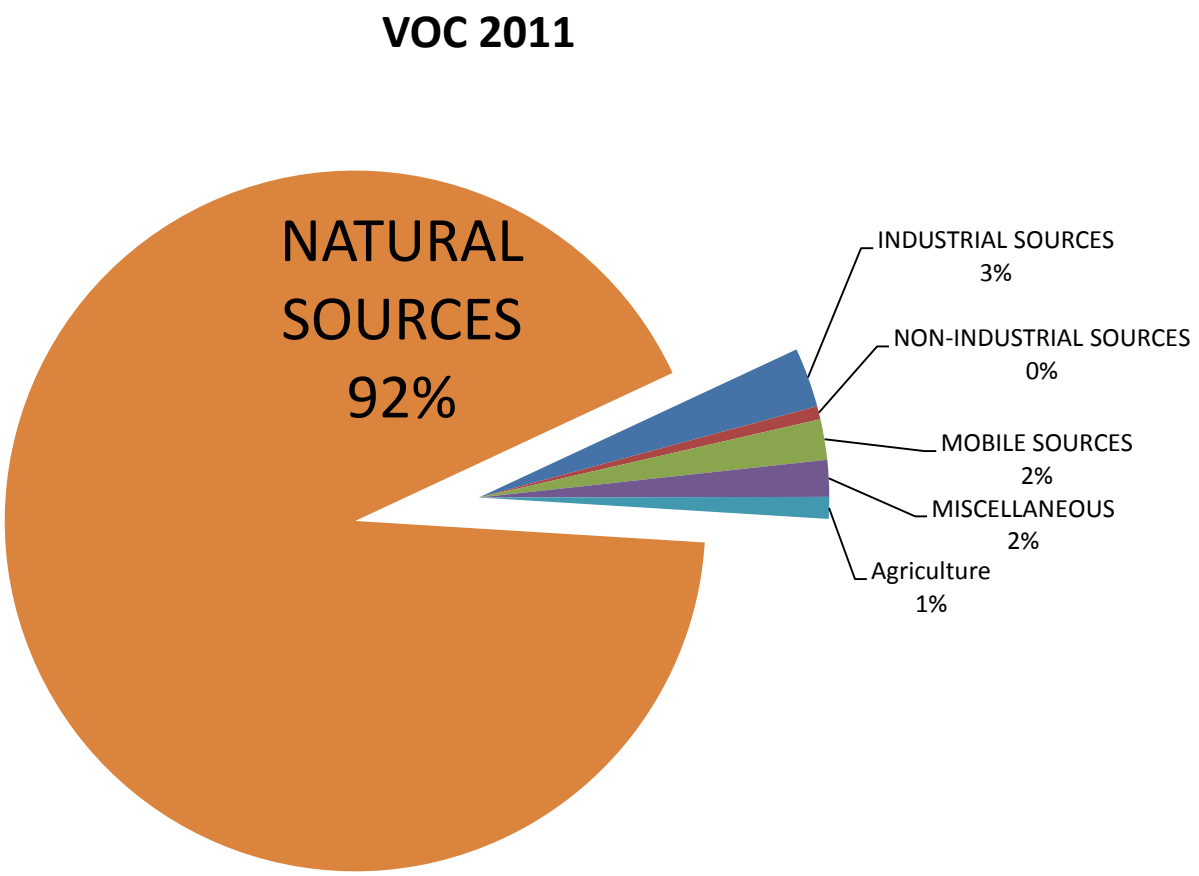
# NOx


NOx emissions
Tonnes
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
INDUSTRIAL SOURCES
NON-INDUSTRIAL SOURCES
MOBILE SOURCES
NATURAL SOURCES

# NOx


NOx by mobile source aplications
Tonnes
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Air Transportation
Heavy-duty diesel vehicles
Heavy-duty gasoline trucks
Light-duty gasoline trucks
Light-duty gasoline vehicles
Marine Transportation
Off-road use of diesel
Off-road use of gasoline/LPG/CNG
Rail Transportation

# VOC


VOC 2011
NATURAL SOURCES 92%
INDUSTRIAL SOURCES 3%
NON-INDUSTRIAL SOURCES 0%
MOBILE SOURCES 2%
MISCELLANEOUS 2%
Agriculture 1%

# Mobile sources VOC reductions