Centro Mario Molina

Research and Development

# Urban Transport in Santiago de Chile's Decontamination Plan

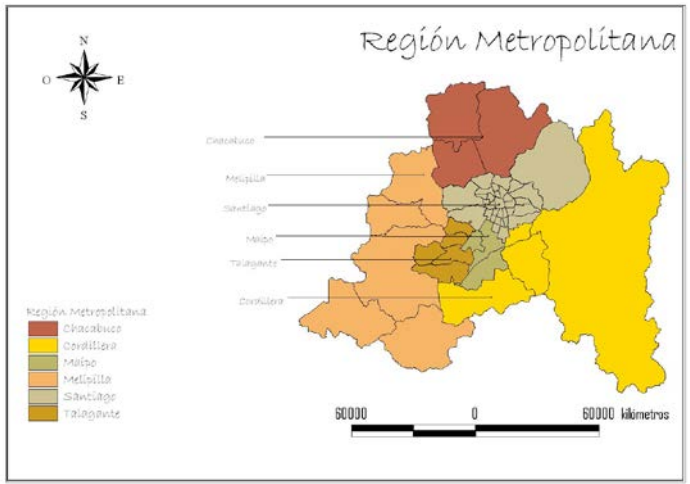
Marcela Castillo -Senior Researcher

June 8, 2018. London, United Kingdom

# Content

1. Characteristics of Chile/Metropolitan Area
2. Decontamination Plan for the Metropolitan Area, 1997
    - Results of the Plan
    - Main Policies carried out
3. The new Decontamination Plan, 2017
    - Main policies
4. What are we doing in real urban emission?
5. What next?

# Chile: Demographics and Regional Context




Metropolitan area,
7 million people
15,400 km$^2$
6,500 urban buses (Santiago)
1,700,000 private cars

Chile,
17 million people
750,000 km$^2$

OECD member since 2010
Motorization rate 250veh/1000inh

CMM Research and Development

# Chile Health impacts of air pollution

- Four thousand annual deaths related to air pollution
  - 871,000 lost work days
  - 3,730,000 restricted activity days
- Between $670 – $1,900 million USD a year related to health expenditures and lost productivity

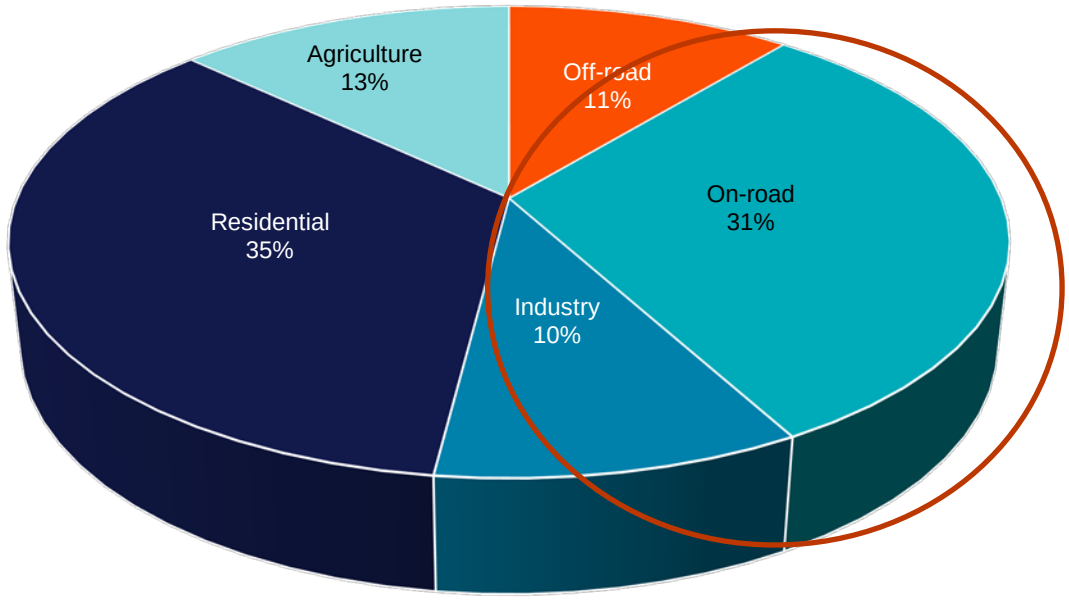
# Decontamination Plan for the Metropolitan Area of Santiago de Chile (1997)

In 1997, the Metropolitan Area of Santiago de Chile was declared a non-attainment Area for $PM_{10,}$ CO, $O_3$ (Standard annual averages exceeded)

Authorities developed a Decontamination Plan with the aim of complying with air qualities standards

# Decontamination Plan for the Metropolitan Area of Santiago de Chile (1997)

## Public policies was focused on $PM_{2,5}$




Contribution to $PM_{2,5}$ (2015)

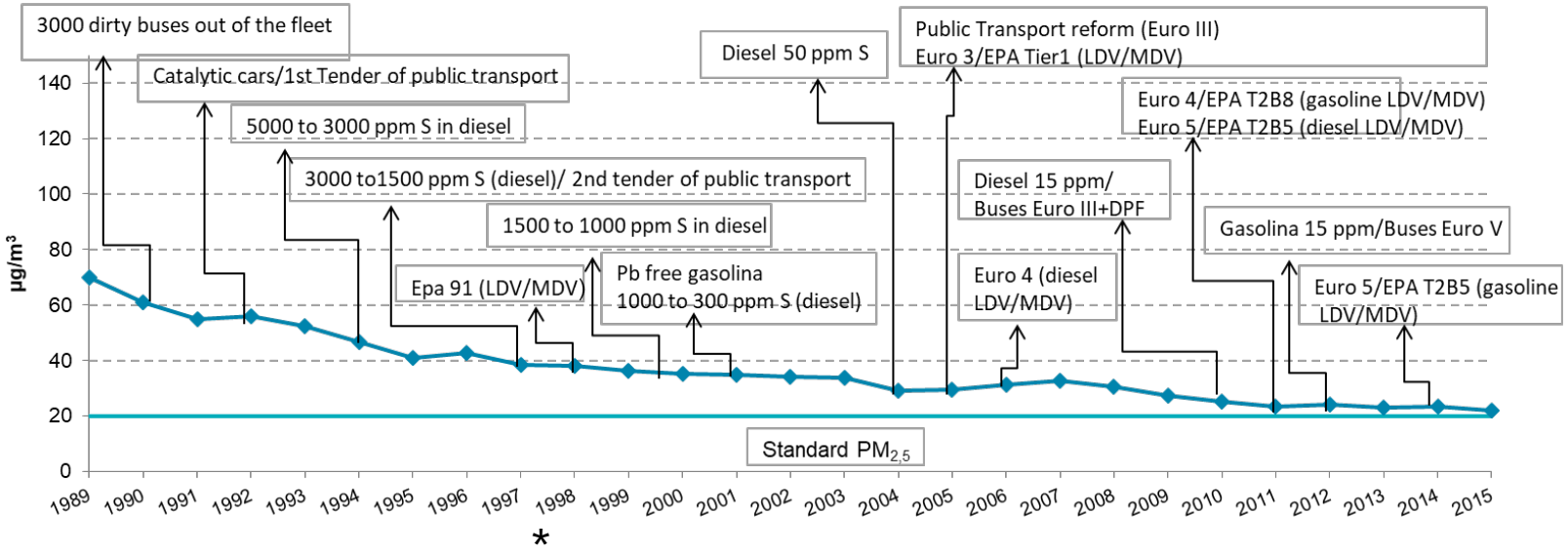
# Decontamination Plan for the Metropolitan Area of Santiago de Chile (1997)

Which public policies were implemented on urban transport?

- Fuel Quality improvements
- Improvement in emissions standards for LDV/MDV/HDV
- Emission standards for Public Transport
- Urban bus fleet renewal

## Results?

# Reduction in $PM_{2.5}$ concentrations between 1989 - 2016

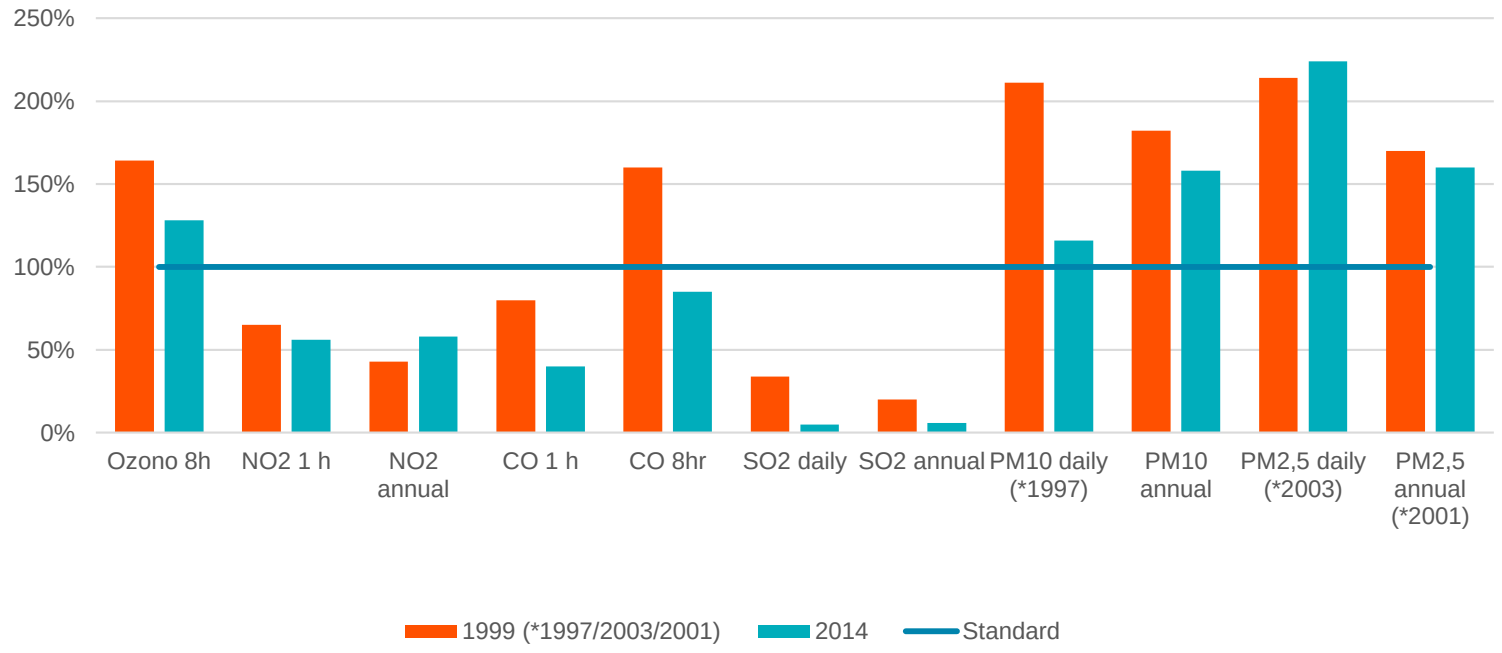



↓ 68% (1989-2015), 43% (1997-2015)

↑ x5 vehicle fleet (2000-2015)

≈ the $PM_{2.5}$ reduction has stabilized since 2010

# Evolution of standards compliance: standard exceeded (%)



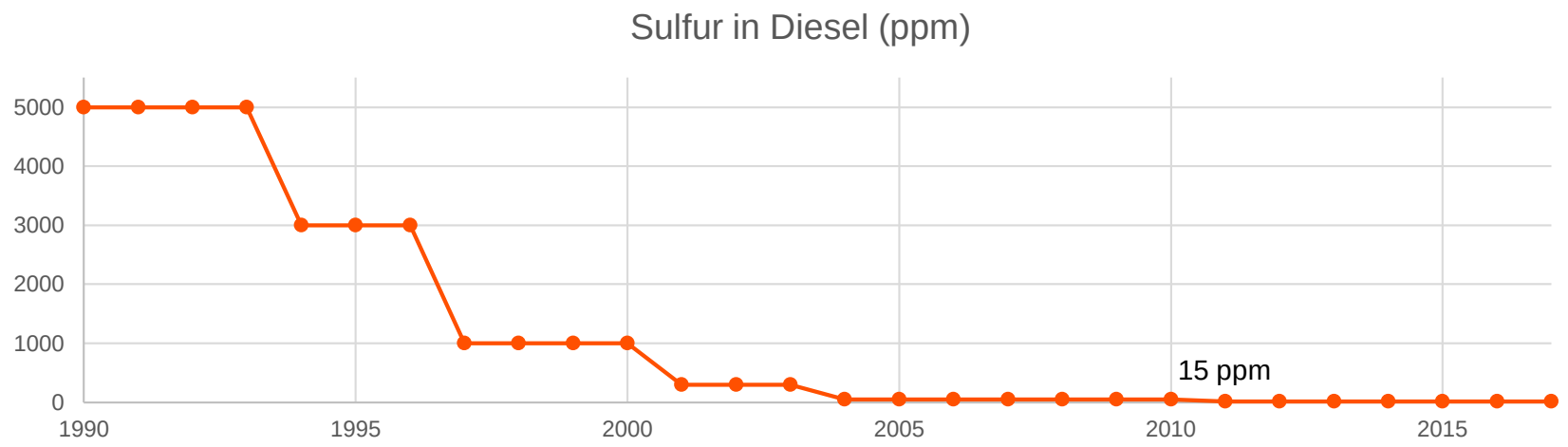

# Main Policies carried out 1997-2016

Euro4


EURO 5

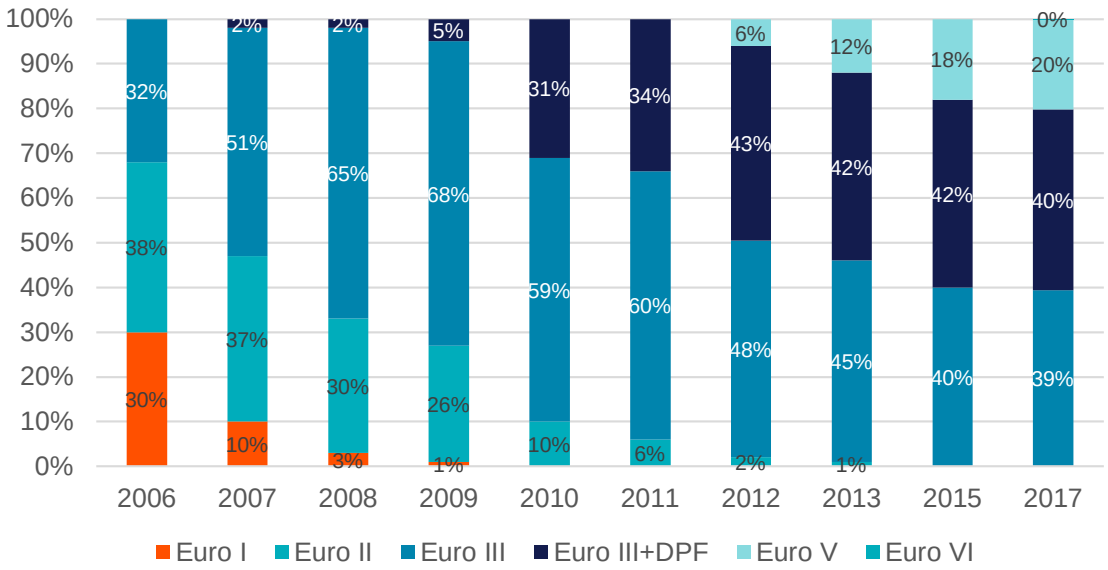
# Continuous improvement in emissions standards alongside fuel quality over last two decades

| | Fuel | 1998 | 2005 | 2006-2007 | 2011-2012 | 2014 |
|---|---|---|---|---|---|---|
| Emission standard | Diesel | EPA 91 | EPA 94/ EURO 3 | TIER1/ EURO 4 | **TIER2B5/ EURO 5** | |
| | Gasoline | | | | TIER2B8/ EURO 4 | **TIER2 B8/ EURO 5** |




Fuel Quality has improved significantly over the last two decades

# Santiago adopted Euro V standards for Public Transport in 2012




Tender 2018: Euro VI and BEB


CMM Research and Development

# Additionally Chile advanced in vehicular fuel economy

| | 2010 | 2011 | 2012 | 2013 | 2014 | |
|---|---|---|---|---|---|---|
| Fuel economy | Baseline FE | Labelling proposal | Feebate proposal | FE mandatory Labelling | "Green" Tax $CO_2$ and NOx | |

Focus on local pollutans

**2015**

**0.0244 g/km de $NO_x$**

**2016**

**0.0172 g/km de $NO_x$**

# Advantage in Latin America region: Capacity built in Homologation and Certification process

Ministerio de Transportes y Telecomunicaciones

Gobierno de Chile

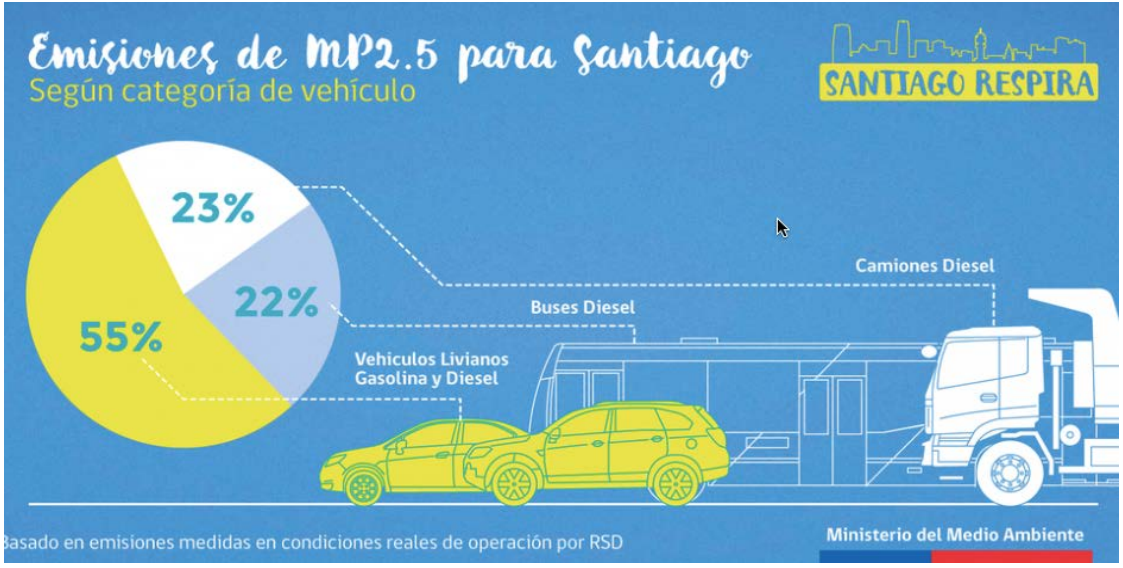

**Center of Control and Certification Vehicular**

# New Decontamination Plan for Santiago de Chile: 2017

# A New Decontamination Plan for Santiago de Chile: 2017

Santiago was declared Nonattainment Ar for PM2.5 (daily) in 2014.

The daily standard for $PM_{2.5}$ (50ug/$m^3$) was exceeded in the 98th percentile for years 2011, 2012 and 2013.




## Main policies:

### Trucks

- Low emission zone 2018

### Urban Bus

- Standard Euro VI 2018/2019

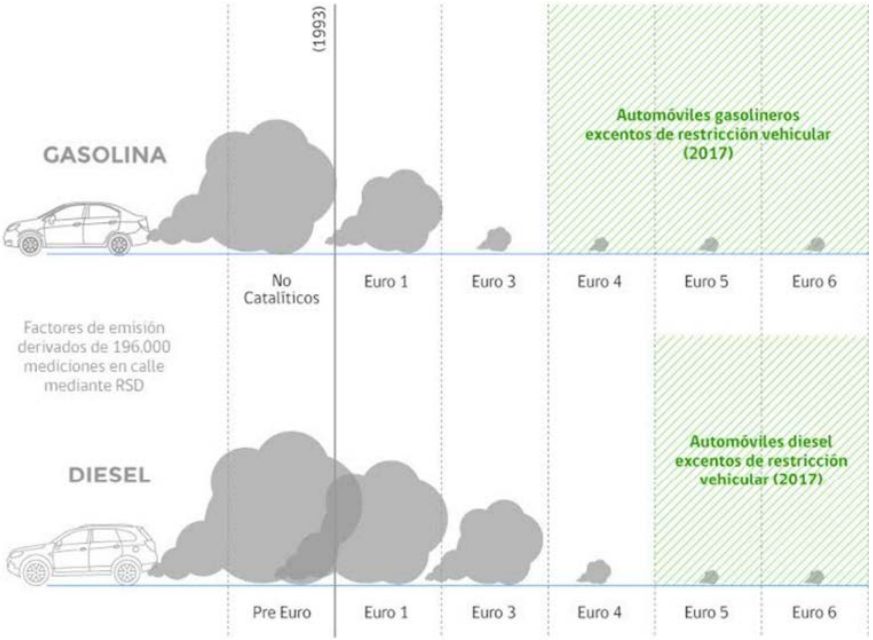
### LDV

- Standard Euro 6 by 2020
- **Permanent Restriction for catalitic vehicles (between May-August)**
- Incentives for electric and hybrid vehicles (in design*)

# Decontamination Plan 2017: Driving restriction on catalytic LDV/MDV vehicles built before 2012

## LDV/MDV:

Permanent Restriction for catalytic vehicles (between May-August) inside a Low Emission Zone




## Which vehicles?

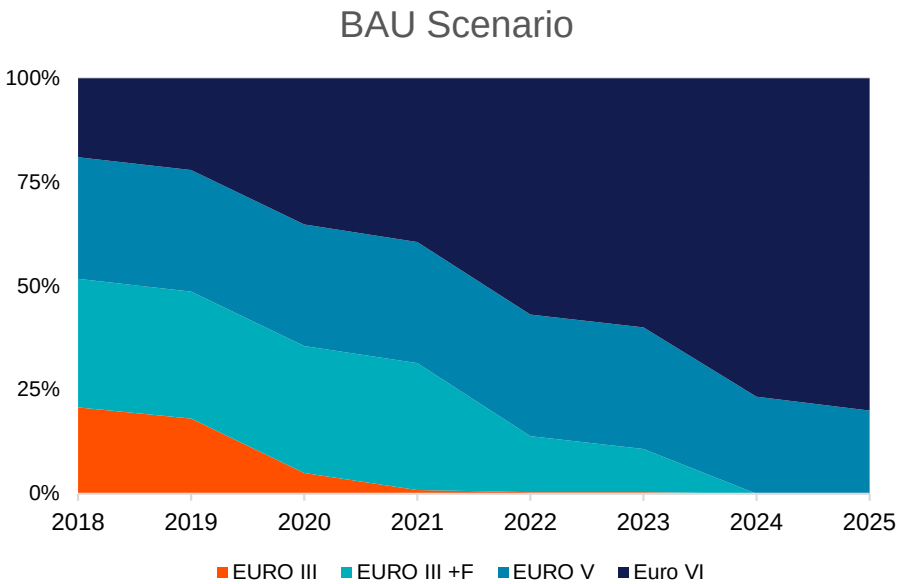
**Restriction by plate number** for vehicles registred before 2012.

## Why before 2012?

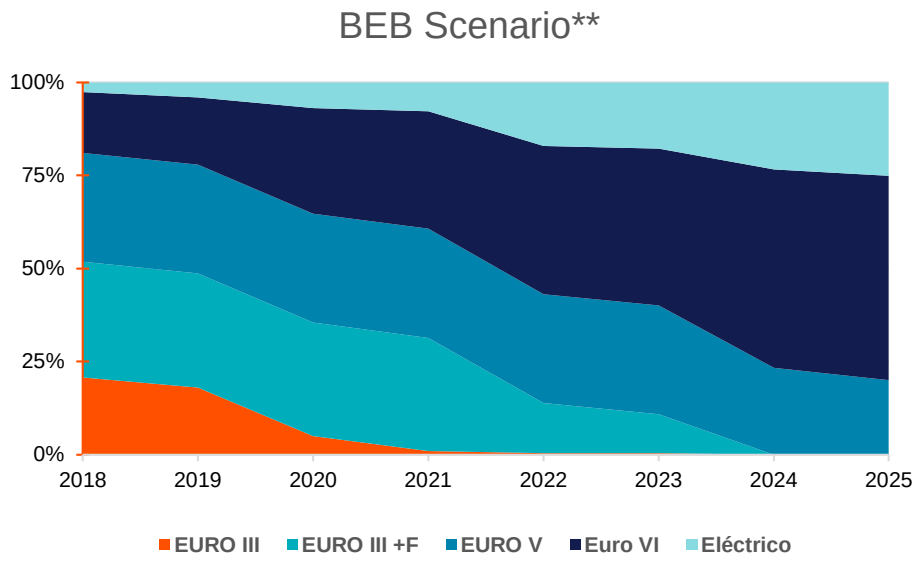
The vehicles registered after 2012comply with Euro 5 (diesel) and Euro 4 (Gasoline) standards

# Chile is the first country in South America to adopt Euro VI standards for Public Transport (2018)

## Emission standard base is Euro VI




## Opportunity to incorporate better technologies



(i) EFM

(ii) PEMS installation

(iii) PEMS main unit

(iv) external battery

# What are we doing in real urban emission measurements?

# Capacity building on Portable Emission Measurement Systems

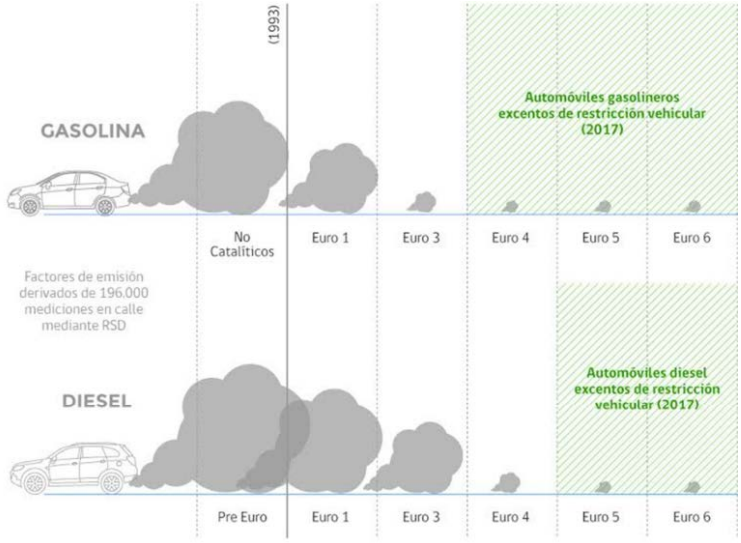
Theoretical workshop in PEMS, February 2018.
Participation of Environment Ministry, Transport Ministry (3CV Lab)
Support of international experts and automotive test systems makers

We hope to carry out a practical workshop on this year.

# Remote sensing measurement (RSD- 4600)


196.000 vehicles tested
19 measure points in Santiago

Focus on Emission Factor correction for Emission Inventories
And support in the design of Permanent Restriction for catalytic vehicles



# Conclusions and opportunities

Chile has improved its fuel and emissions standards the last 20 years.

**Without emission standard**
**Diesel 5000 ppm S**

**Euro VI/6**
**Diesel 15 ppm S**

Opportunity for adopting TRUE initiative through a development of “smart” vehicle restriction, not by emission standard but by maker/model/

**Restriction by plate number**

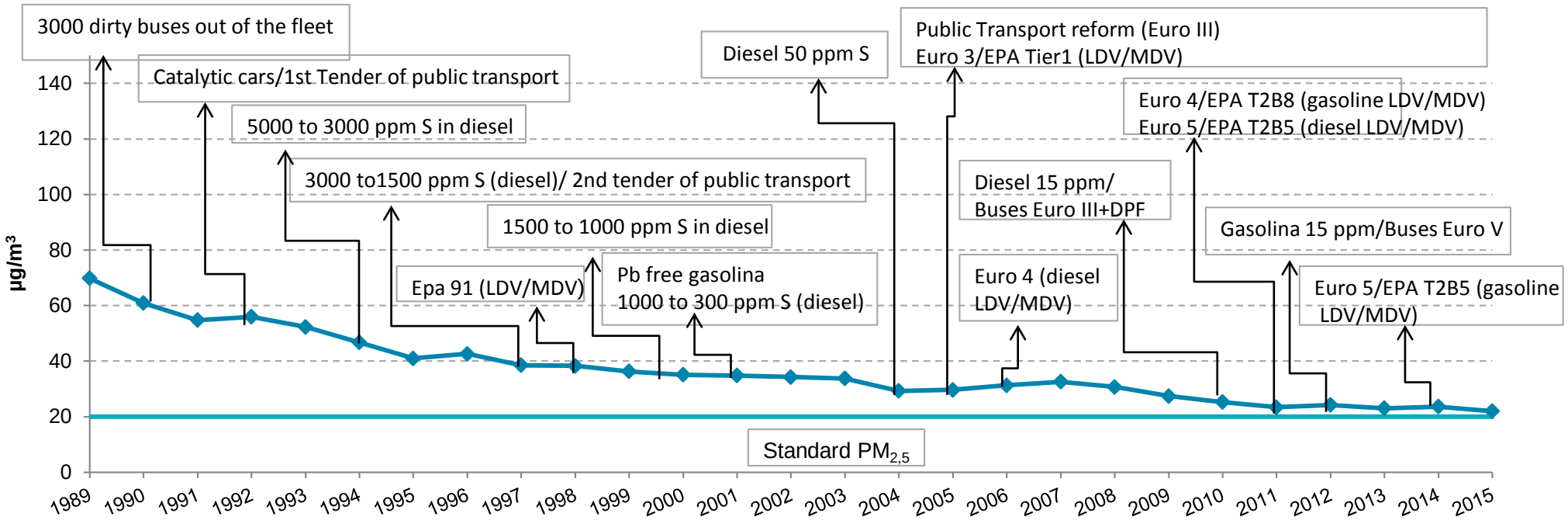
**Restriction by real emission (Ranking?)**

Thanks!!

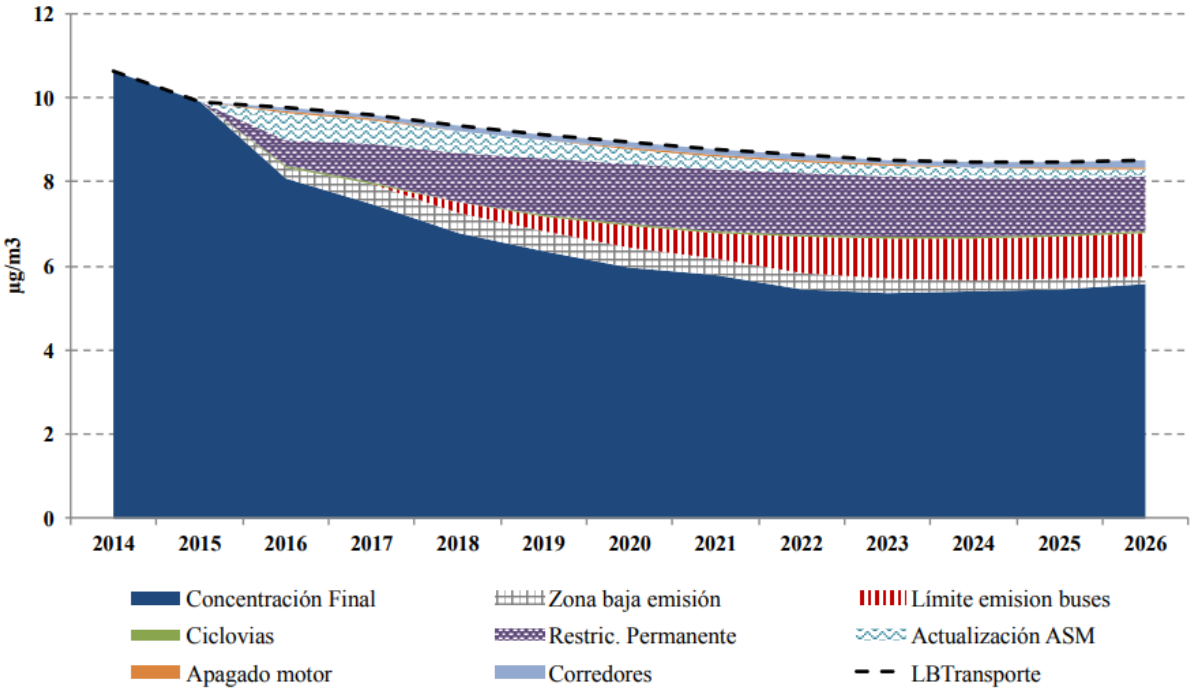
Marcela Castillo
mcastillo@cmmolina.cl

www.cmmolina.cl
www.electromovilidad.org

editable


3000 dirty buses out of the fleet
Catalytic cars/1st Tender of public transport
5000 to 3000 ppm S in diesel
3000 to1500 ppm S (diesel)/ 2nd tender of public transport
1500 to 1000 ppm S in diesel
Epa 91 (LDV/MDV)
Pb free gasolina
1000 to 300 ppm S (diesel)
Diesel 50 ppm S
Public Transport reform (Euro III)
Euro 3/EPA Tier1 (LDV/MDV)
Diesel 15 ppm/
Buses Euro III+DPF
Euro 4 (diesel
LDV/MDV)
Euro 4/EPA T2B8 (gasoline LDV/MDV)
Euro 5/EPA T2B5 (diesel LDV/MDV)
Gasolina 15 ppm/Buses Euro V
Euro 5/EPA T2B5 (gasoline
LDV/MDV)
Standard PM2,5
µg/m³
0
20
40
60
80
100
120
140
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

# Decontamination Plan 2017: Expected emission reduction from the transport sector




Major reductions by:

- urban bus standard
- Permanent restriction