

An assessment of strategies for the control of both climate change and air pollution emissions in Spain. Results from the power, transport and waste management sectors.

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● Outline

1 Introduction and methodology

2 Transport sector

3 Waste management sector

4 Power generation sector

5 Conclusions











- **Related environmental challenges:**
 - Air Quality:
 - Health and vegetation problems due to Ozone
 - Acidification
 - Eutrophization
 - Health problems linked to Particulate Matter
 - Climate change

- **Importance of considering holistic strategies to face them up**

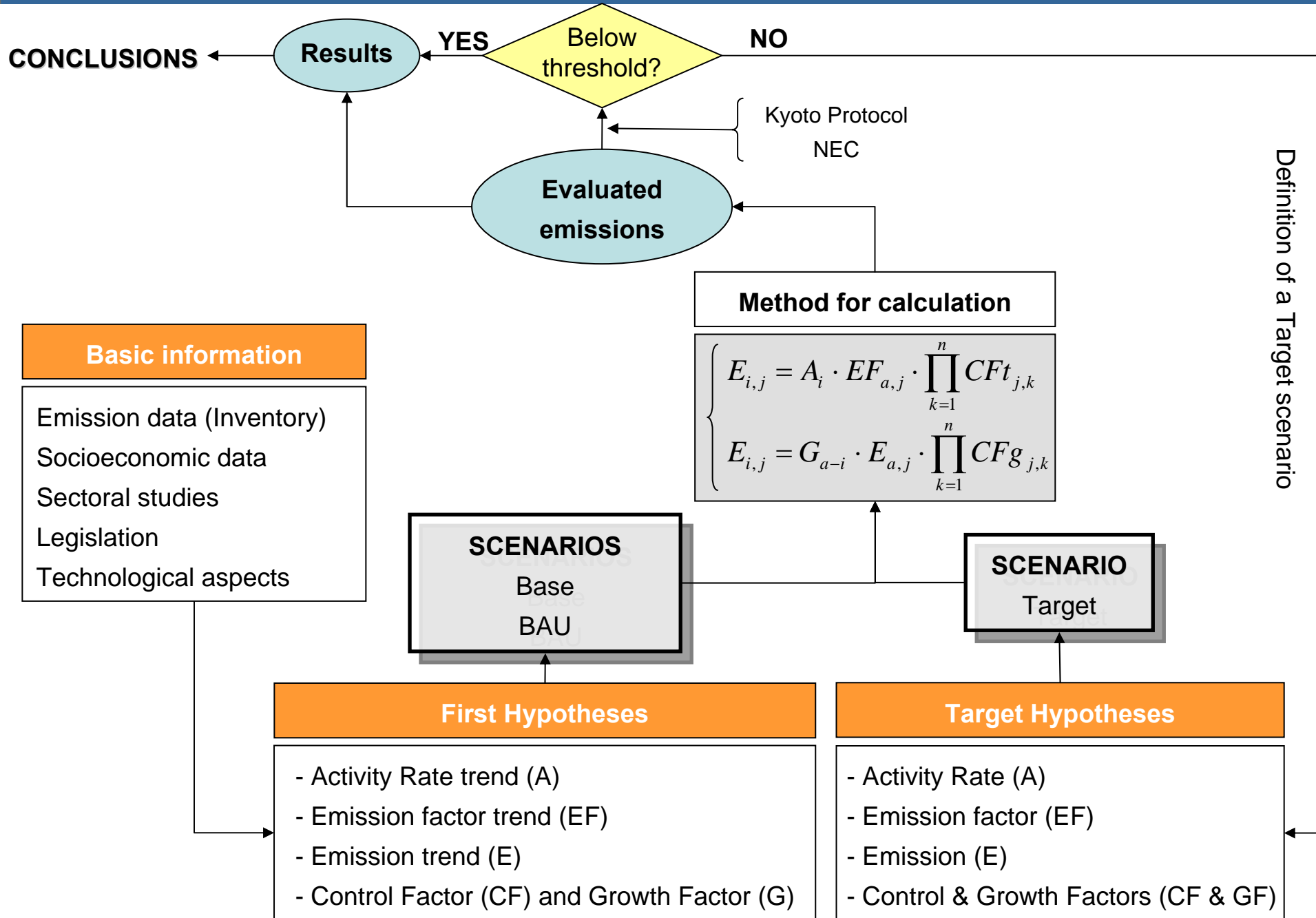
- **Sustainable measures: considering social and economic implications**

- **To achieve the environmental objectives in an optimal cost-efficient way**

● Combined effect of policies and measures

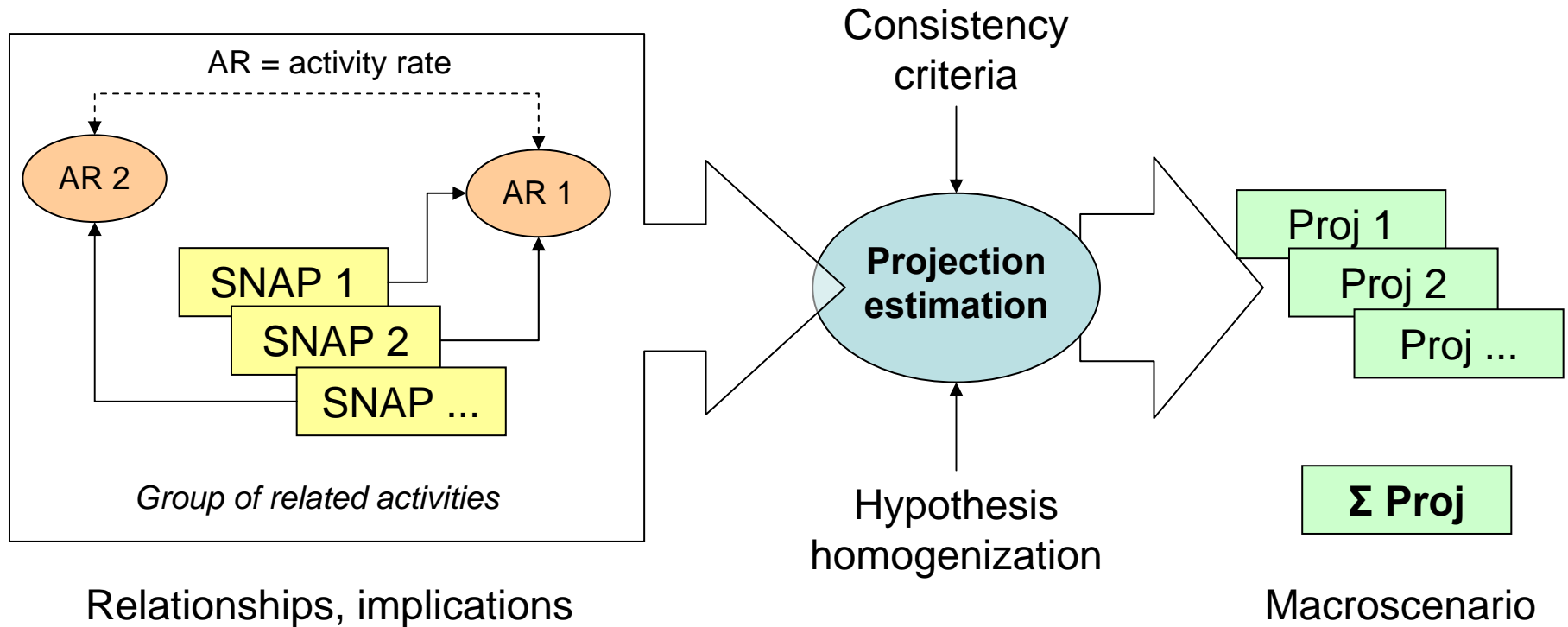
Air Quality	Climate Change	Policy or measure
		Fuel desulfurization
		¿End of pipe measures?
		Energy efficiency, fuel substitution
		Biomass burning
		Use of waste as fuel in cement plants

- **Aim: to assess the combined effects of national/regional sectoral strategies for Spain**
- **Other objectives: to support policy makers with technical arguments to adopt optimal measures**



● Integration criteria

- Development of 'macroscenarios' for coherence assurance



Methodology

- 3 steps:

- 1) Identification of activities with higher emissions
- 2) In-depth examination of critical parameters for each activity
- 3) Evaluation of the influence in GHG and air pollution emissions of changes in the parameters

#	SNAP code	SO _x	NO _x	VOC	CH ₄	CO ₂	N ₂ O	NH ₃	SF ₆	HFC	PFC
1	01.01.01	63,6	17,9	0,2	-	27,7	0,9	-	-	-	-
2	02.02.02	1,1	1,2	1,5	1,6	5,4	0,7	-	-	-	-
3	03.01.03	4,9	1,8	0,1	0,1	5,8	0,5	-	-	-	-
4	03.03.11	3,5	3,7	-	-	3,2	0,3	-	-	-	-
5	04.03.01	0,3	0,1	-	-	0,2	-	-	-	-	90,3
6	04.06.11	-	-	4,5	-	-	-	-	-	-	-
7	04.06.12	-	-	-	-	4,9	-	-	-	-	-
8	04.08.01	-	-	-	-	-	-	-	-	36,0	-
9	06.05.02	-	-	-	-	-	-	-	-	44,3	9,1
10	06.05.06	-	-	-	-	-	-	-	-	15,3	-
11	06.05.07	-	-	-	-	-	-	-	-	-	-
12	07*	1,1	37,3	7,4	0,5	25,0	6,5	1,4	-	-	-
13	07.06.00	-	-	3,4	-	-	-	-	-	-	-
14	08.06.00	0,1	7,2	0,6	-	2,2	0,2	-	-	-	-
15	09.04.01	-	-	-	15,4	-	-	-	-	-	-
16	10.01.02	-	0,6	6,1	-	-	23,5	38,1	-	-	-
17	10.01.05	-	0,1	-	-	-	16,8	12,1	-	-	-
18-20	10.0X	-	-	-	58,8	-	-	21,2	-	-	-
TOTAL		74,6%	69,9%	23,8%	76,4%	74,4%	49,4%	72,8%	0,0%	95,6%	99,4%

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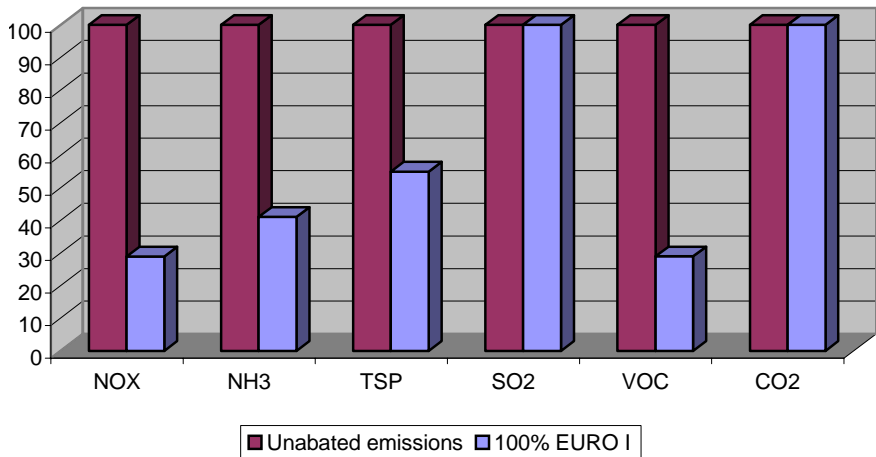
3 Waste management sector

4 Power generation sector

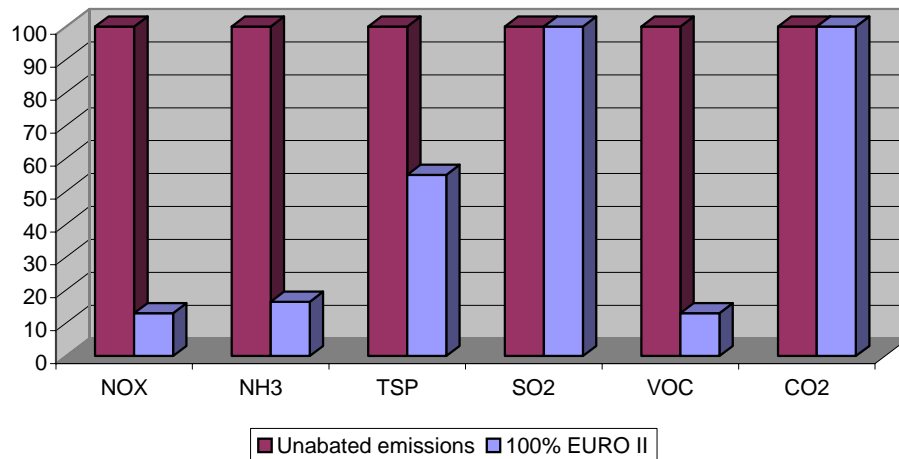
5 Conclusions

Gasoline cars in road transport

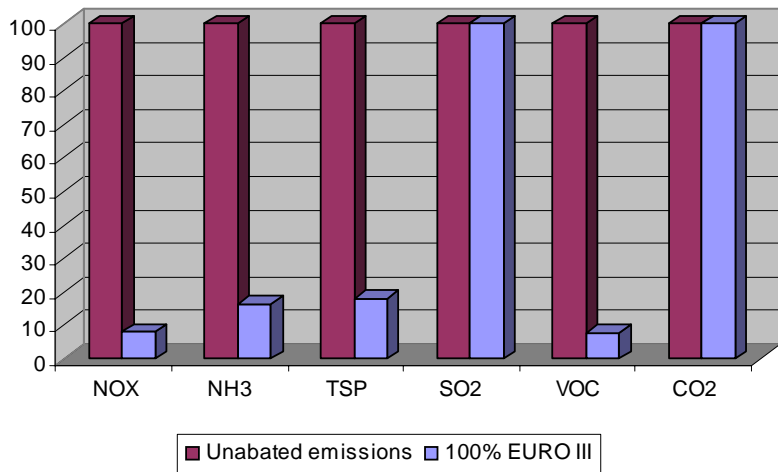
EURO I and emissions (%) Road transport (gasoline cars)



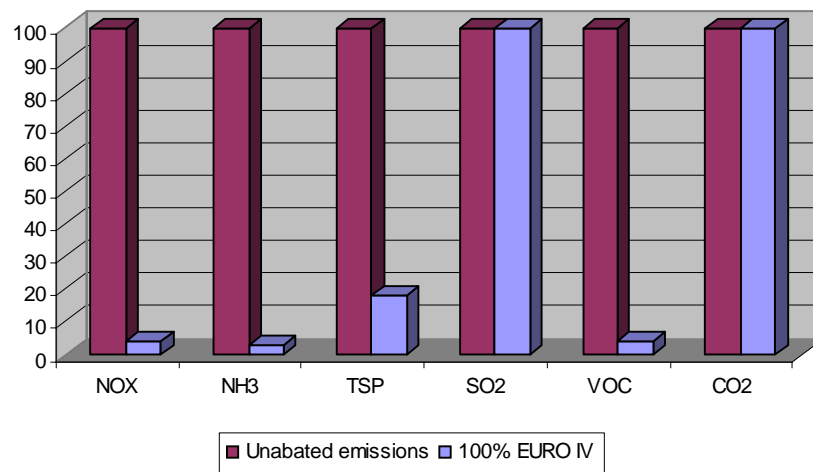
EURO II and emissions (%) Road transport (gasoline cars)



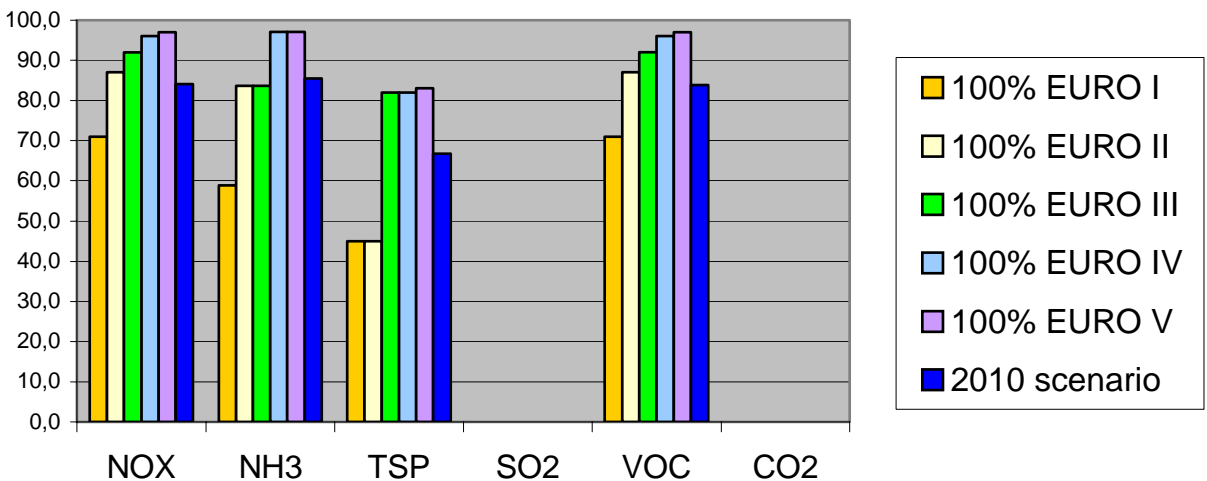
EURO III and emissions (%) Road transport (gasoline cars)



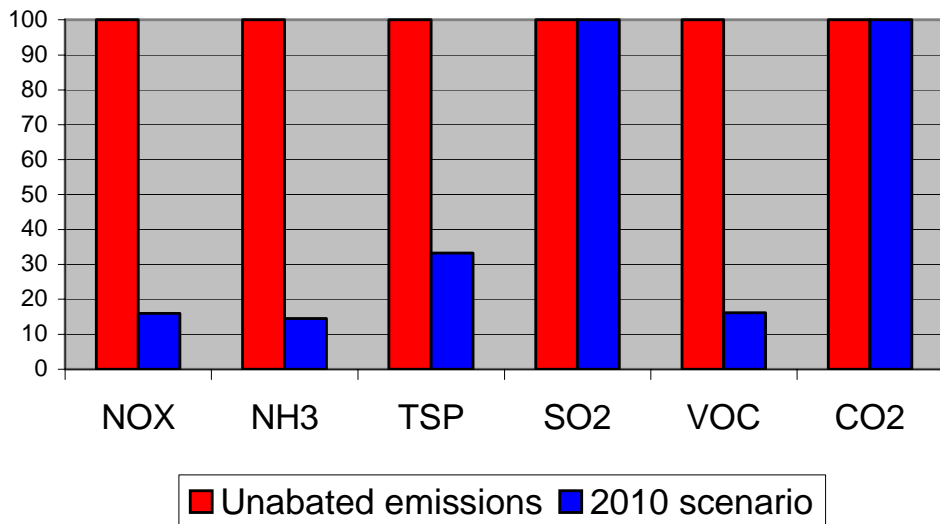
EURO IV and emissions (%) Road transport (gasoline cars)

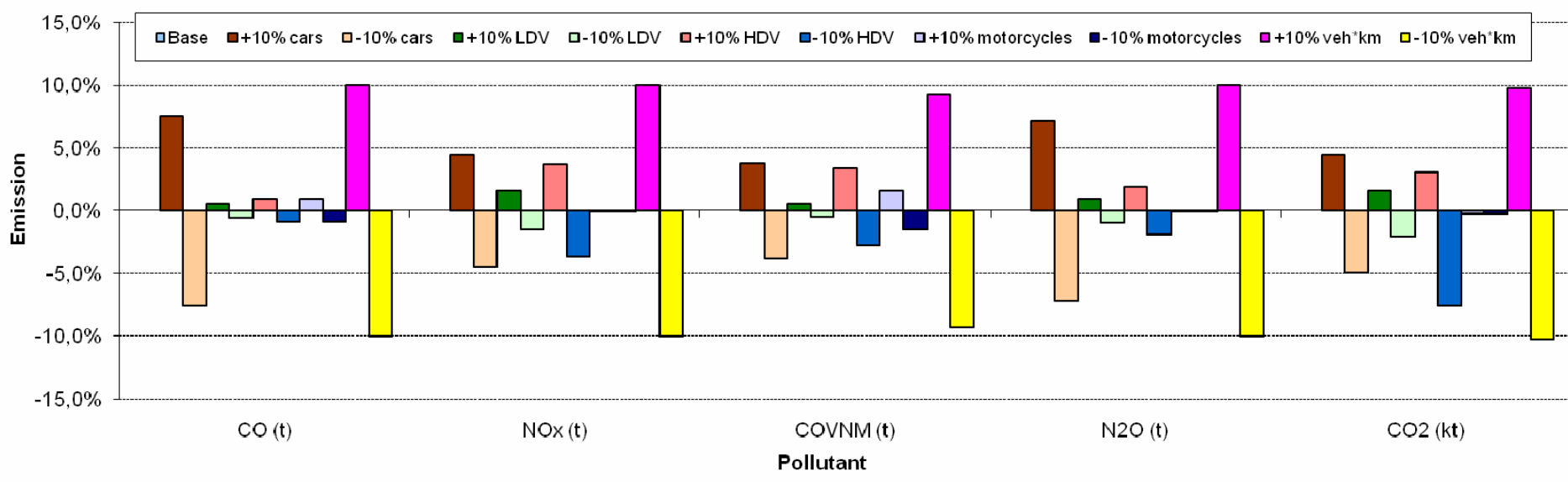
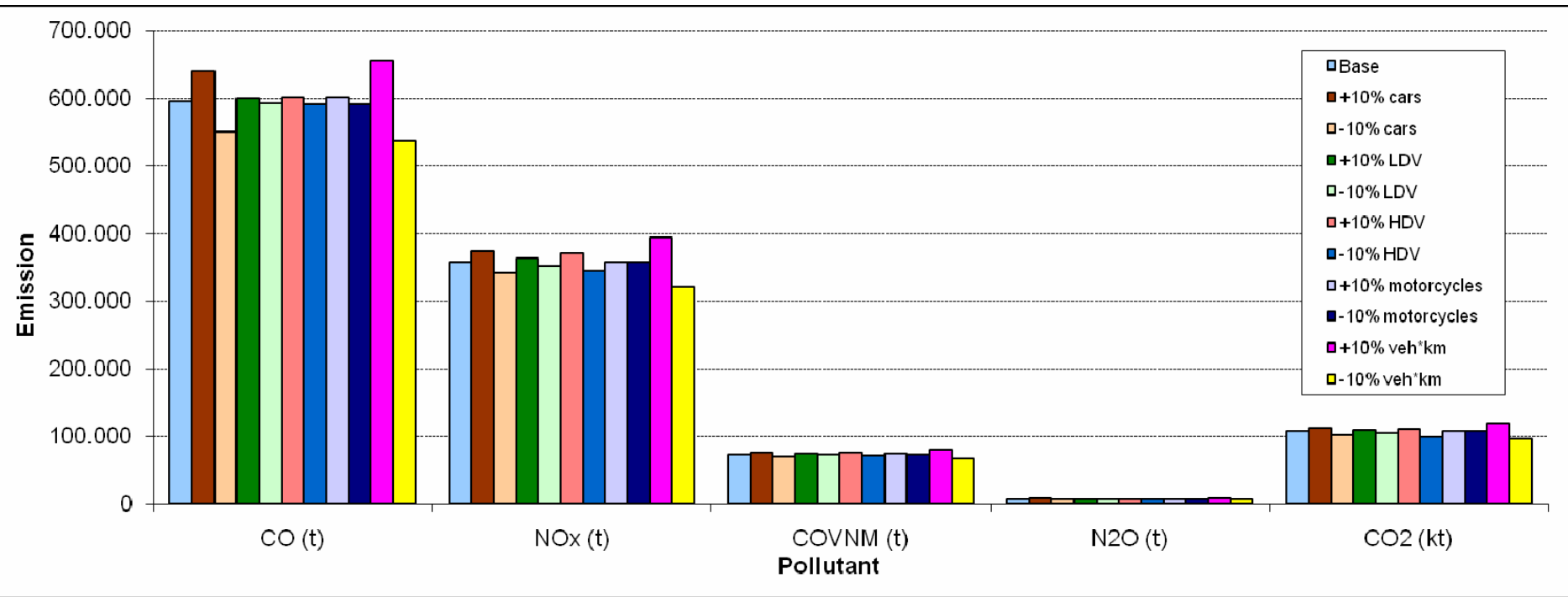


Technology vs. Emissions reductions (%)
Road transport (gasoline cars)



Technology combination vs. Emissions (%)
Road transport (gasoline cars)





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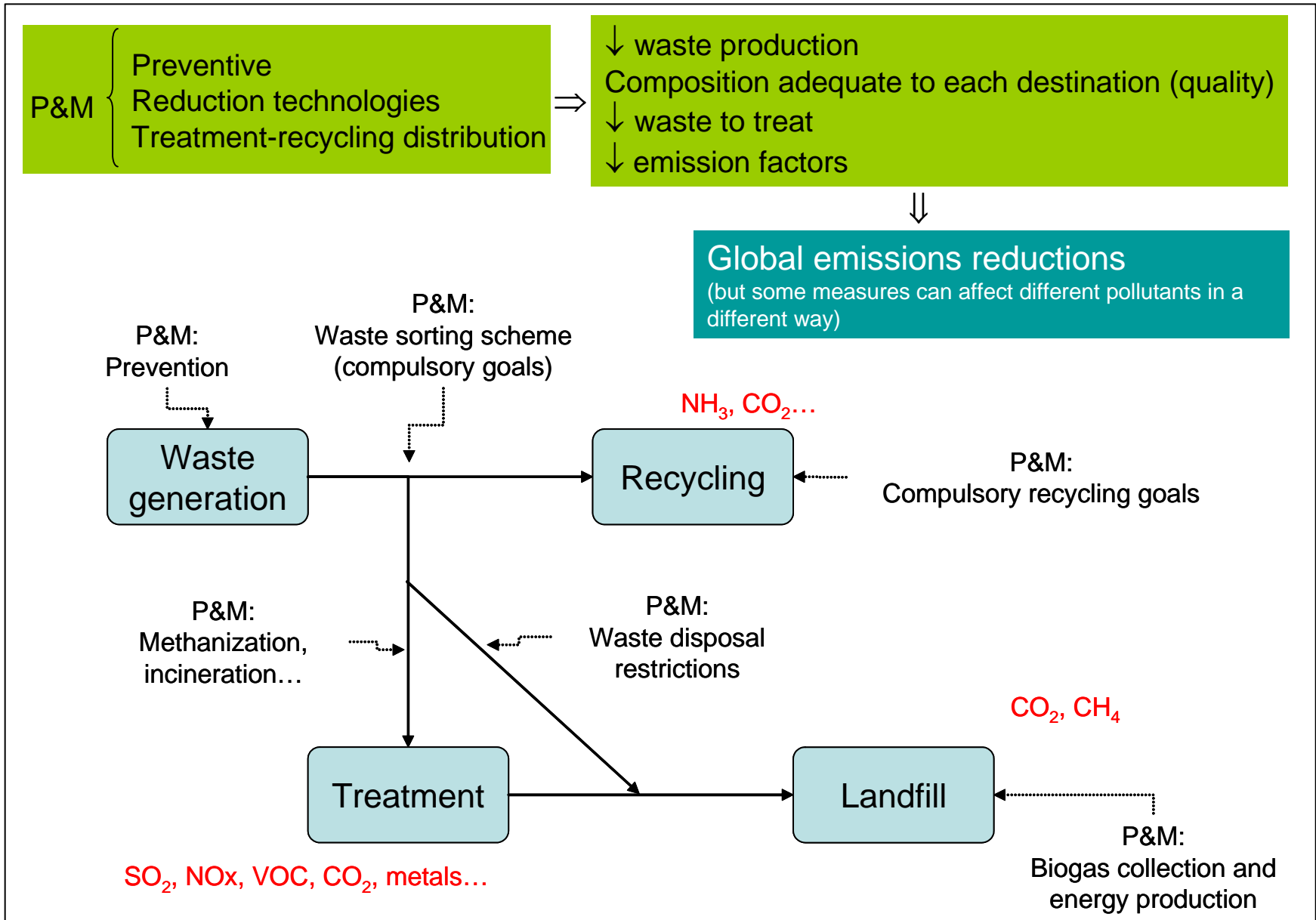
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Alternative P&M in waste management sector

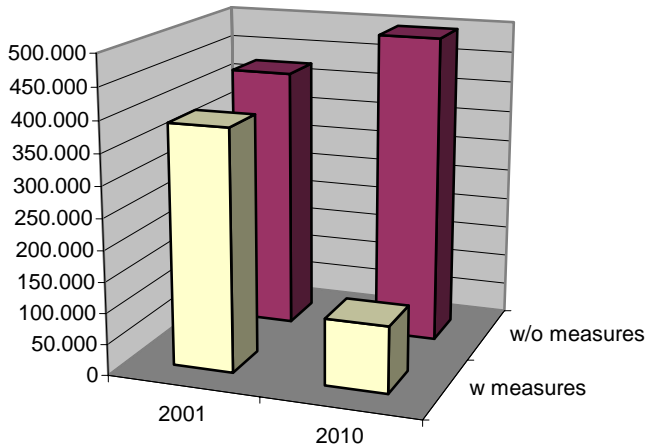


Waste treatment distribution hypothesis under considered scenarios

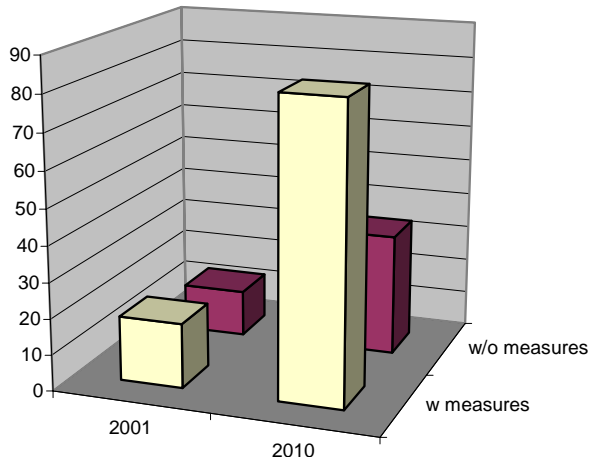
Activity	Without measures		With measures	
	2001	2010	2001	2010
Sorting scheme	7,0%	10,6%	19,3%	26,4%
Uncontrolled	7,5%	2,5%	5,0%	0,0%
Composting	21,0%	23,4%	22,2%	26,2%
Incineration	7,0%	9,2%	9,0%	17,7%
Landfill disposal	57,5%	54,3%	44,5%	29,7%
CH ₄ recovery (landfills)	12,28%	23,09%	17,60%	75%

Results

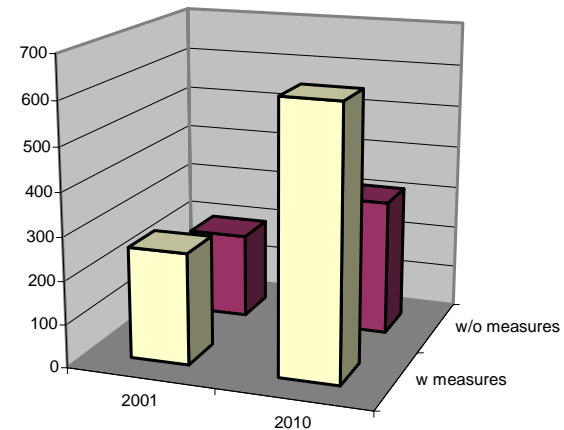
Landfills CH4 emissions



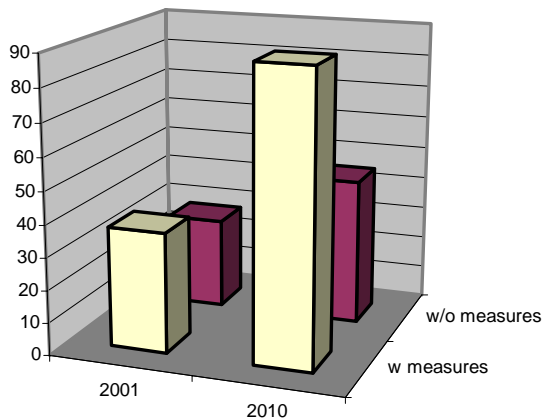
Biogas production CO2 emissions



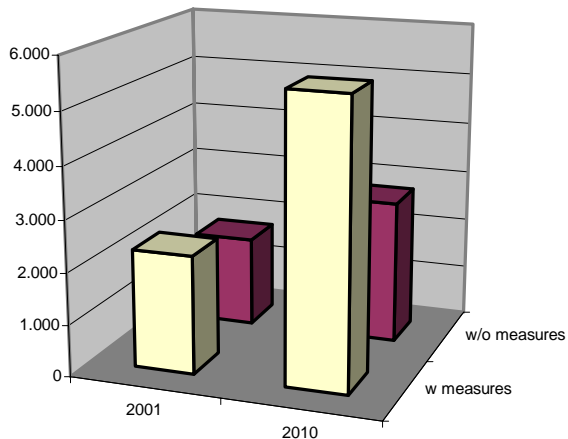
Incineration SO2 emissions



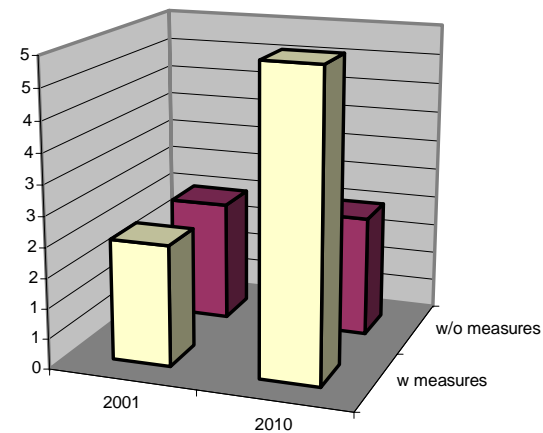
Incineration VOC emissions



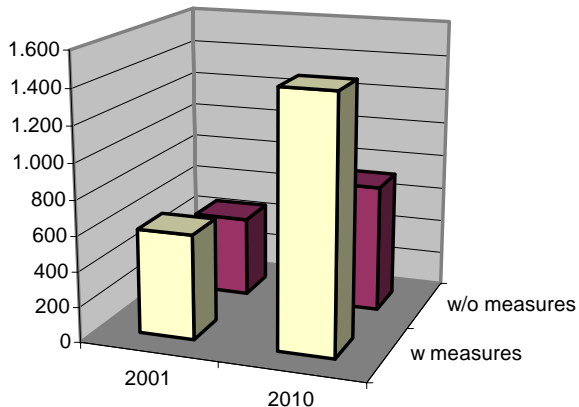
Incineration NOx emissions



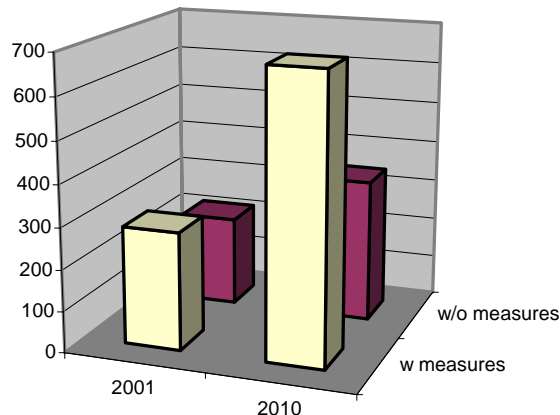
Incineration CH4 emissions



Incineration CO2 emissions

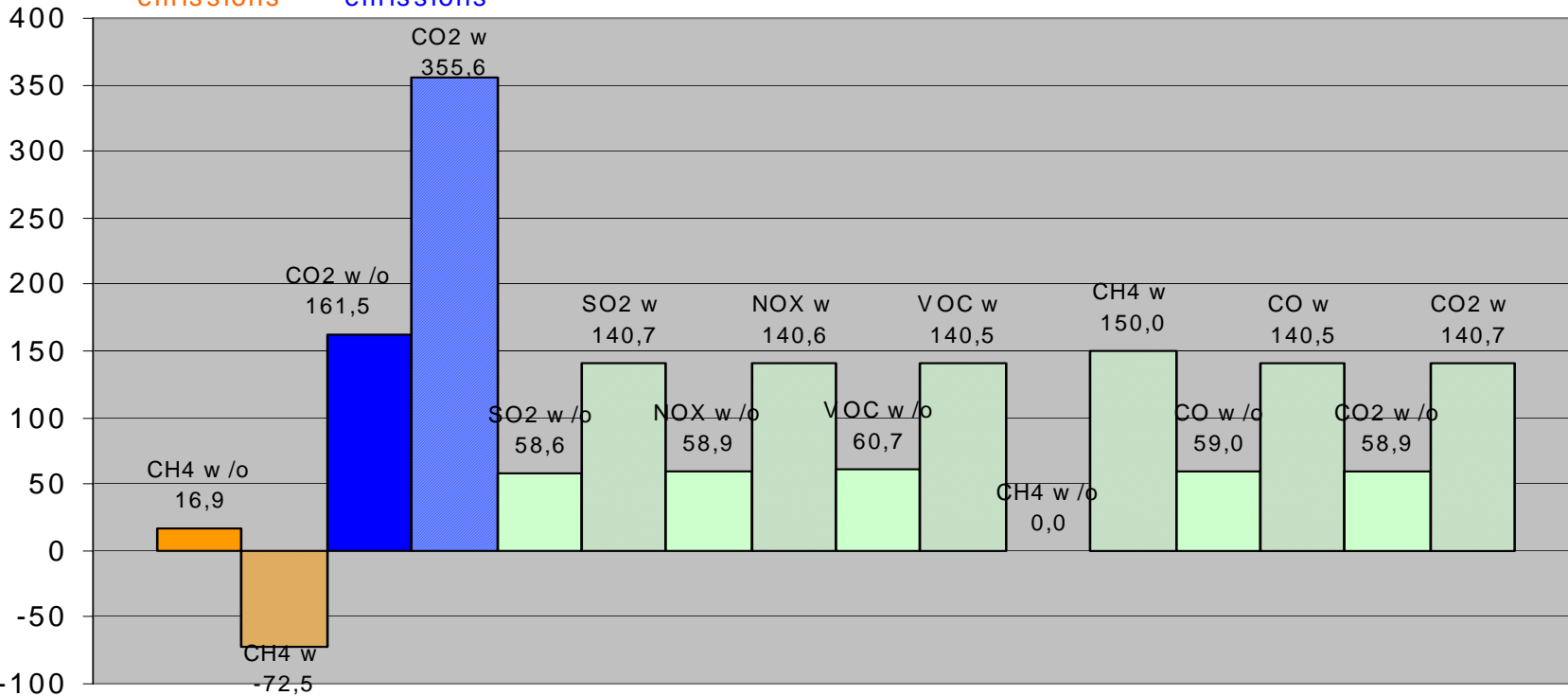


Incineration CO emissions



Landfills emissions Biogas production emissions

Incineration emissions

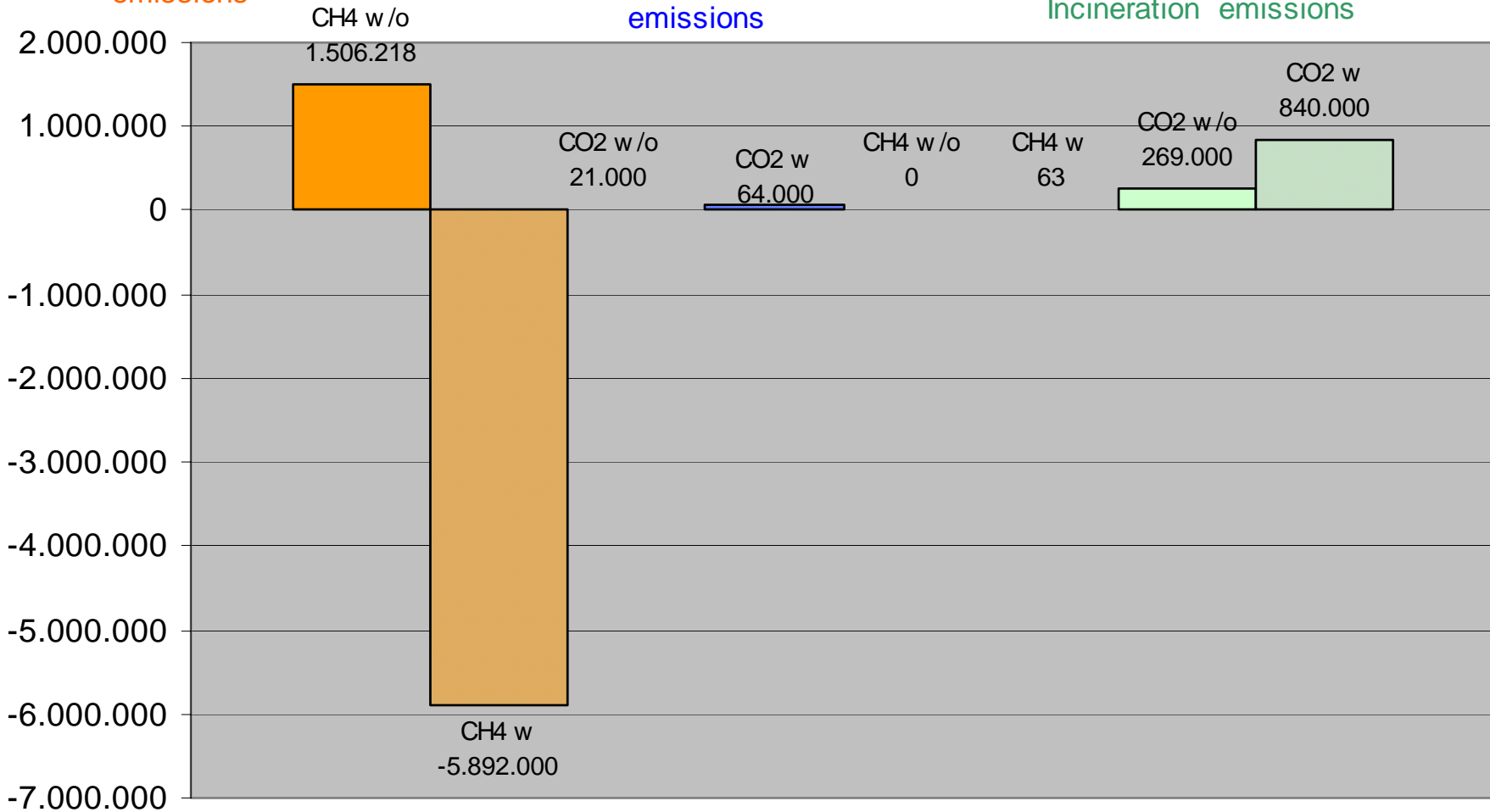


Emissions projections; measures, activities and pollutants

Landfills emissions

Biogas production emissions

Incineration emissions



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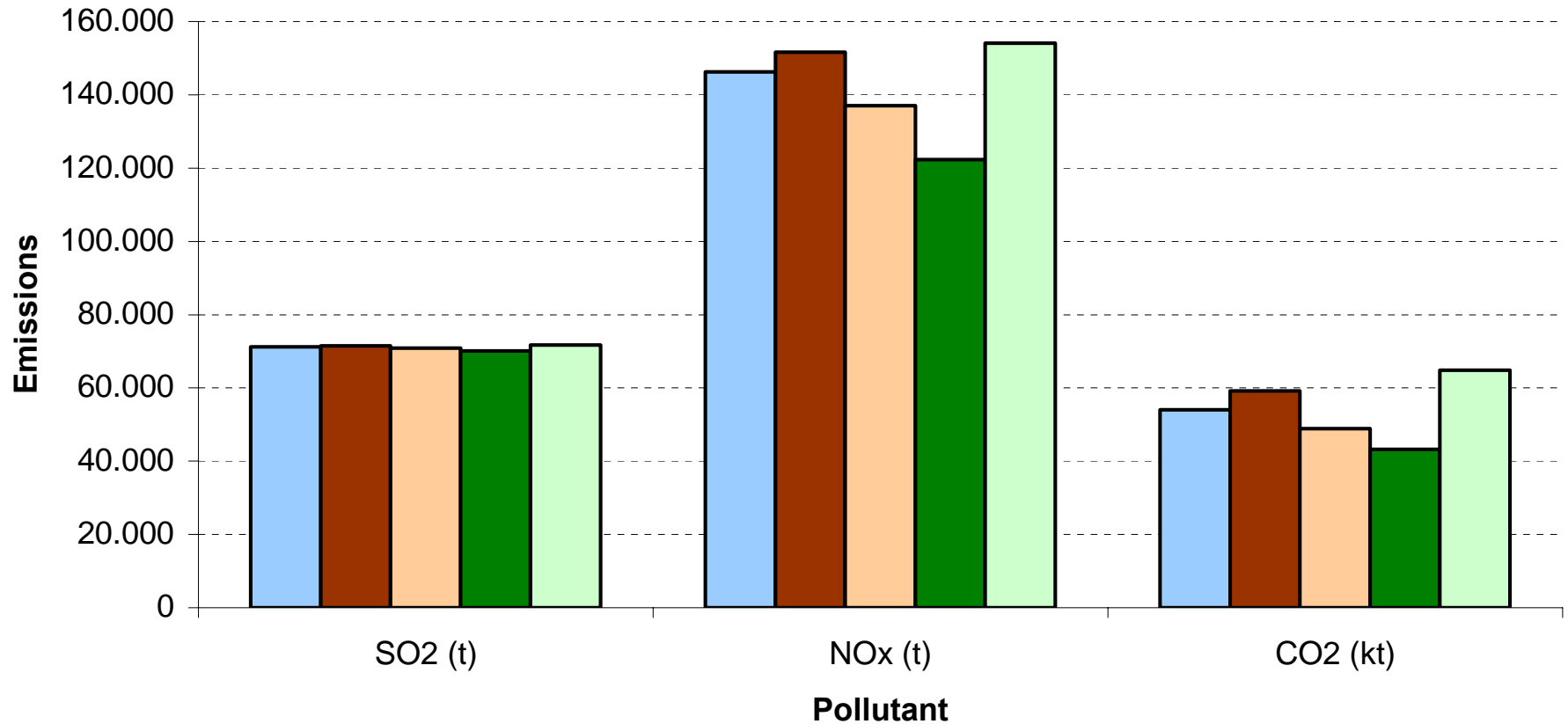
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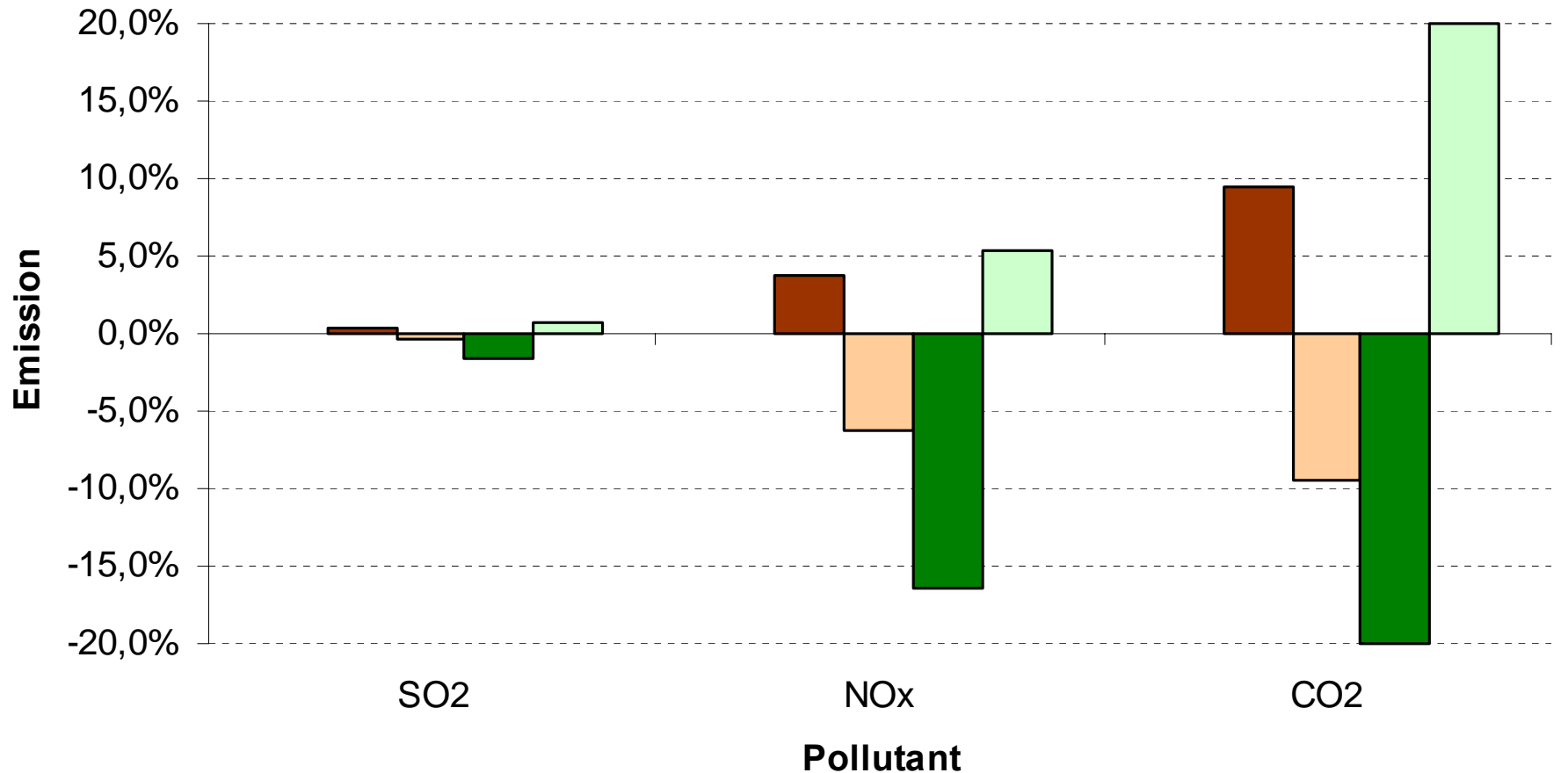
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Effect of different measures



■ w/m ■ +10% Energy ■ -10% Energy ■ 10% switch from coal-gas ■ 10% switch from gas-coal

Effect of changes in energy demand and fuel substitution for large combustion plants using CEP methodology. Results for Spain



■ w/m ■ +10% Energy ■ -10% Energy ■ 10% switch from coal-gas ■ 10% switch from gas-coal

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- **Combined effects of P&M are analyzed for three of the most important Spanish sectors from the atmospheric emissions point of view**
- **For transport sector, implementation of technologies has considerable ancillary benefits in terms of AQ emissions**
- **For the power sector, fuel substitution has a co-benefit in air quality and GHG emission reduction. This effect is higher than energy saving**
- **In the waste management sector, policies and measures have effects in different ways:**
 - reduces GHG emissions in 66%
 - increases NO_x, SO₂, VOC and CO emissions between 141% to 150%
- **Further work should focus the attention on a cost/benefit assessment in order to obtain the cost per unit of emission reduction for each measure**