



# **Integrated Assessment of Air Pollution Control Measures in Megacities**

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**May 8th, 2012**



## **Policy related questions to MEGAPOLI**

### **Problems in large cities:**

- **Large health risks due to PM2.5,**
- **PM10 and NO2 concentration limits frequently exceeded,**
- **Considerable contribution to GHG emissions,**
- **Health impacts due to climate change expected.**

### **Objective of MEGAPOLI (coordinator Alexander Baklanov, DMI)**

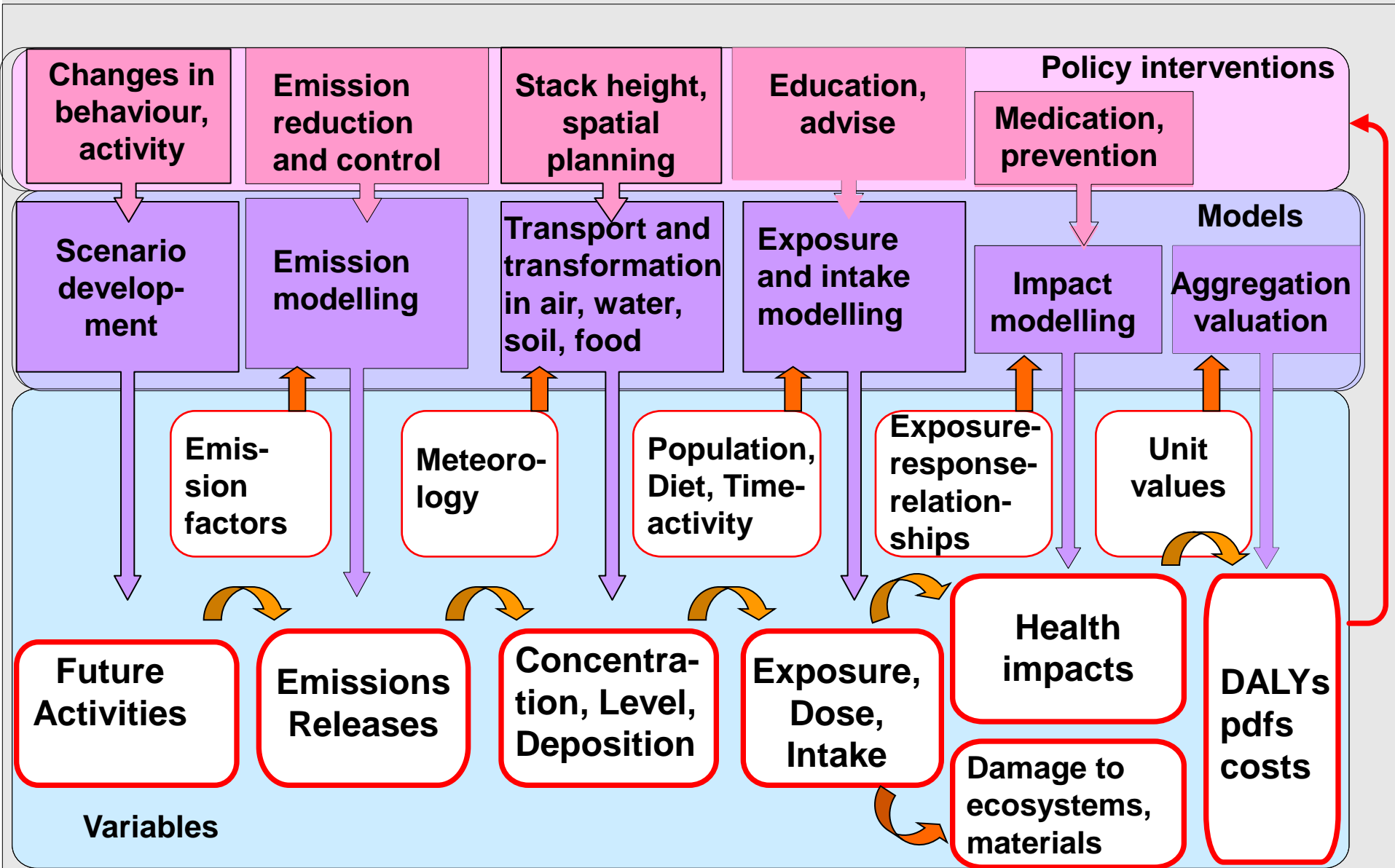
**Identification and assessment of additional policies and measures for reducing environmental health risks and greenhouse gas emissions in large cities.**



## Approach

- **Assessment of measures for Paris, London, Rhine-Ruhr area and Po valley,**
- **Include as well local as EU wide measures, include non-technical measures**
- **Integrated assessment of measures following the full chain or impact pathway approach and the ECOSENSE integrated assessment model:**
  - **Simultaneous assessment of outdoor air pollution, greenhouse gas emissions, and if relevant indoor air pollution**
  - **European wide model plus improved urban increment modelling plus distribution function of street canyon concentration**
  - **Exposure modelling for PM2.5**
- **Cost-benefit analysis including utility losses, ranking of options according to net present value of monetized benefits minus costs:**
  - **NPV = monetized health impacts plus CO<sub>2-eq.</sub> reduction \* marginal avoidance costs minus costs of measure minus utility losses.**
  - **Marginal avoidance costs 2020: 52 €/t CO<sub>2-eq.</sub>; 2030: 85€/t; 2050: 225 €/t**

# The Full Chain Approach



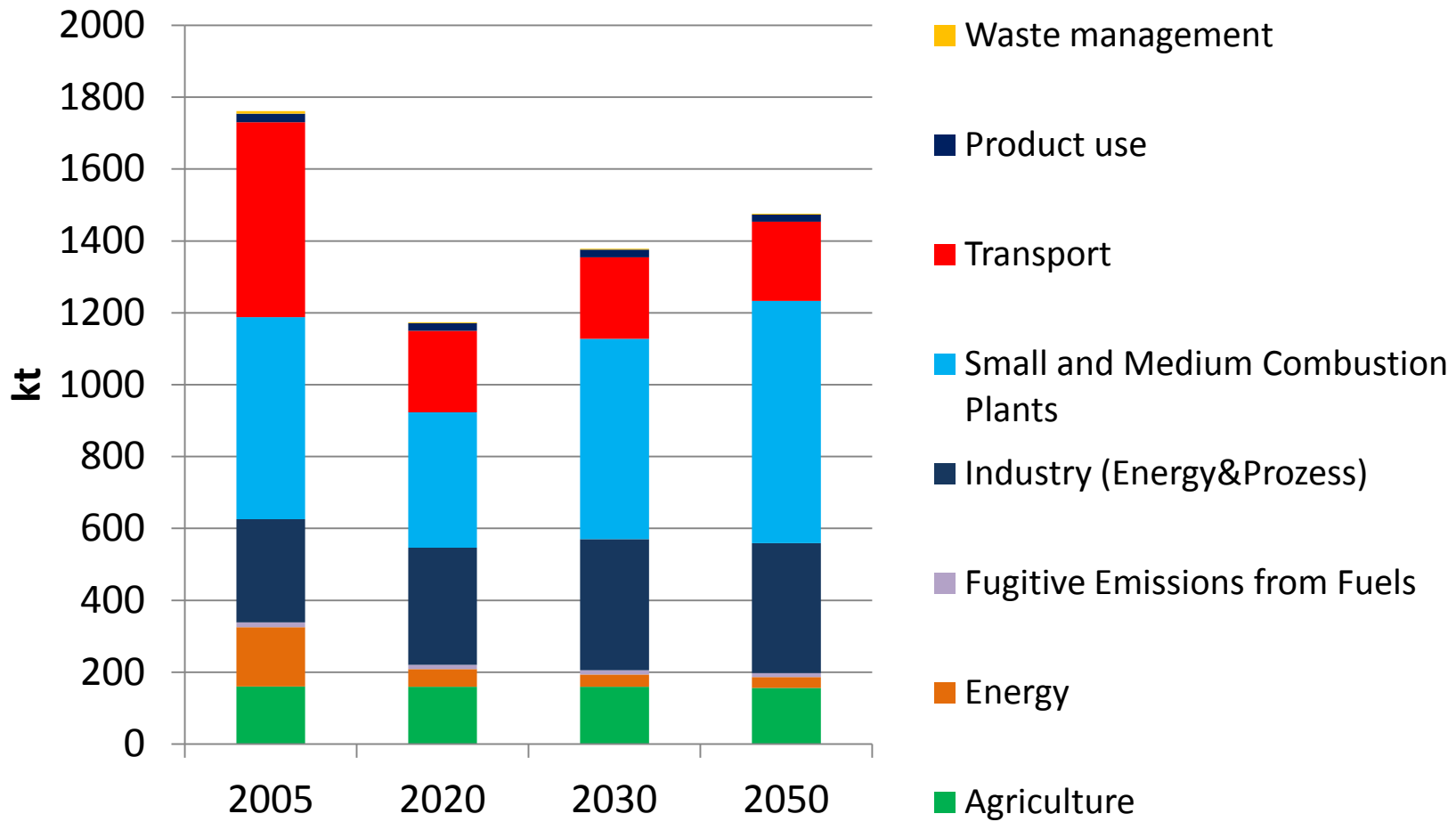


## Reference Scenario

- **European policy according to the EU energy and climate package; extrapolation of ETS**
- **Minimum market shares for hybrid electric, battery electric and plug-in hybrid electric vehicles, promotion of renewables based on national targets**
- **Reduction of EU greenhouse gas emissions by 25 % until 2020 and 50 % until 2050 compared to 1990, for Germany 56%**

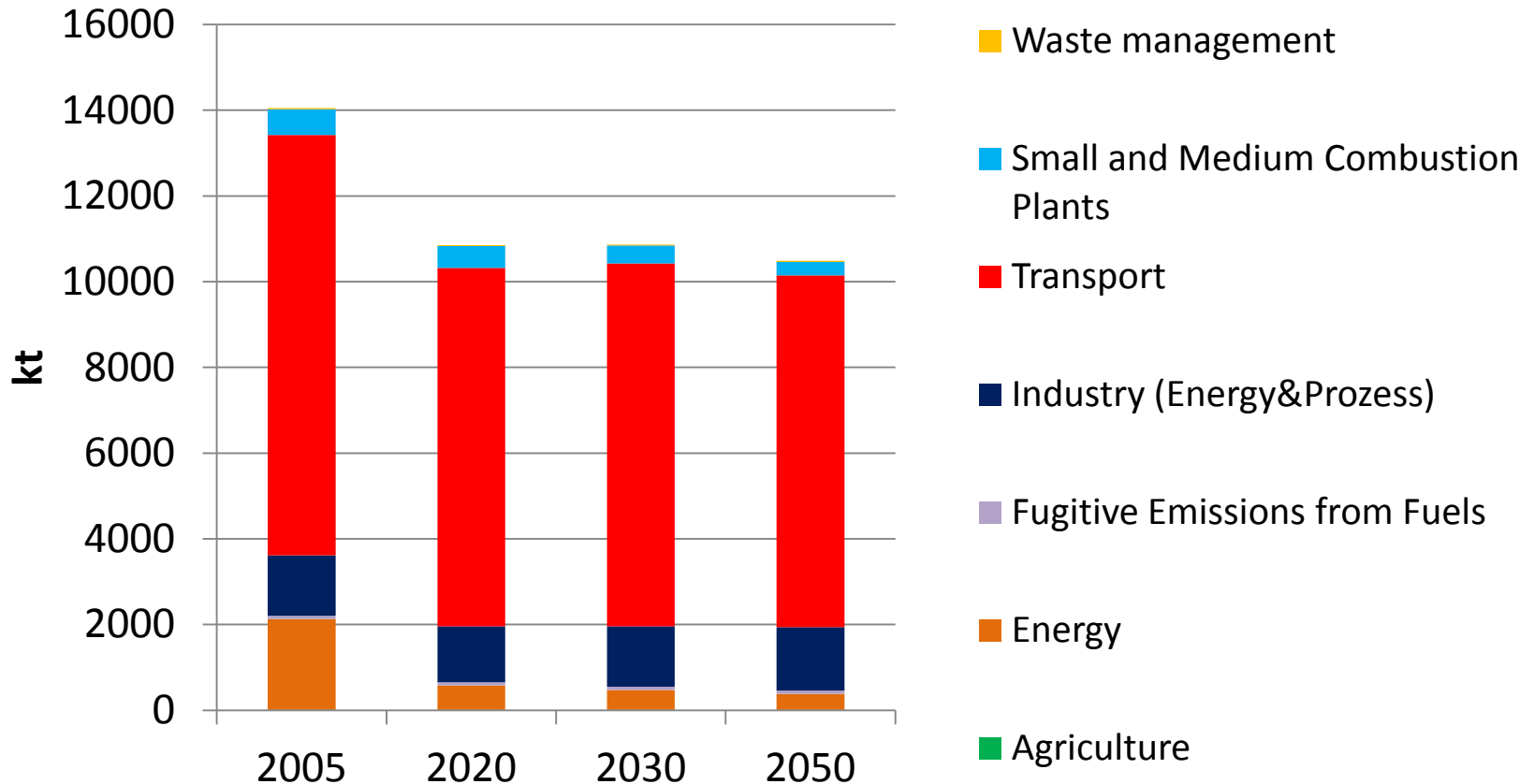


## PM2.5-Emissions in Europe (EU27 + NO + CH)





## NO<sub>x</sub>-Emissions in Europe (EU27 + NO + CH)



Transport related emissions include road, navigation, aviation, railways and other mobile sources





## Considered Measures and policy options

- Energy sector (LCP) =>2 measures
- Energy sector (Small combustion) =>5 measures
- Industry => 4 measures
- On-road => 9 measures
- Offroad => 4 measures

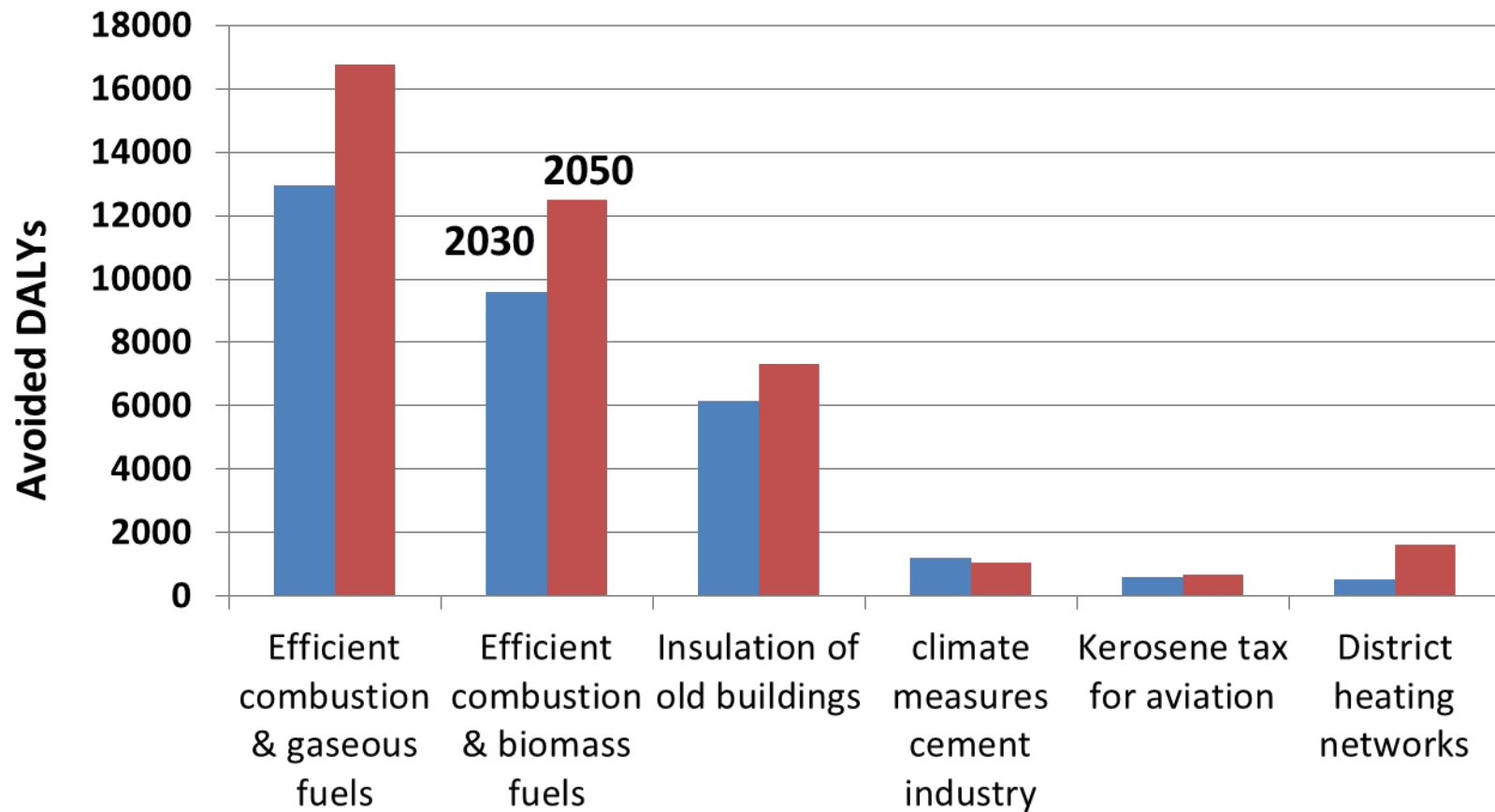
**Pollutants considered: GHG(CO<sub>2</sub>, CH<sub>4</sub>), , NO<sub>x</sub>, SO<sub>2</sub>, NMVOC, NH<sub>3</sub>, CO, PM10, PM2.5**

**Distinction between measures with impact specific to the MC areas and measures which affect the whole European domain**



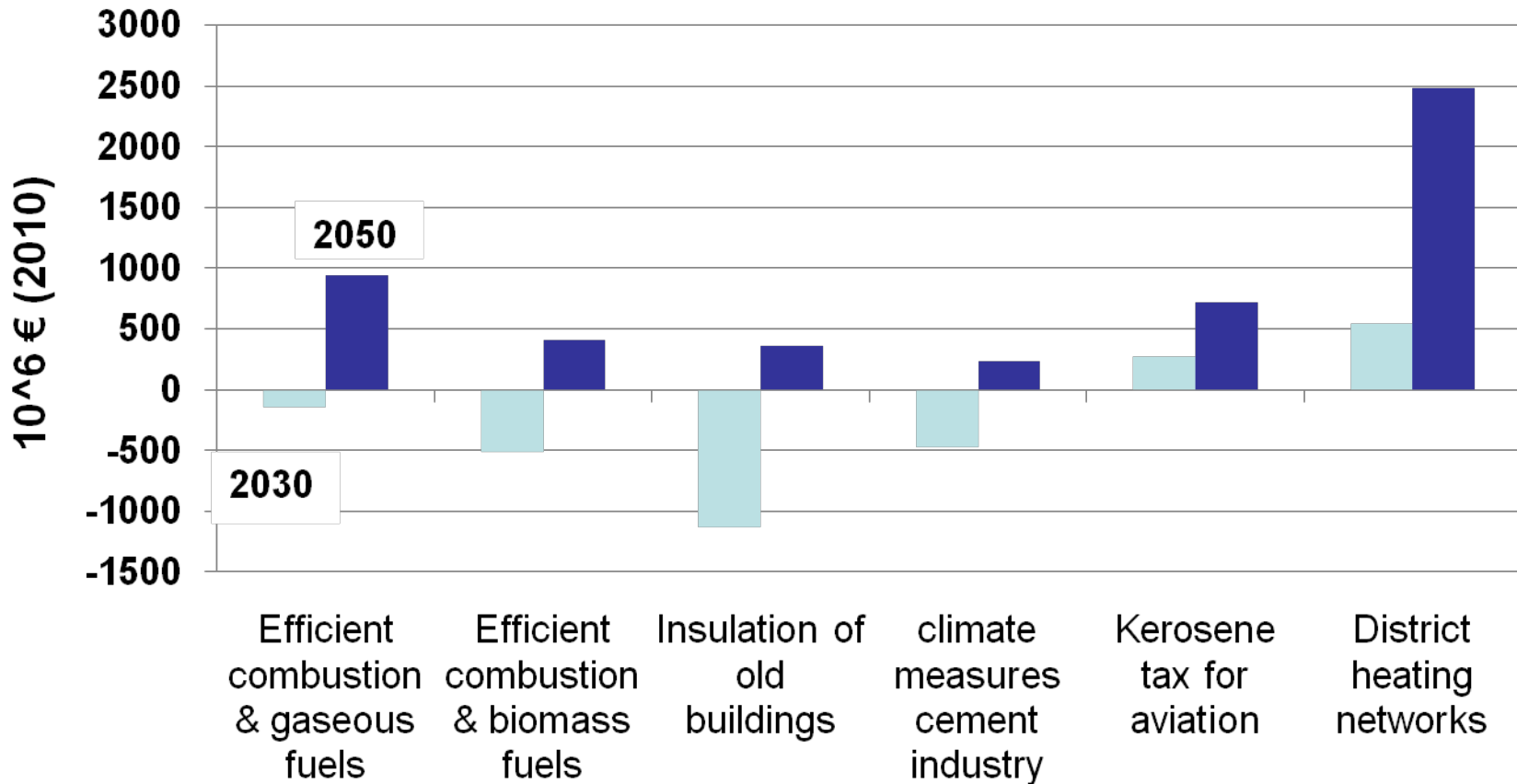


## Most Effective Measures (in DALYs avoided per Year) in the Paris Area



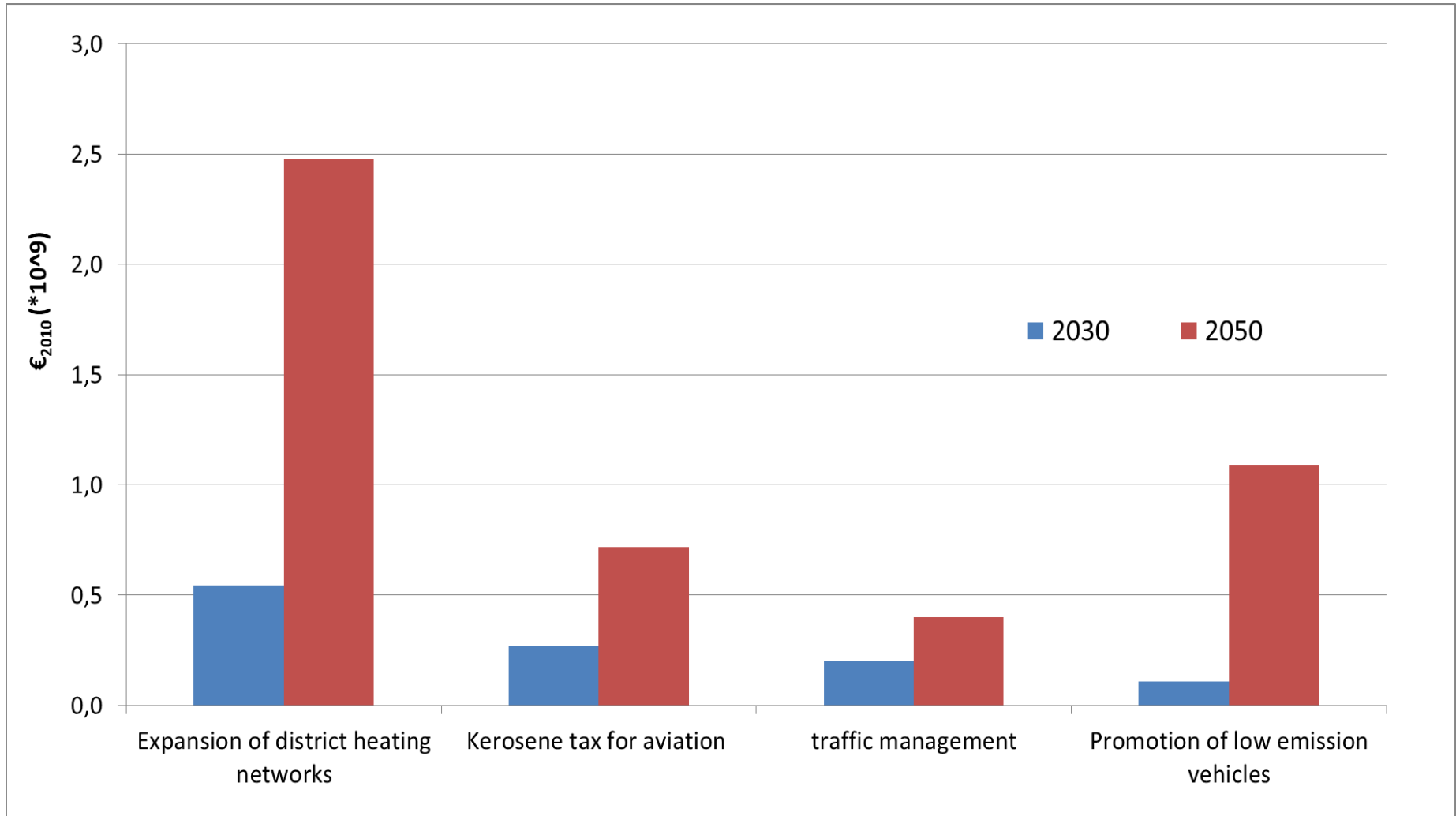


## Efficiency (net present value of benefits minus costs) of effective measures in Paris





## Most Efficient Measures, Paris Area





## Efficiency (net present value of benefits minus costs) of specific measures with and without utility losses (Paris)

	With utility losses		Without utility losses	
	2030	2050	2030	2050
	<b>10<sup>6</sup> €(2010)</b>			
Enhanced use of bicycles (direct health benefits not included)	-75	-84	15	18
Low emission zones	-18	-21	0	0



## Results – Measure SCP003 -energy-efficient modernisation of old buildings-





## **Ranking of the measures with the best efficiency for Paris in 2050**

- **Expansion of district heating networks**
- **Promotion of low emission vehicles**
- **Replacement of solid fuels fired small coal and wood fired stoves with efficient combustion techniques using natural gas**

## **Ranking of the measures with the best efficiency for Po Valley in 2050**

- **Kerosene tax for aviation**
- **Promotion of low emission vehicles**
- **Combined climate protection measures in cement industry**



## Summary

**A tool for carrying out an integrated assessment of environmental policies has been developed (ECOSENSE). Features are simultaneous assessment of air pollution, greenhouse gases and indoor pollution with the full chain or impact pathway approach ([www.integrated-assessment.eu](http://www.integrated-assessment.eu))**

**In some cities bottom-up emission data differs considerable from top-down data.**

**The most efficient measures for improving air quality and protecting climate in European megacities are:**

- **Expansion of district heating networks**
- **Electric vehicles**
- **Improve traffic management**
- **Kerosene tax for aviation**
- **Replacement of small coal and wood stoves with efficient combustion techniques for natural gas**