POPULATION HEALTH AND COBENEFITS FROM SLCF MITIGATION

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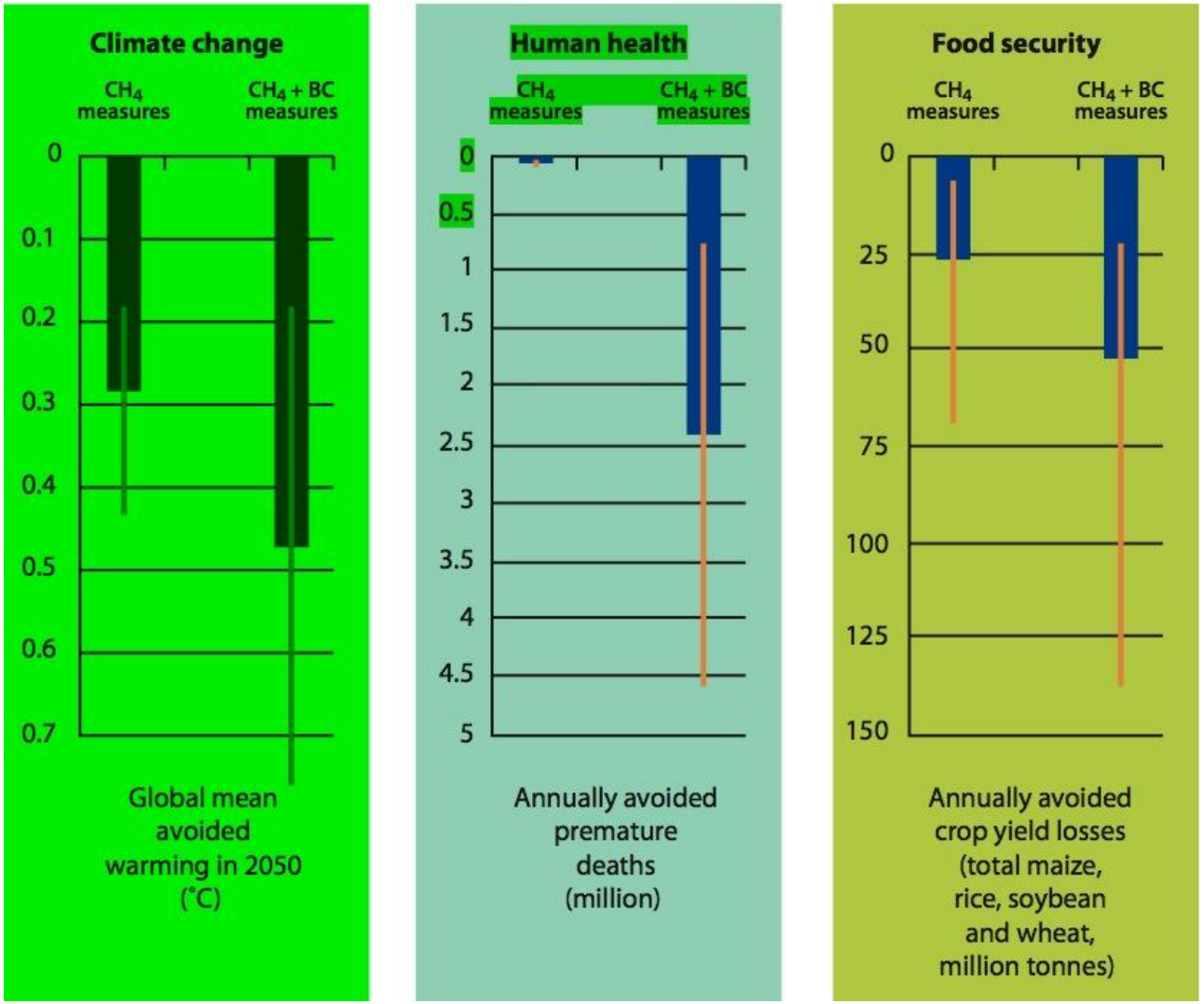
Main results of the UNEP assessment

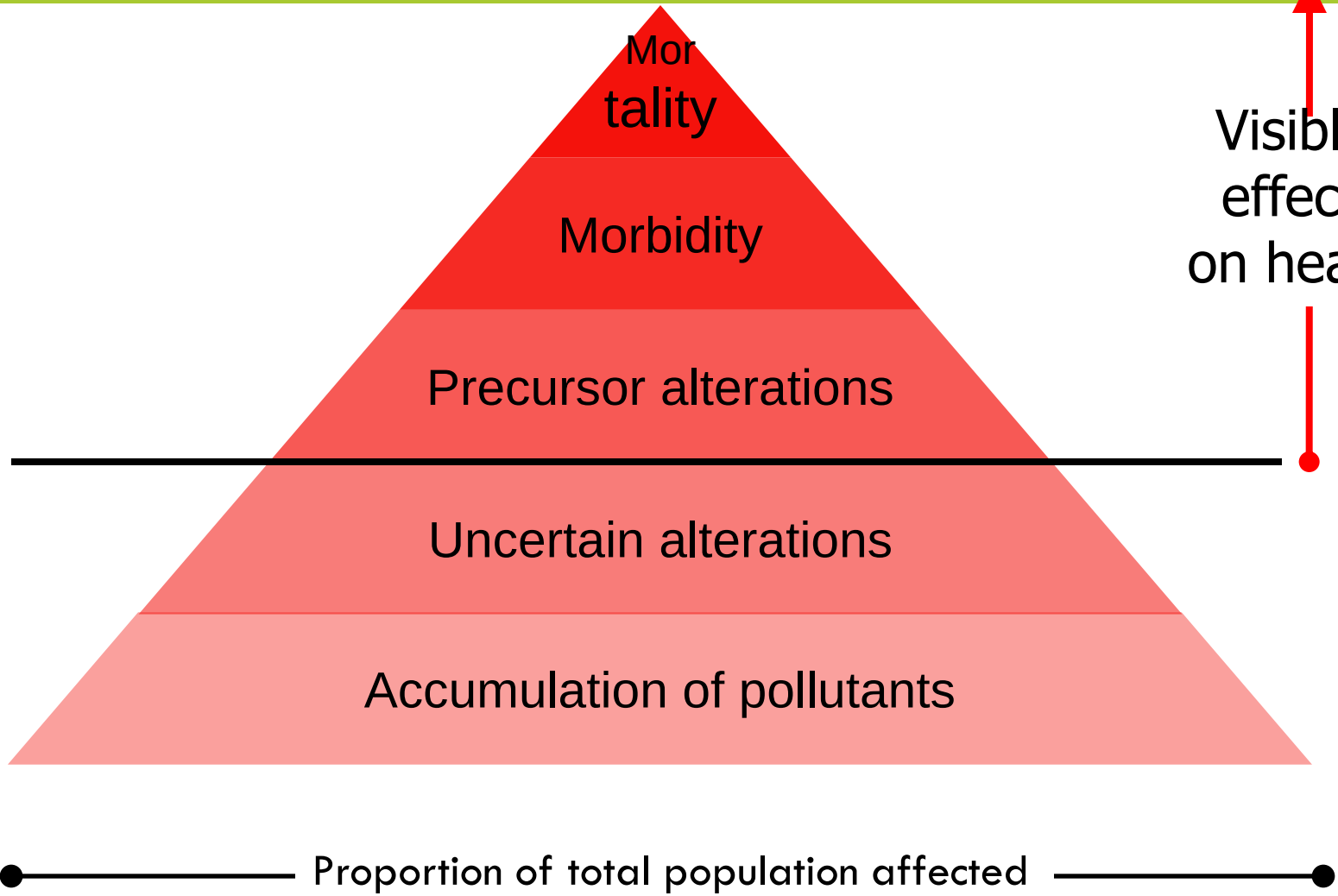


Causal steps

- Mitigation measures
- Reduction of pollutants and CAPs emissions
- Reduction on BC and O3 concentrations, along with a host of other pollutants
- Reduction on health effects
- Valuation of the avoided effects

Impacts of BC and O3 on human health

Biological response to pollution



Which pollutants have an impact on health?

- Particulate matter has long been recognized as having a strong impact on human health, from physiological changes to premature mortality
- The evidence has shown smaller size particles to be more toxic
- Ozone has long been shown to have irritant and oxidant properties, and only recently (~2005) its impact on premature mortality has been recognized.

BC health effects

- BC is part of PM2.5. But does it has a different impact on mortality
- Modest, but growing, volume of literature on the effects of BC:
  - Maynard *et al.*, 2007: acute mortality effects of exposure to BC in homes) , twice as big as PM2.5's.
  - Tonne *et al.*, 2009: increased incidence of heart attacks

Indirect evidence on BC-mortality association

- In relation to $PM_{2.5}$, BC was more strongly associated with:
  - blood pressure (Lundback *et al.*, 2009; Mordukhovich *et al.*, 2009; Zanobetti *et al.*, 2004)
  - markers of the thickening of artery walls (atherosclerosis) (Madrigano *et al.*, 2009; Park *et al.*, 2008; Hansen *et al.*, 2007)
  - electrocardiogram changes that are risk factors for arrhythmia (abnormal electrical activity of the heart) (Zanobetti *et al.*, 2009)
  - electrocardiogram changes that are risk factors for ischemia (restriction in blood supply) (Chuang *et al.*, 2008; Gold *et al.*, 2005)
  - changes in DNA methylation (Baccarelli *et al.*, 2009).

Household BC vs Diesel BC

- BC is a surrogate for all particle mass that comes from diesel in one instance, and from household combustion in the other, and the fellow traveller particles are different in each case.
- So it is important to ask separately about the evidence for household derived BC. Here the evidence is weaker…
- …although it is clear that biomass combustion increases the risk of respiratory disease (Samuelsen *et al.*, 2008; Dherani *et al.*, 2008; Smith *et al.*, 2000; Lipsett *et al.*, 1997).
- Recently, a randomized trial of a chimney stove intervention in Guatemala was shown to reduce blood pressure (McCracken *et al.*, 2007). Since blood pressure is a major risk factor for cardiovascular mortality, this provides support for the association of BC from such combustion and mortality.

BC mortality risk

- Given that :
  - traffic related BC is more toxic than average
  - and the weaker evidence on the relative toxicity of biomass particles
- It was assumed that BC particles have the same risk as PM2.5 (average risk)

Scope

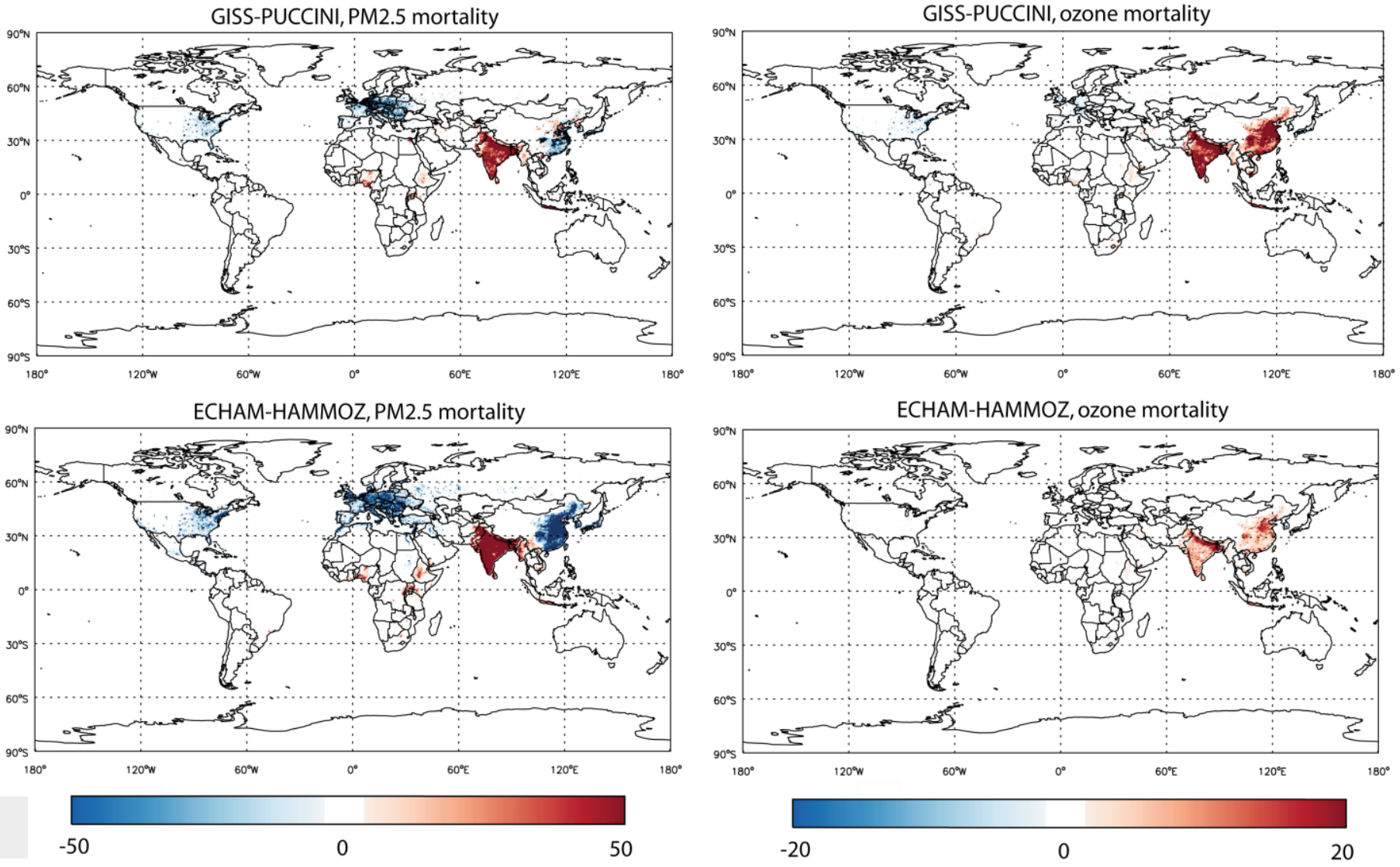
- Health impacts in 2030 due to the change in $PM_{2.5}$ and O_3 concentrations projected in 2030 relative to 2005 concentrations based on the reference scenario.
- Change in ambient concentrations simulated by two models: GISS-PUCCINI and ECHAM-HAMMOZ
- Endpoints considered:
  - PM : cardiopulmonary mortality and lung cancer
  - O_3 : respiratory mortality
  - Years of life lost (YLL) calculated based on current life expectancies.

Scope

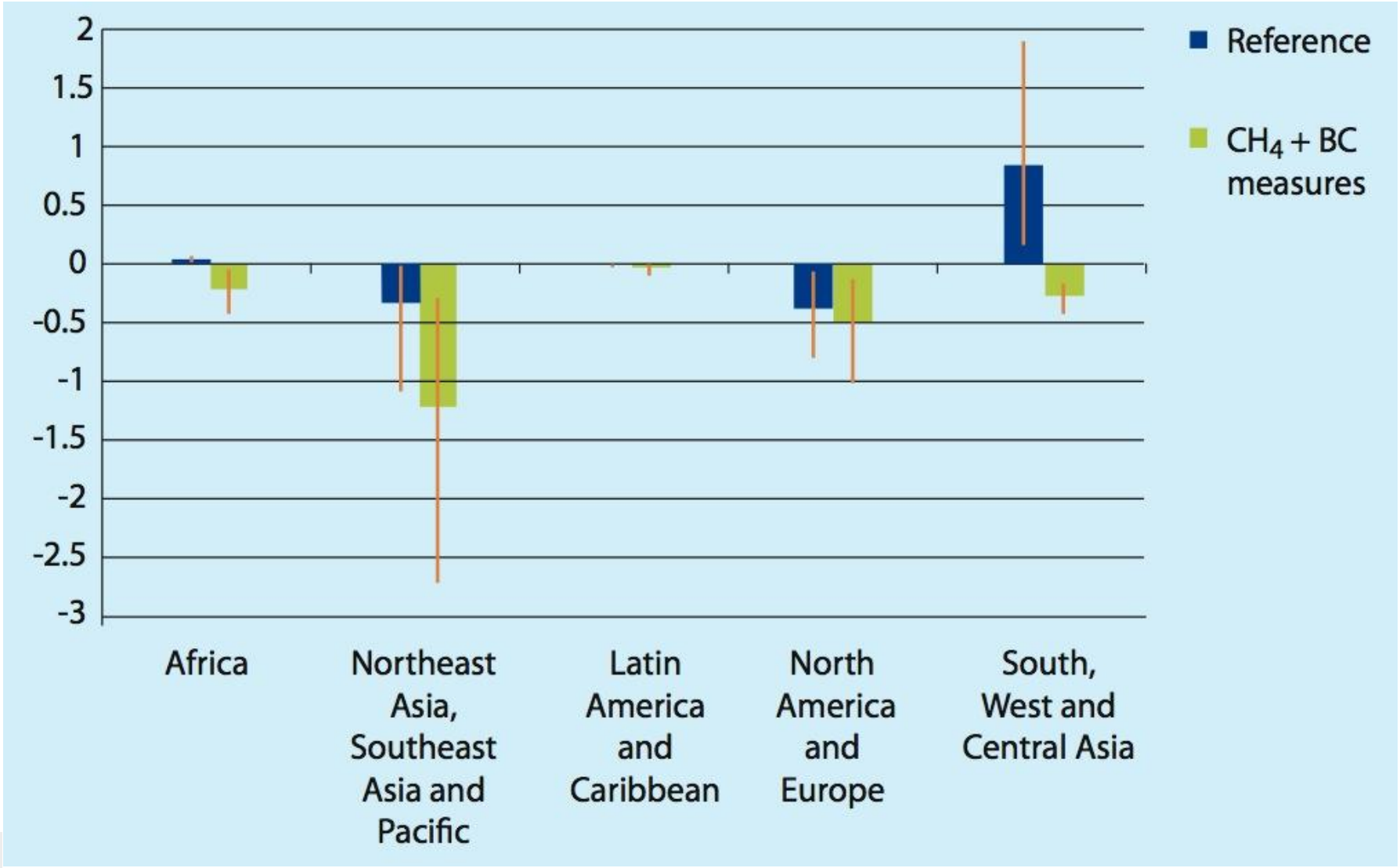
- **Outdoor air pollution**
  - PM2.5 and O3 considered.
  - Unit risk from EPA's expert elicitation: 1.06% per ug/m3 PM2.5 (1.8x ACS risk). Linear function.
- **Indoor Air Pollution**
  - To be conservative, only respiratory mortality considered
  - Only India and China considered due to data limitations

Results

Change in annual $PM_{2.5}$ cardiopulmonary and lung cancer and O_3 respiratory mortality (lives per 1 000 km^2) in 2030 relative to 2005 for the reference scenario.



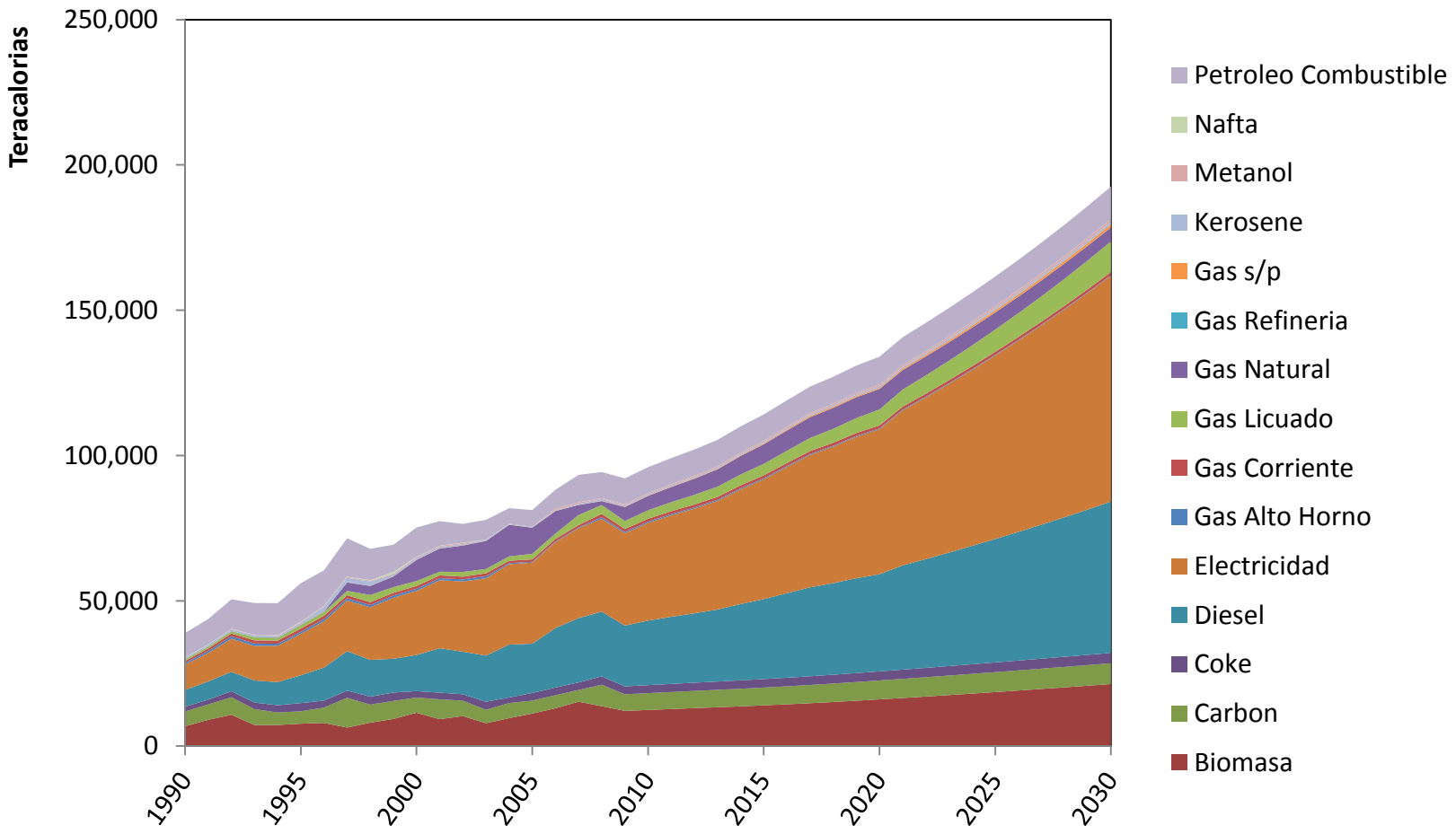
Premature mortality (millions of premature deaths annually) by region, showing the change in 2030 in comparison with 2005



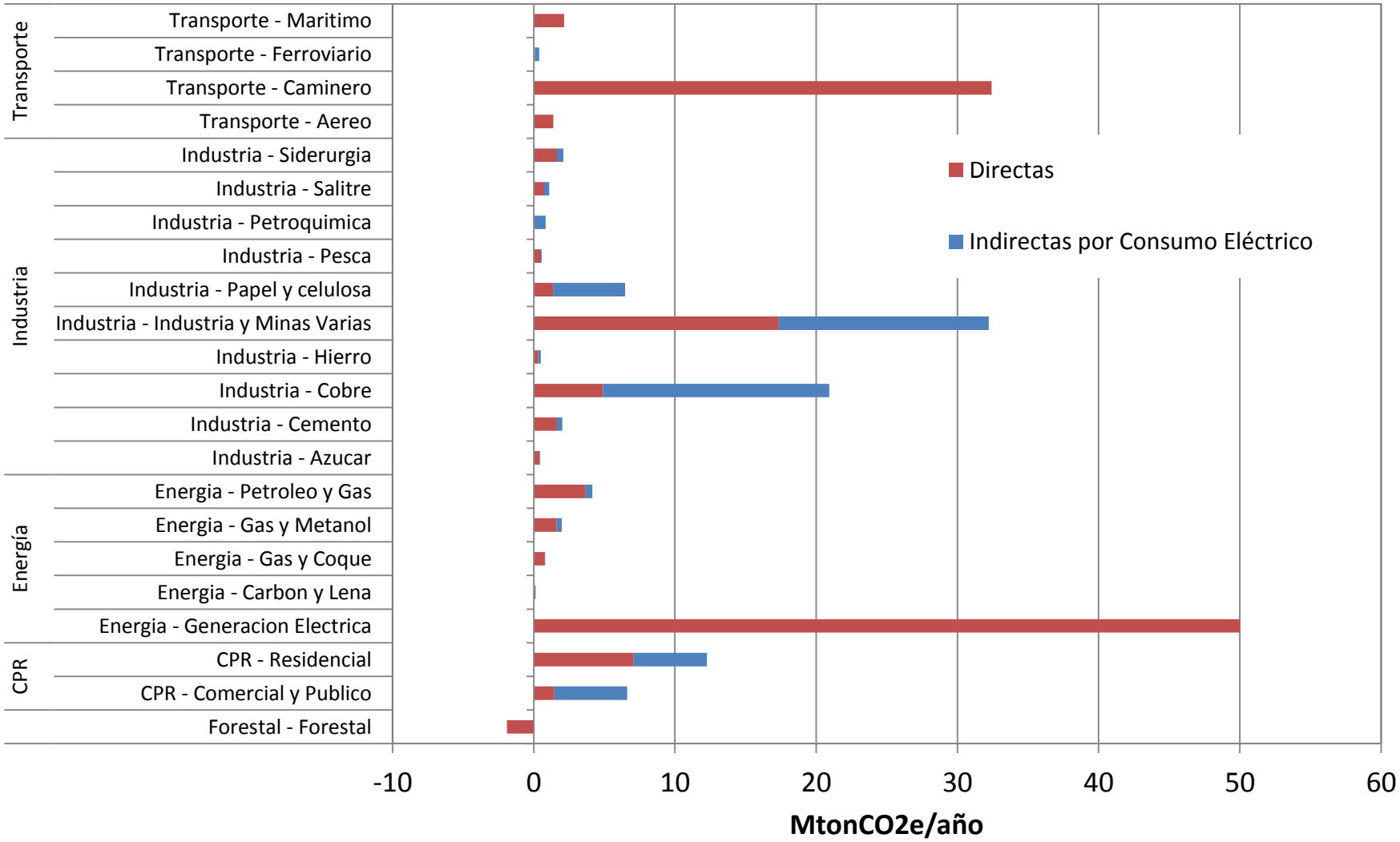
Cobenefits of Climate Mitigation Actions in Chile

1. Although Chile has not formal mitigation commitment, in Copenhagen it pledged a voluntary reduction of 10% + 10%
2. What are the costs of this pledge?
3. What are the public health benefits of it?

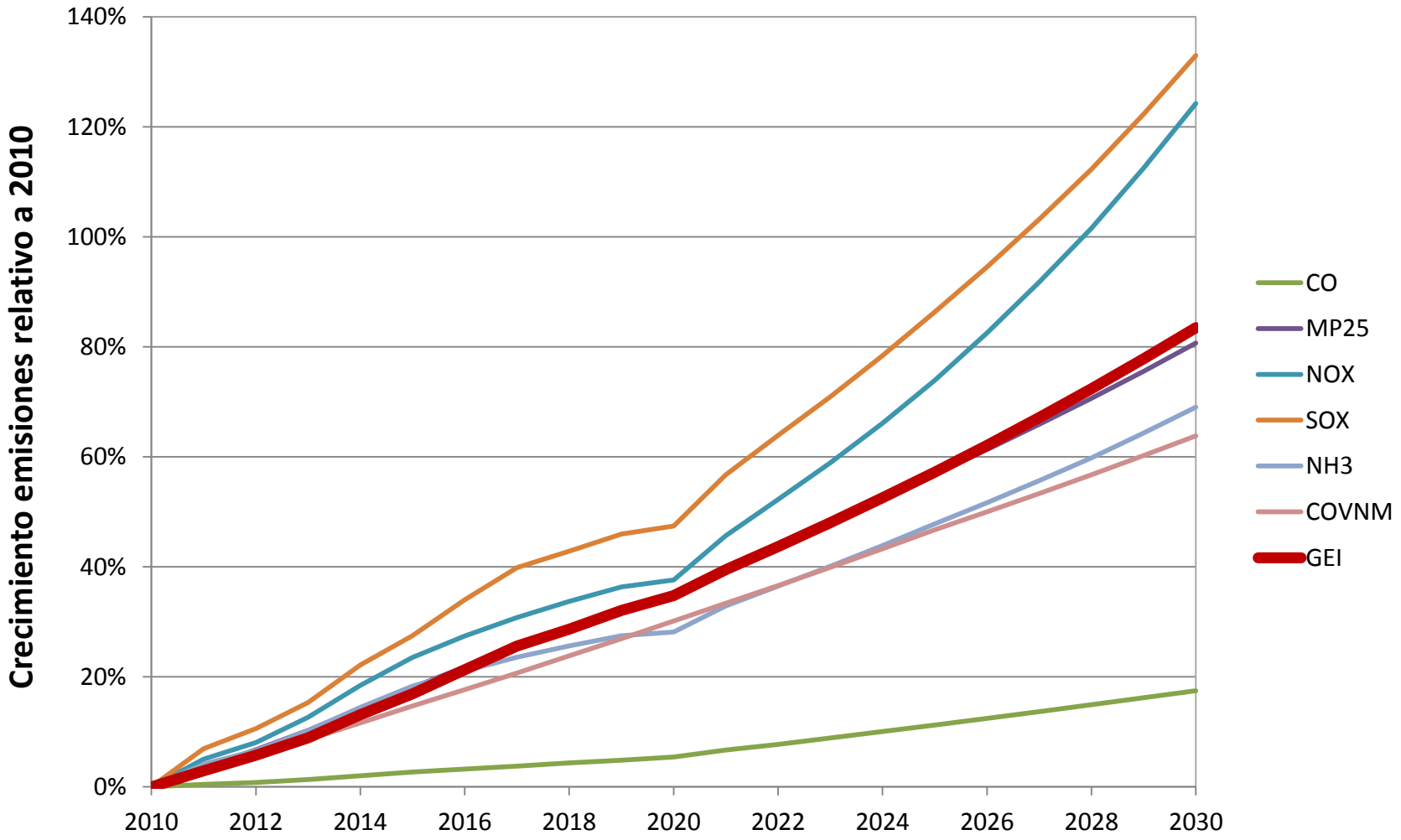
Enery consumption is rapidly growing



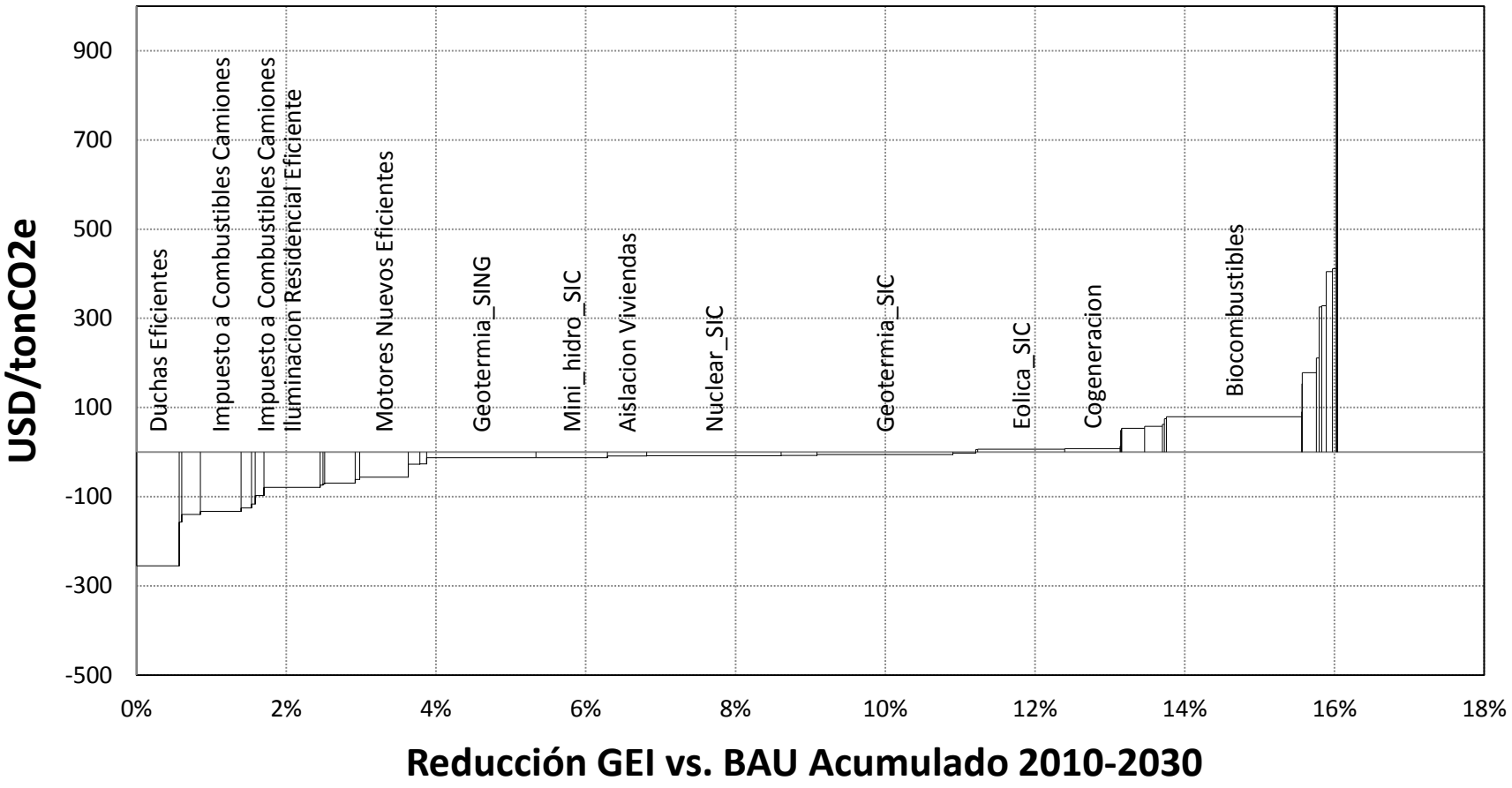
Emisiones de GEI directas e indirectas Año 2030



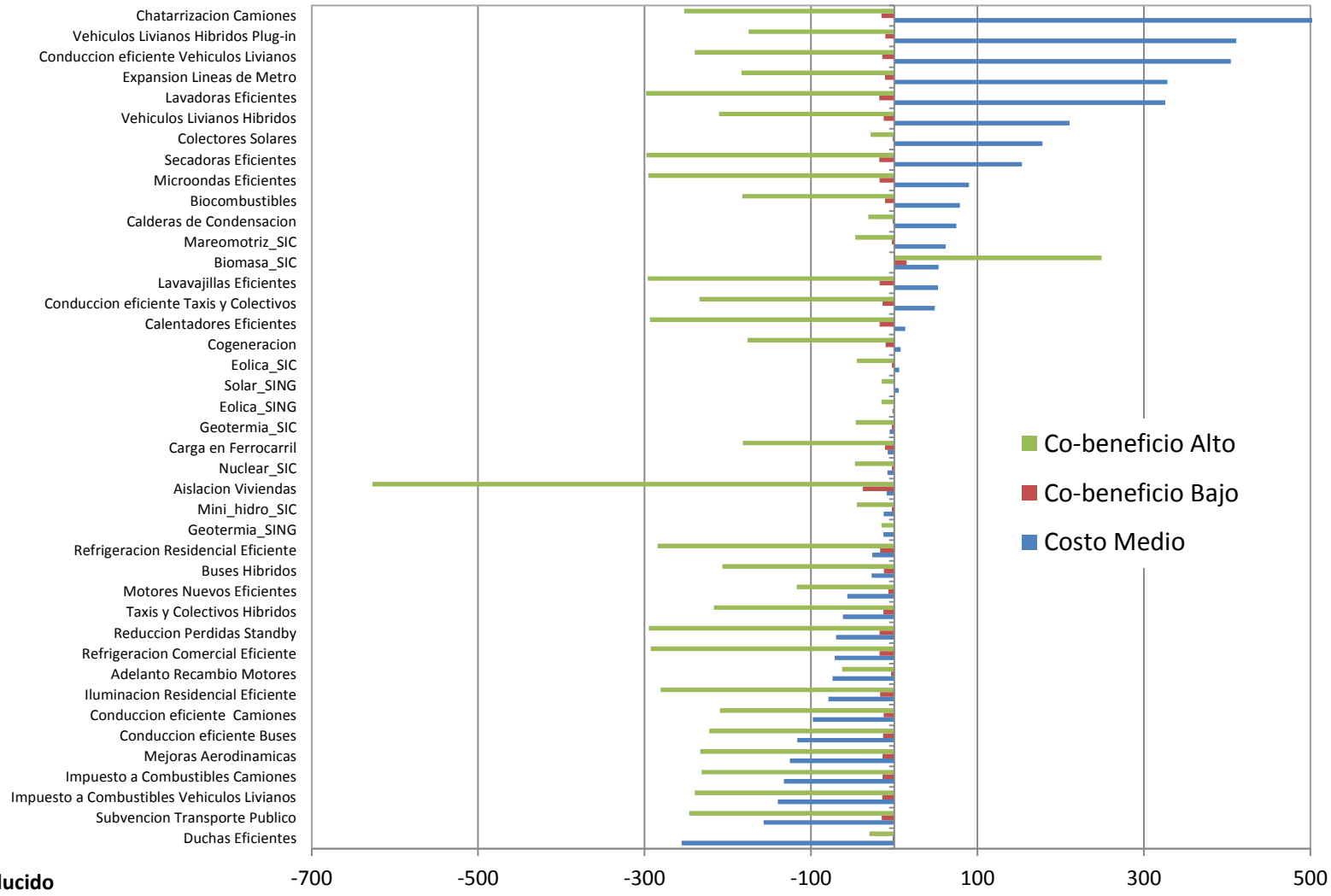
Emissions Growth in the BAU scenario relative to 2010



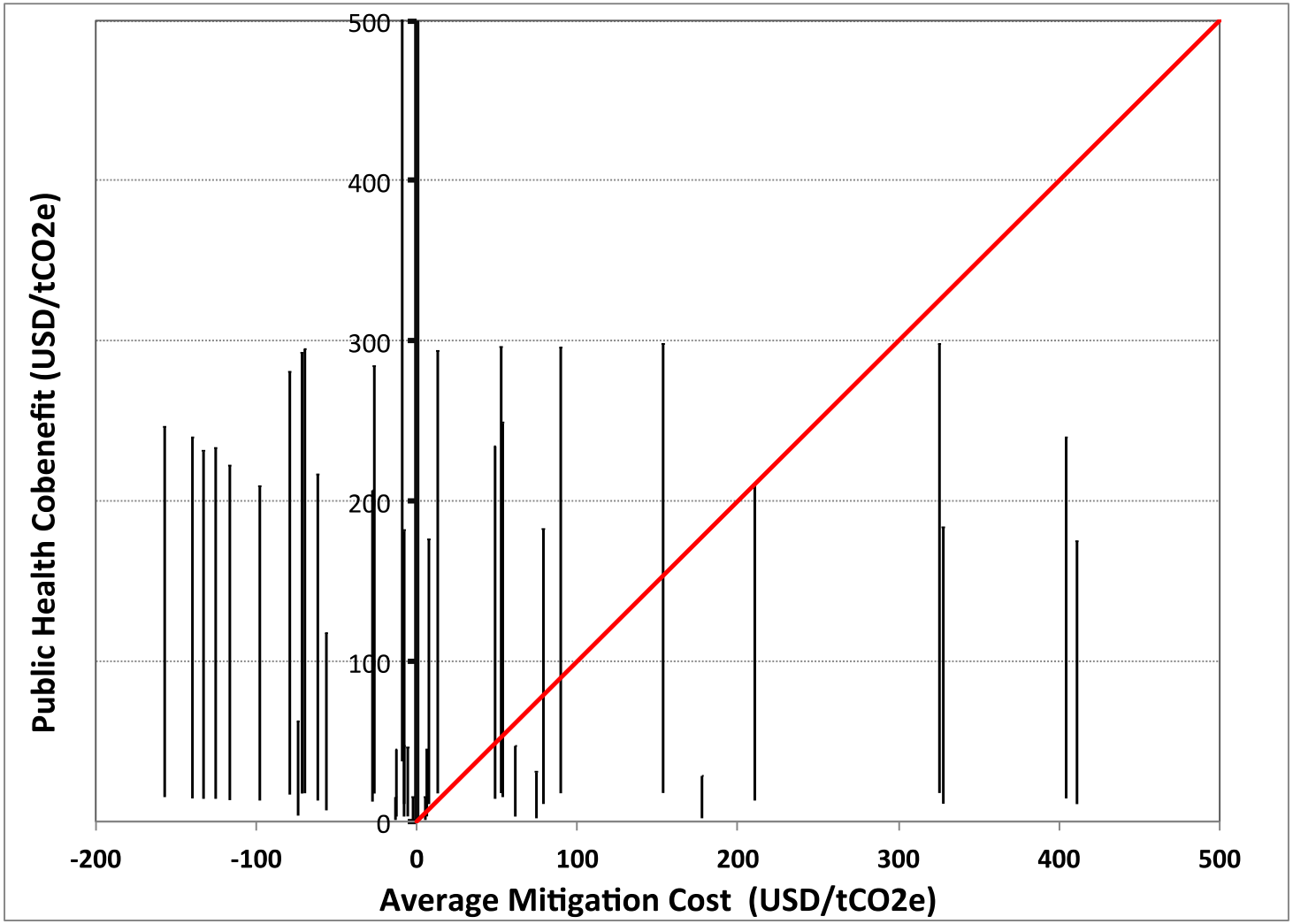
Marginal Mitigation Cost Curve



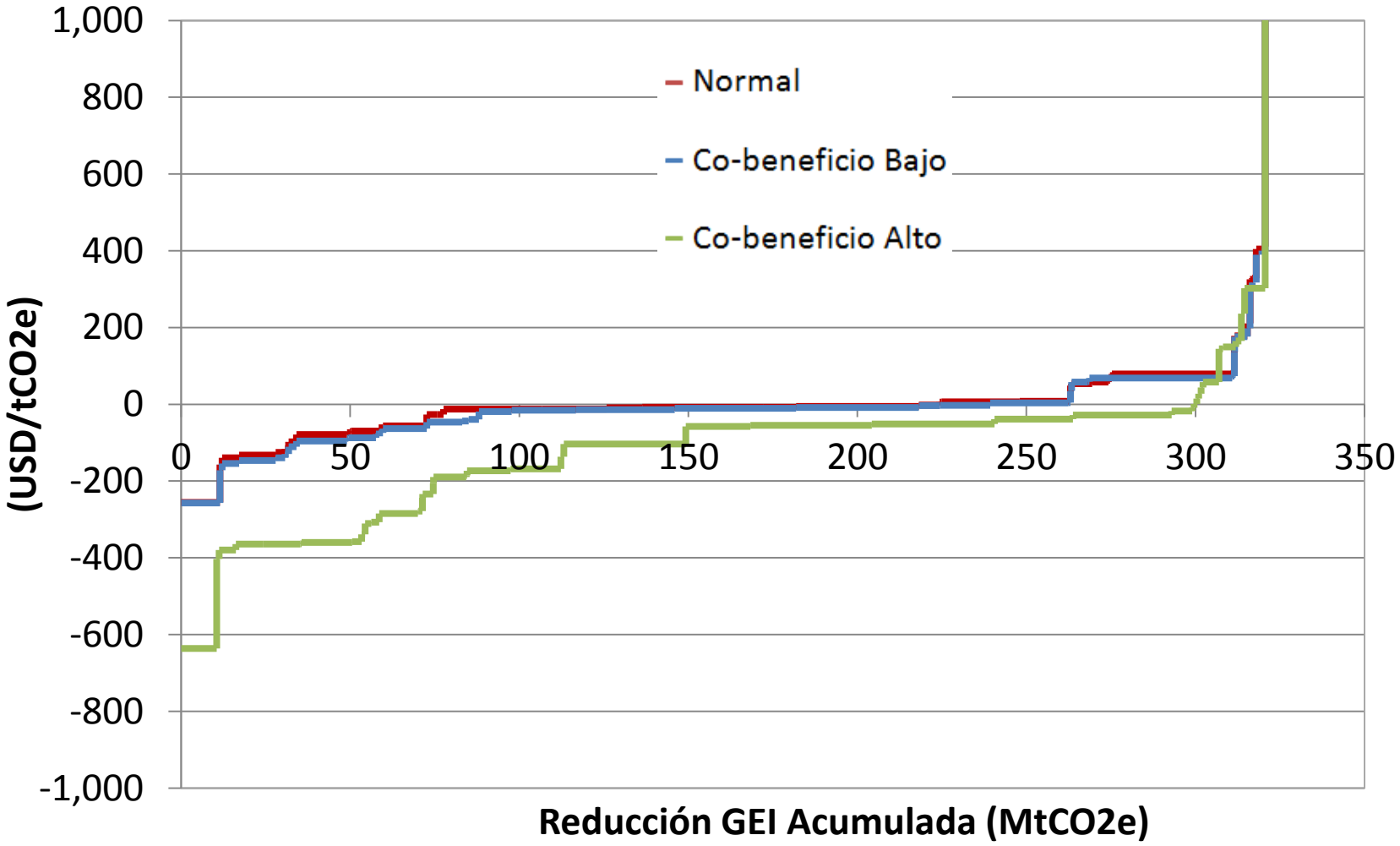
Average cost and public health benefit by measure 2010-2030 (mid scenario)



Cobenefits are generally higher than mitigation costs

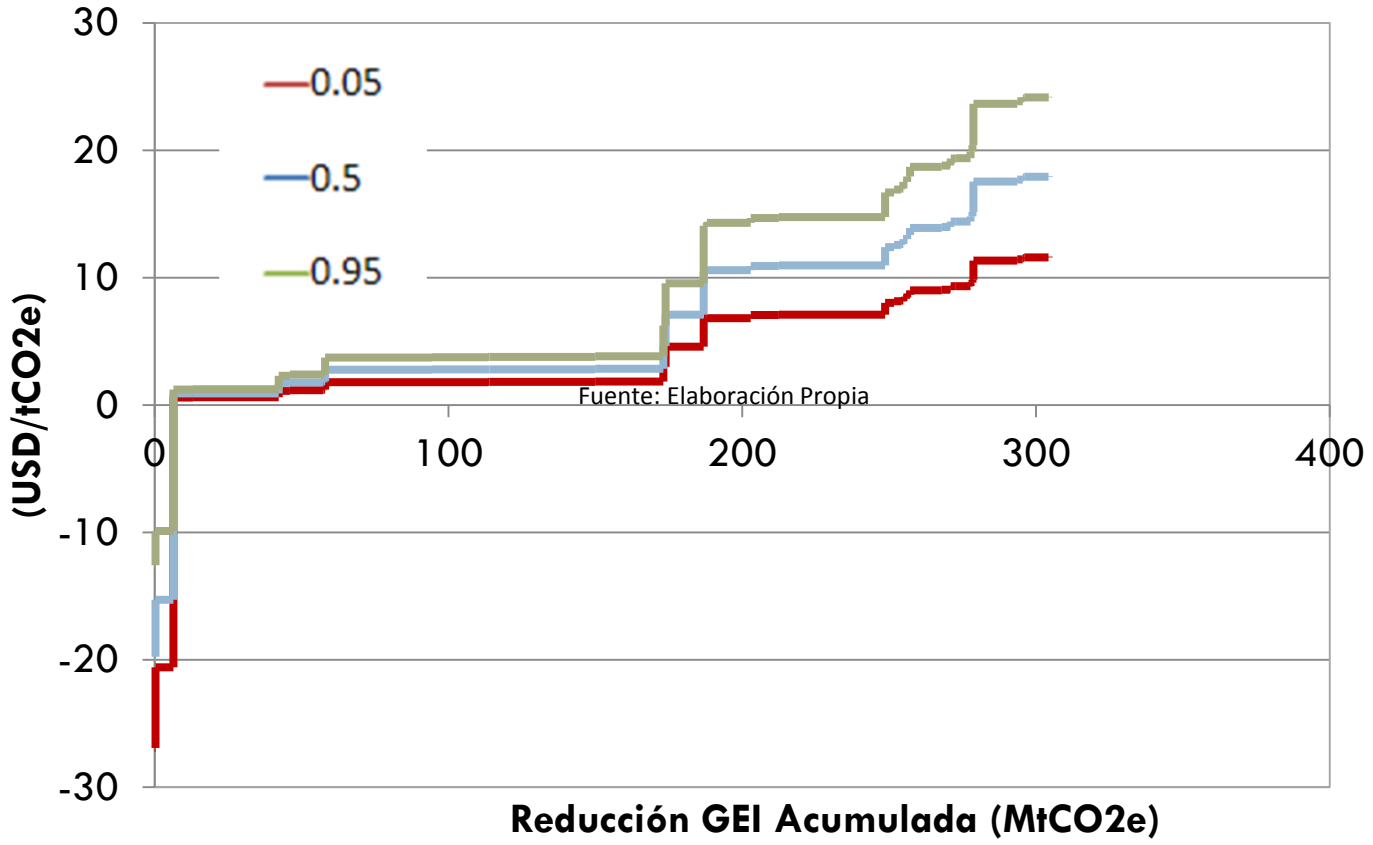


Marginal mitigation costs including co-benefits



Uncertainty on the public health benefits

- **Curva de co-beneficios Escenario Bajo de valoración - Escenario MIT Medio**



Co-benefits by Measure 2010-2030 (mid scenario)

Medida	Co-beneficio (USD/tCO2e)
Aislación Viviendas	[38 - 627]
Chatarrización Vehículos Livianos	[18 - 299]
Electrodomésticos Eficientes	[18 - 298]
Refrigeración Comercial Eficiente	[17 - 292]
Refrigeración Residencial Eficiente	[17 - 284]
Iluminación Residencial Eficiente	[17 - 281]
Chatarrización Camiones	[15 - 253]
Subvención Transporte Publico	[15 - 246]
Medidas a los vehículos livianos	[14 - 240]
Impuesto a Combustibles Camiones	[14 - 231]
Conducción eficiente Buses	[13 - 222]
Vehículos livianos Híbridos	[13 - 210]
Conducción eficiente Camiones	[13 - 209]
Buses Híbridos	[12 - 207]
Biocombustibles	[11 - 183]
Expansión Líneas de Metro	[11 - 184]
Carga en Ferrocarril	[11 - 182]
Vehículos Livianos Híbridos Plug-in	[11 - 175]
Cogeneración	[10 - 176]
Motores Nuevos Eficientes	[7 - 117]
Adelanto Recambio Motores	[4 - 63]
Renovables Limpias SIC	[3 - 47]
Medidas de reducción consumo Agua Caliente	[2 - 30]
Renovables Limpias SING	[1 - 15]
Biomasa_SIC	[-15 - -249]

Thanks a lot

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