

# Environmental Health Impacts of European Policies for Mitigation of and Adaptation to Climate Change – a Case Study for Integrated Health Assessment Using the INTARESE/HEIMTSA Methodology

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## **The issue:**

**Main criteria for selecting policies and measures for mitigation of and adaptation to climate change:**

- **reduction of CO<sub>2</sub>eq. emissions (mitigation)**
- **reduction of climate change impacts (adaptation)**
- **costs and distribution of costs (who pays how much)**

## **However:**

**Relevant side benefits or side detriments might exist, especially secondary environmental health impacts.**

**Examples: production and burning of biomass, renewables and nuclear instead of coal and gas for electricity production, lower air exchange rate indoors, wood stoves indoors...**

**These side effects should be taken into account, if relevant!**

## The Question:

**What are the (negative or positive) impacts of**

- a) EU mitigation options (policies and resulting measures) to reduce greenhouse gas emissions**
- b) EU adaptation options (policies and resulting measures) to reduce impacts of climate change on human health worldwide?**

**-> Case Study of EU projects INTARESE and HEIMTSA (EC FP6 funded projects on Integrated Assessment of Health Risks from Environmental Stressors in Europe)**

# Approach:

## Step 1: Develop scenarios

### **'Business as usual' scenario:**

Activities and emission factors follow trend and include agreed policies, however no climate change mitigation measures after 2012;

Some adaptation measures included;

GHG emissions and climate change according to IPCC A1B scenario

### **Climate protection scenario:**

World wide strategy to limit temperature increase to 2° ;

-71% GHG emissions 1990-2050 for EU; Implementation of the EU energy and climate package;

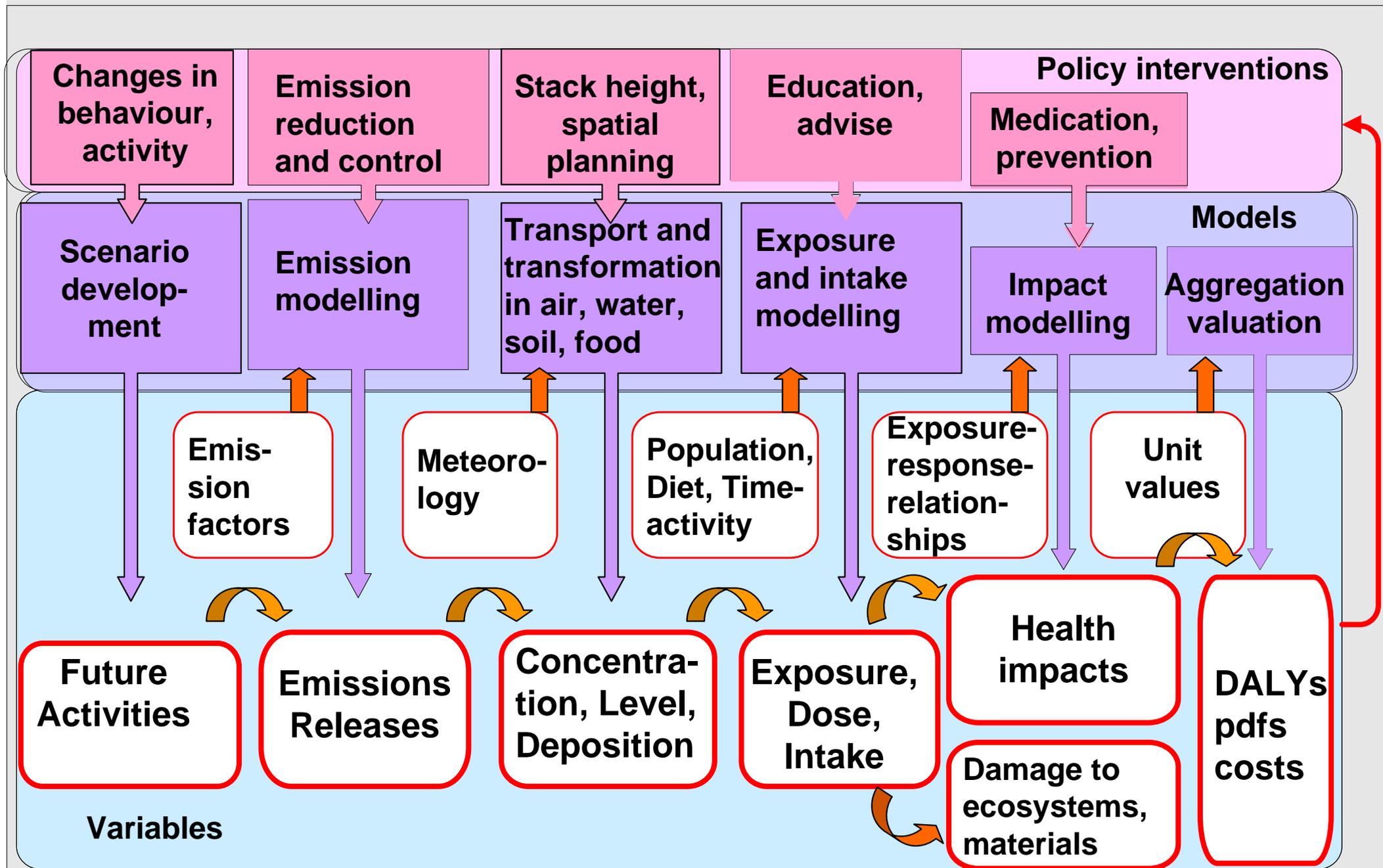
Optimal system fulfilling '2° aim'

**Step 2: Estimate impacts (health, ecosystem, materials) using the Full Chain or Impact Pathway Approach**

**Step 3: Allocate shares of overall differences to policies**

## Policies and Measures Included in the Climate Scenario

- **Energy supply: more wind, biomass (incl. wood stoves), natural gas, solar, nuclear, CHP (combined heat and power), some CCS (carbon capture and storage)**
- **Energy demand: more insulation, heat pumps, changed industry processes, more air conditioning...**
- **Transport: more electric, biofuels, hybrid; enhanced public transport and bicycle use; speed limits; fuel taxes, city tolls, road pricing;**
- **Agriculture: production of energy crops, reduced consumption of red meat and milk products;**



## Examples of Concentration-Response-Relationships Used

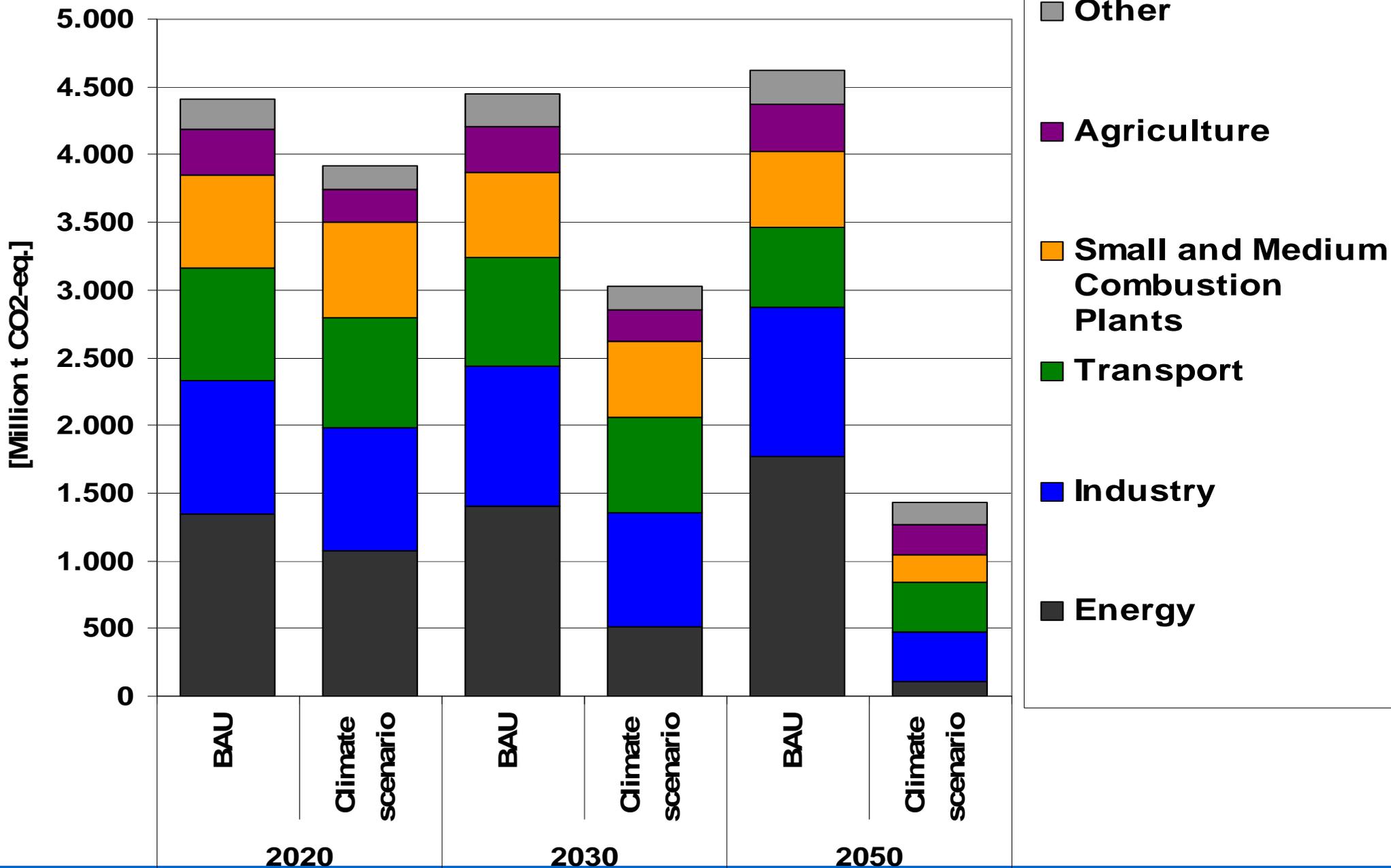
(source: Torfs, Hurley, Miller, Rabl –NEEDS project)

<b>Endpoint</b>	<b>CRF slope: impact per person per <math>\mu\text{g}</math> PM<sub>2.5</sub> per m<sup>3</sup></b>	<b>unit</b>
<b>Life expectancy reduction - YOLL</b>	<b>6.51E-04</b>	<b>YOLL</b>
<b>net Restricted activity days (netRADs)</b>	<b>9.59E-03</b>	<b>days</b>
<b>Work loss days (WLD)</b>	<b>1.39E-02</b>	<b>days</b>
<b>Minor restricted activity days (MRAD)</b>	<b>3.69E-02</b>	<b>days</b>

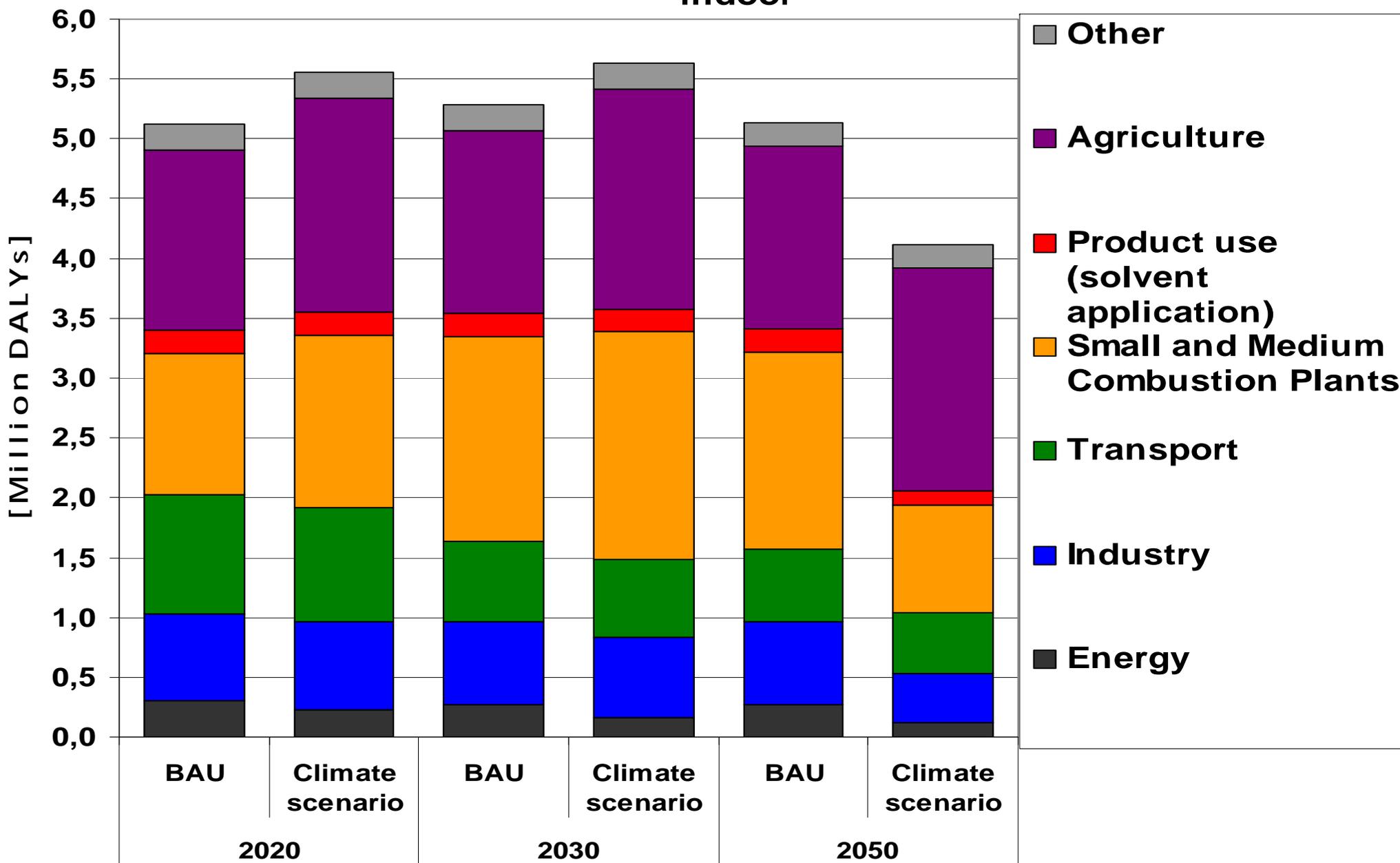
<b>Endpoint</b>	<b>CRF slope: impact per person per <math>\mu\text{g}</math> PM<sub>10</sub> per m<sup>3</sup></b>	<b>unit</b>
<b>Increased mortality risk (infants)</b>	<b>6.84E-08</b>	<b>cases</b>
<b>New cases of chronic bronchitis</b>	<b>1.86E-05</b>	<b>cases</b>
<b>Respiratory hospital admissions</b>	<b>7.03E-06</b>	<b>cases</b>
<b>Cardiac hospital admissions</b>	<b>4.34E-06</b>	<b>cases</b>
<b>Medication use / bronchodilator use</b>	<b>4.03E-04</b>	<b>cases</b>
<b>Medication use / bronchodilator use</b>	<b>3.27E-03</b>	<b>cases</b>
<b>Lower respiratory symptoms (adult)</b>	<b>3.24E-02</b>	<b>days</b>

**Stressors considered include: PM<sub>10</sub>; PM<sub>2.5</sub>; ozone; NO<sub>x</sub>; SO<sub>2</sub>; NMVOC; NH<sub>3</sub>; CH<sub>4</sub>; N<sub>2</sub>O; CO; CO<sub>2</sub>; C<sub>14</sub>; heavy metals; pesticides; heat; fertilizers**

Total tCO<sub>2</sub>-eq. in EU-29



**Environmental human health impacts for EU-29, except climate, indoor**



# Analysis of Single Measures

- **Energy Policies** (mDALYs / t CO<sub>2</sub> avoided):
  - i. Electricity production with more wind replacing coal : - 0.4
  - ii. Coal fired plants with CCS: -0.1
  
- **Transport Policies** (mDALYs / t CO<sub>2</sub> avoided):
  - i. Electric cars : -0,2
  - ii. City toll in all European metropolitan areas -0,1

An increase of DALYs is expected for

biomass use: e.g. wood in small furnaces

better insulation of houses (increase of mould, env. tobacco smoke, radon conc.)

1 mDALY = one thousandths of a DALY; 1 DALY = 1 disability adjusted life year

## Assessment of results:

- **Marginal avoidance costs for reaching 2° aim: 2020 ca 40€/t CO<sub>2</sub>**
- **Monetary value of a statistical life year lost (NEEDS survey):**  
**40 000 €/life year lost = 40€/per milliDaly**

**Thus 0,4 mDALYs per t of CO<sub>2</sub> avoided means, that the importance of avoided health impacts is about 40% of that of avoided greenhouse gas emissions.**

# Conclusions

- i. The impact of most climate change mitigation policies on environmental human health is about as important as the climate change effects.**
- ii. Some policies, e.g. biomass burning and reducing air exchange rates in houses, cause quite high additional health impacts.**
- iii. In general: relevant ‘side effects’ might change policy recommendations substantially and should thus be taken into account when making decisions**

More information: [www.integrated-assessment.eu](http://www.integrated-assessment.eu) (from October 2010); [www.ExternE.info](http://www.ExternE.info) (impact pathway approach)