# *Time for action?*

## *Options to address climate change*

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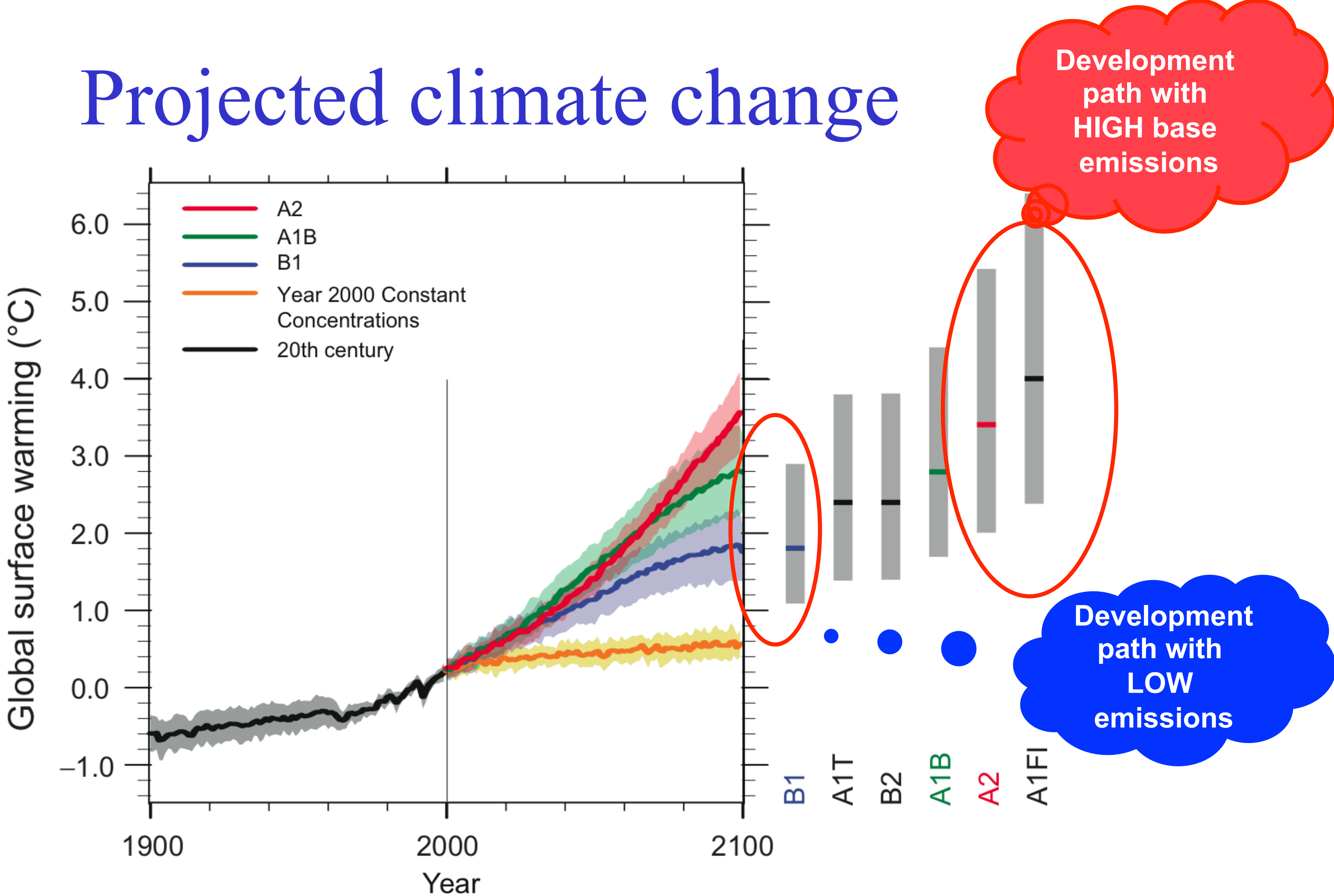
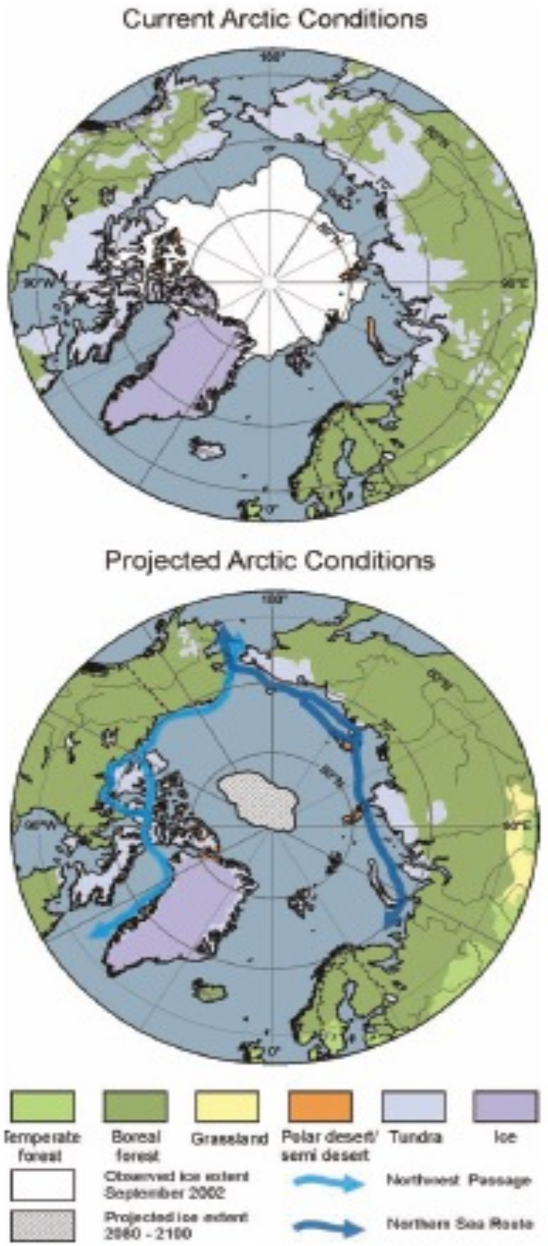
Dublin, November 27th, 2007

# Projected climate change



# Projected changes in the Arctic by 2090-2100



# Food production threatened

Grain productivity in tropics goes down at any warming;

Rainfall patterns change and risk of drought increases (particularly in dry areas)

In temperate areas productivity of some crops increases with moderate warming;

With more than 3 degrees warming also there a decline

# Nature seriously threatened

Temp increase 1 2 3 4 5

Coral: bleaching already happening; dying at 1-3 degrees warmer water


Alpine flora: in 2080 60% threatened with extinction

20-30% of species threatened with extinction at 1,5-2,5 degrees warming

Extensive extinction of species

Eastern Amazone turns into savanna by 2050

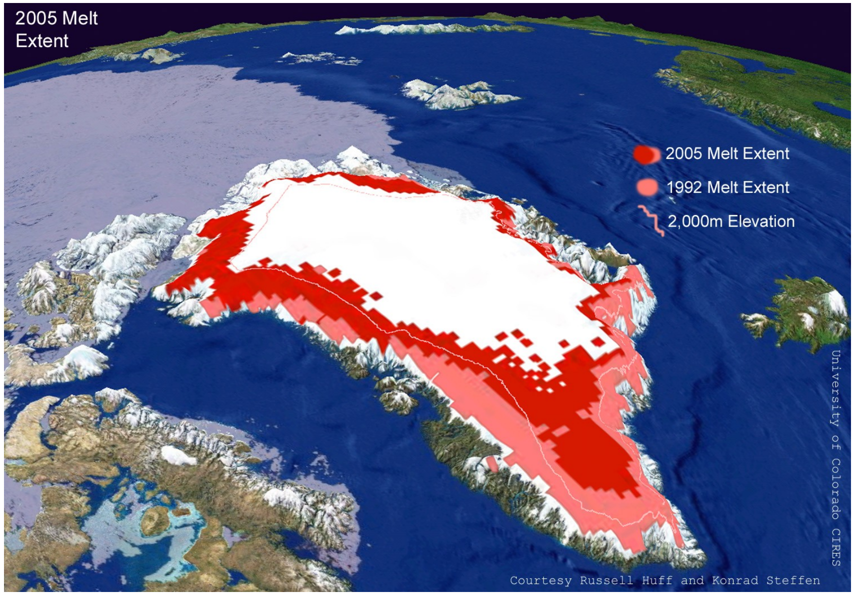
# Threatened deltas


Relative vulnerability of coastal deltas as indicated by the indicative population potentially displaced by <u>current</u> sea-level trends to 2050 (Extreme $\geq$ 1 million; high 1 million to 50,000; medium 50,000 to 5,000)

# Sea level rise unstoppable

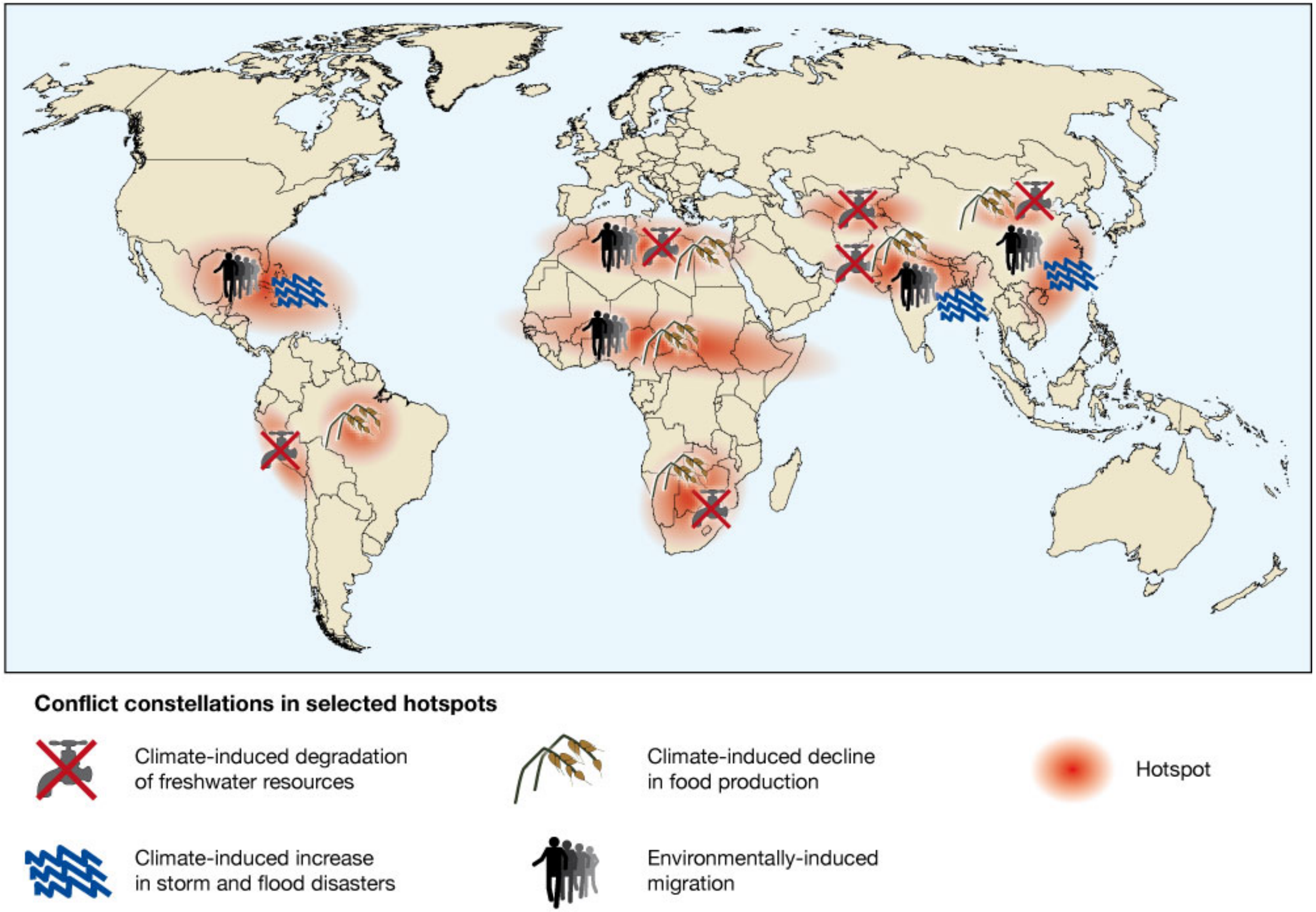
- 2100: 20 -60 cm
- Many centuries: several meters

  (WITHOUT melting Greenland/ Antarctica ice sheets)



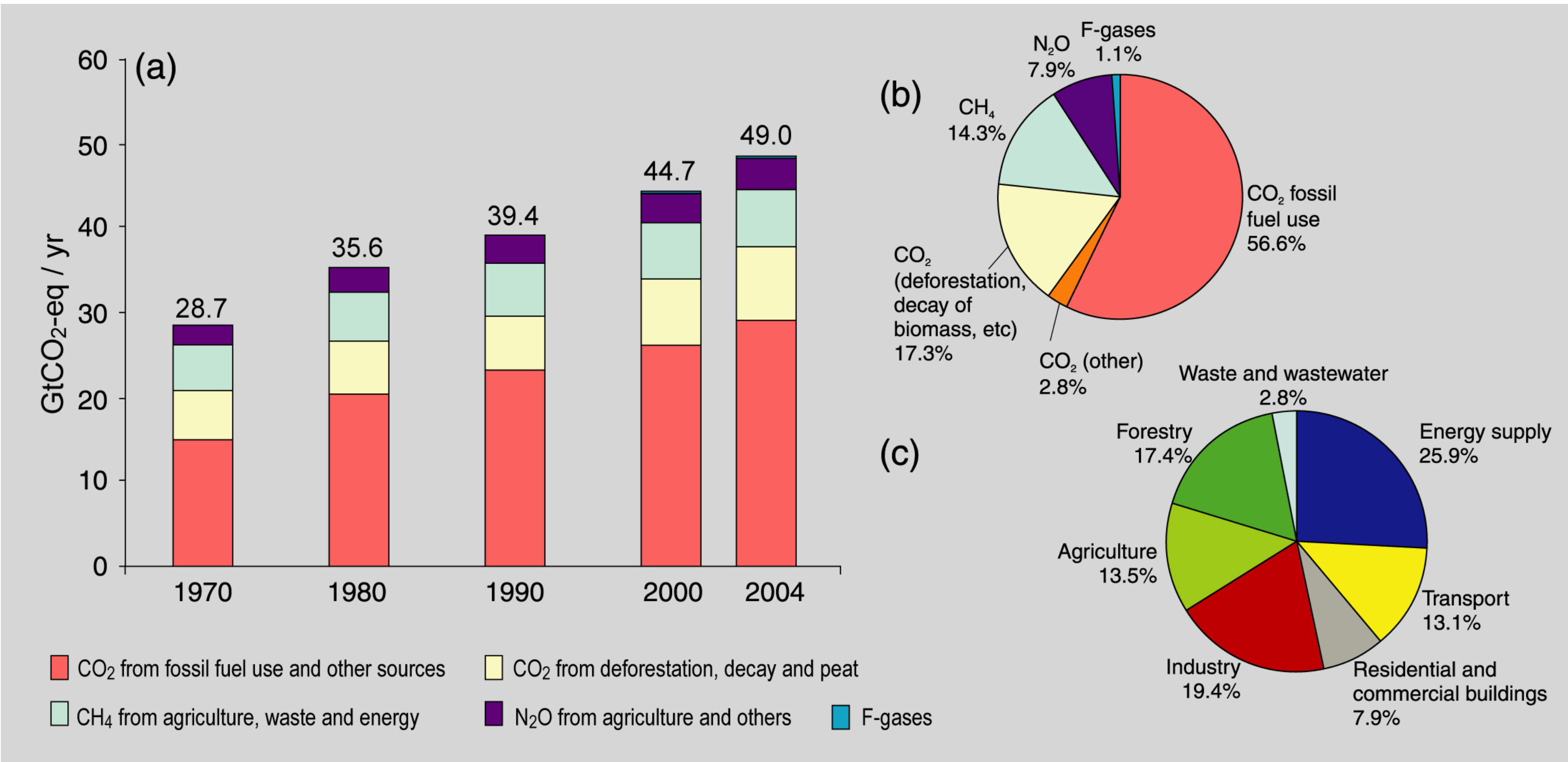

- 1.5 to 4°C warmer for several centuries/ thousands of years: up to 7m increase from melting Greenland ice sheet (like 125,000 years ago)

# Security risks associated with climate change

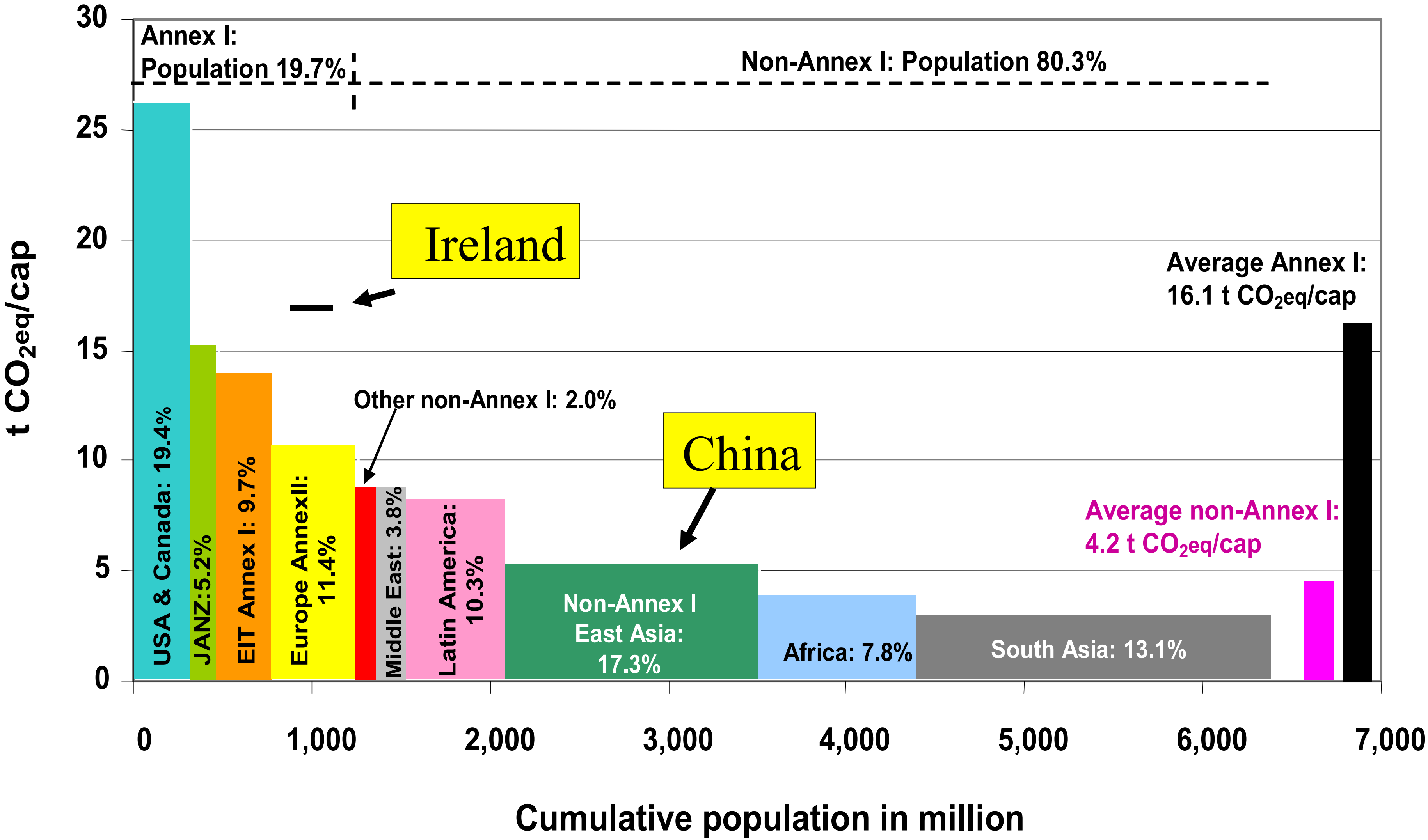



Source:German Advisory Council on Global Change, 2007

# Emissions of Greenhouse Gases increased by 70% between 1970 and 2004



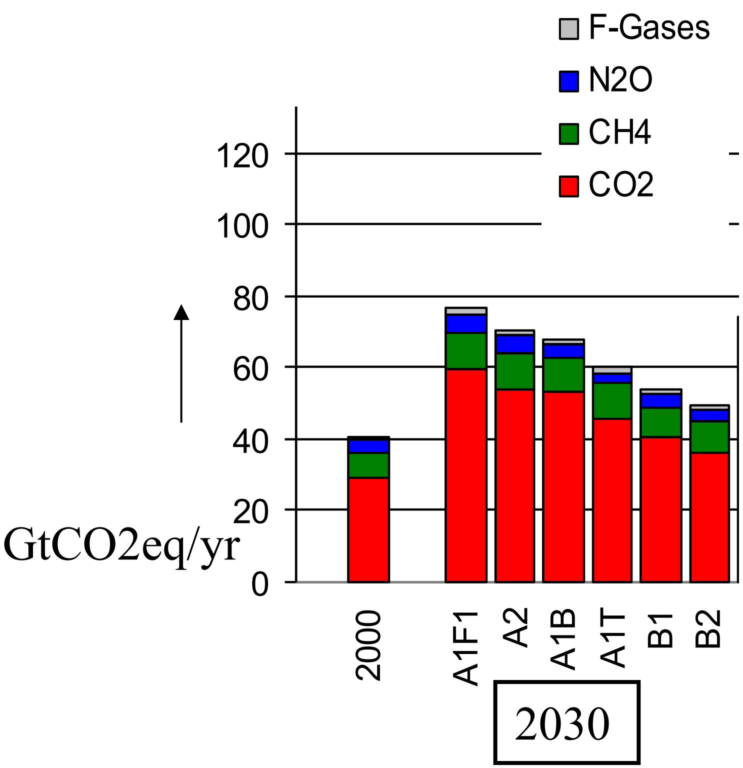
# Differences in per capita emissions




IPCC

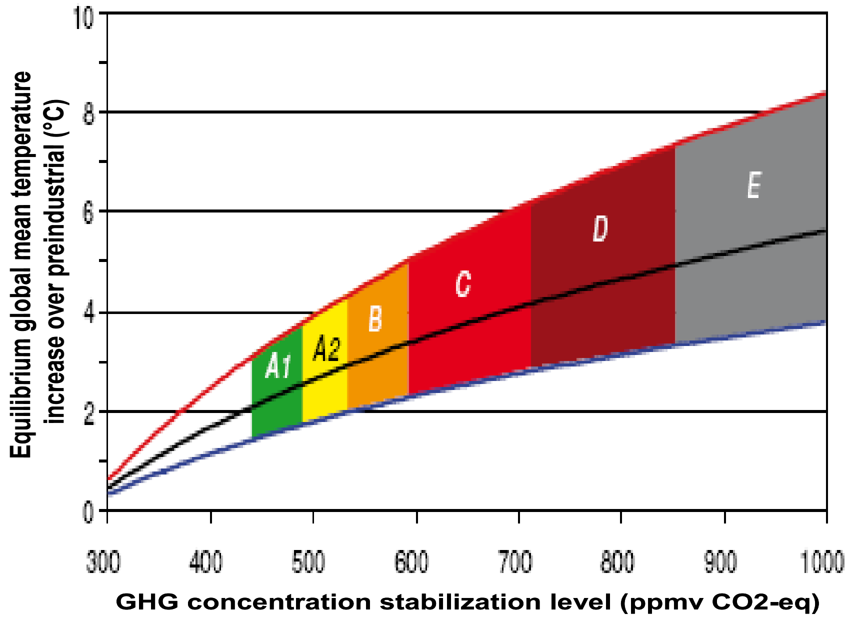
# With current climate change mitigation policies *and related sustainable development practices*, global GHG emissions will continue to grow over the next few decades

- IPCC SRES scenarios: 25-90 % increase of GHG emissions in 2030 relative to that of 2000
- Two thirds to three quarters of the increase of $CO_2$ emissions are projected to come from developing countries
- Average per capita $CO_2$ emissions in developing country regions will remain substantially lower (2.8– 5.1 $tCO_2$/cap) than in developed country regions (9.6-15.1 $tCO_2$/cap).



# The key question: can “dangerous anthropogenic climate change” be avoided?

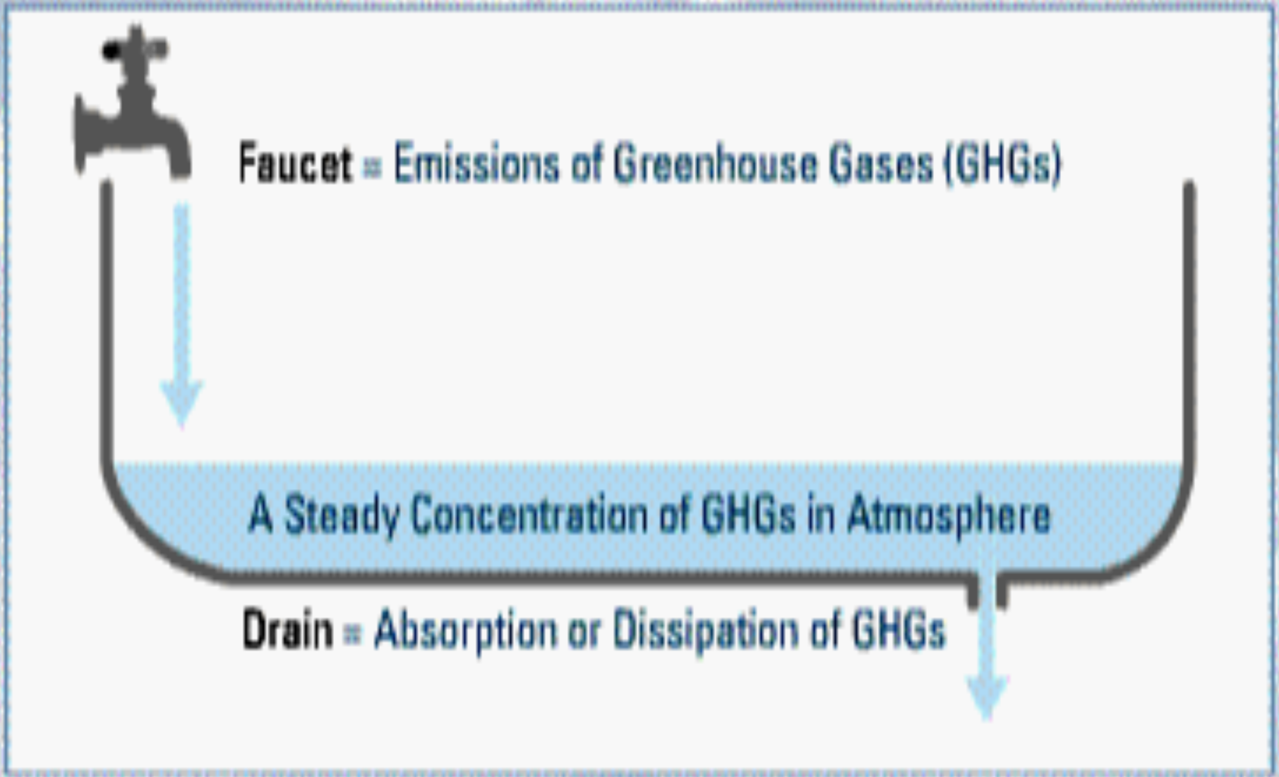
EU, Norway




At 2 degrees global mean warming serious adaptation is required!

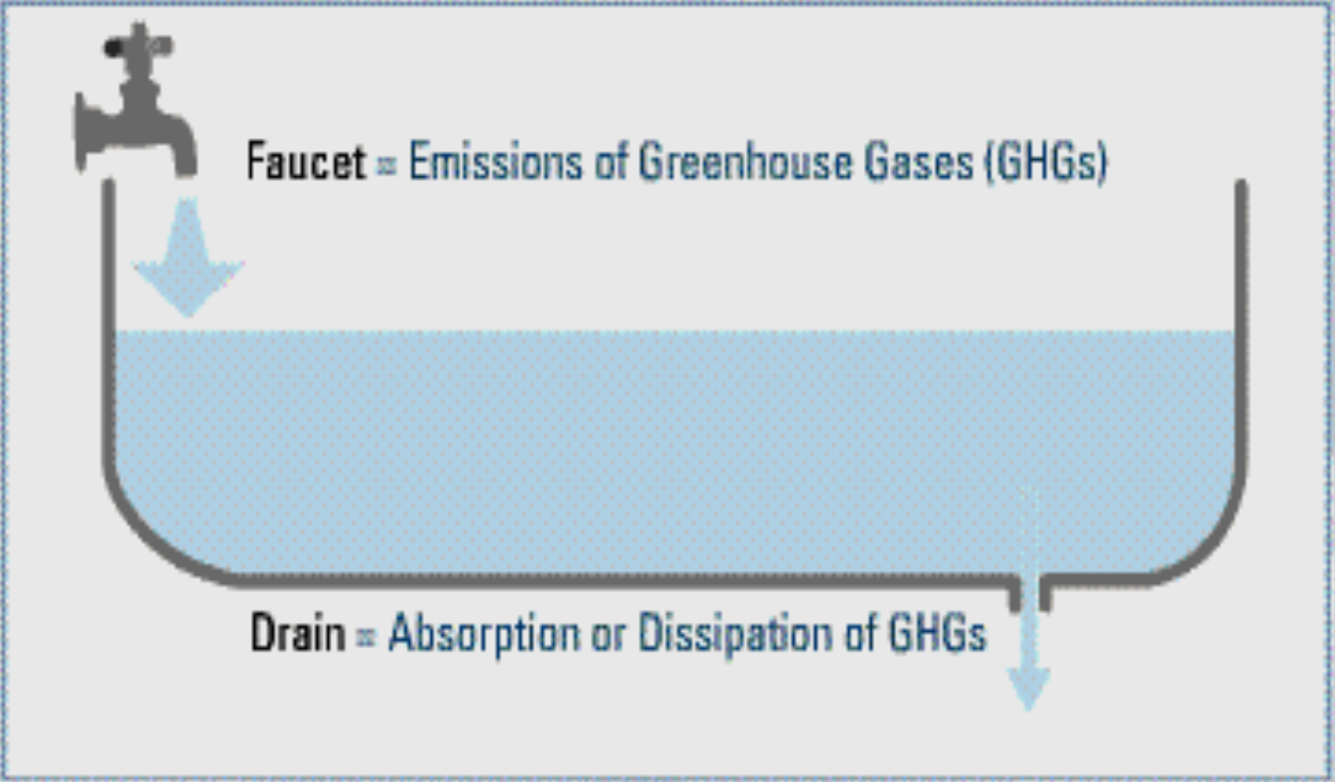
# The Greenhouse Effect

Think of the atmosphere as a bathtub...

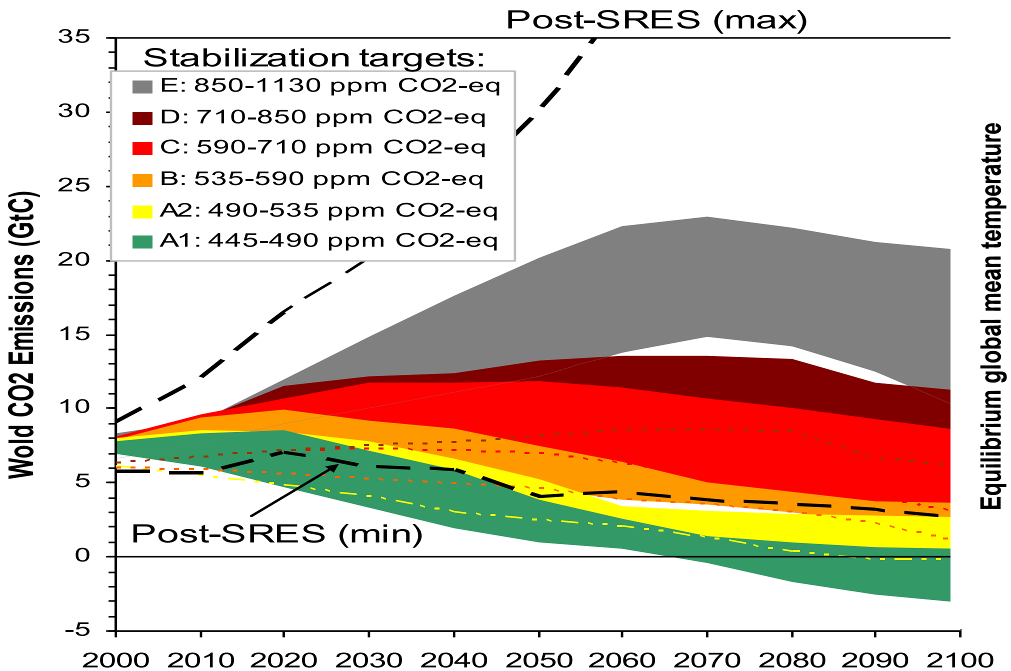


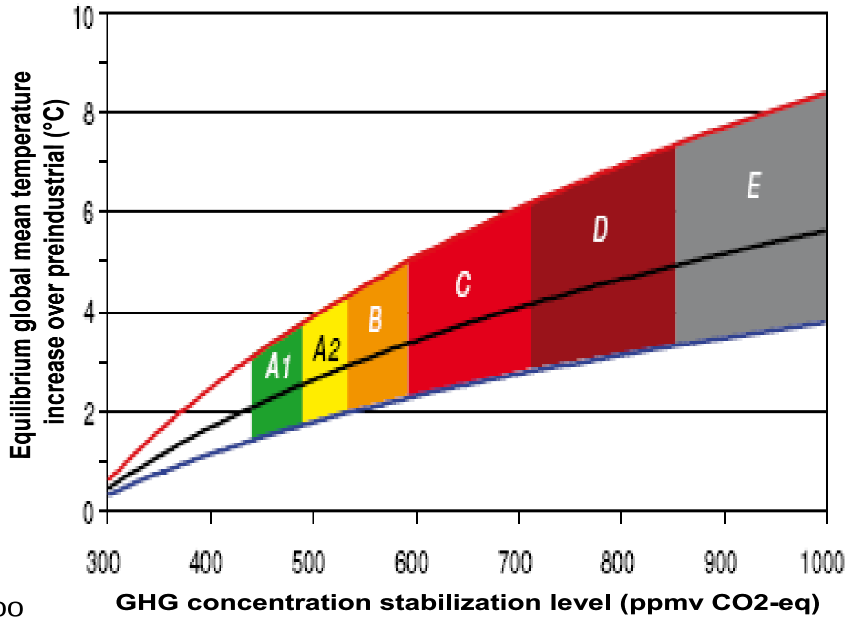
# The Greenhouse Effect

If the "faucet" is opened wider while the "drain" stays the same, the bathtub may overflow.



# The lower the stabilisation level the earlier global emissions have to go down




Multigas and CO2 only studies combined

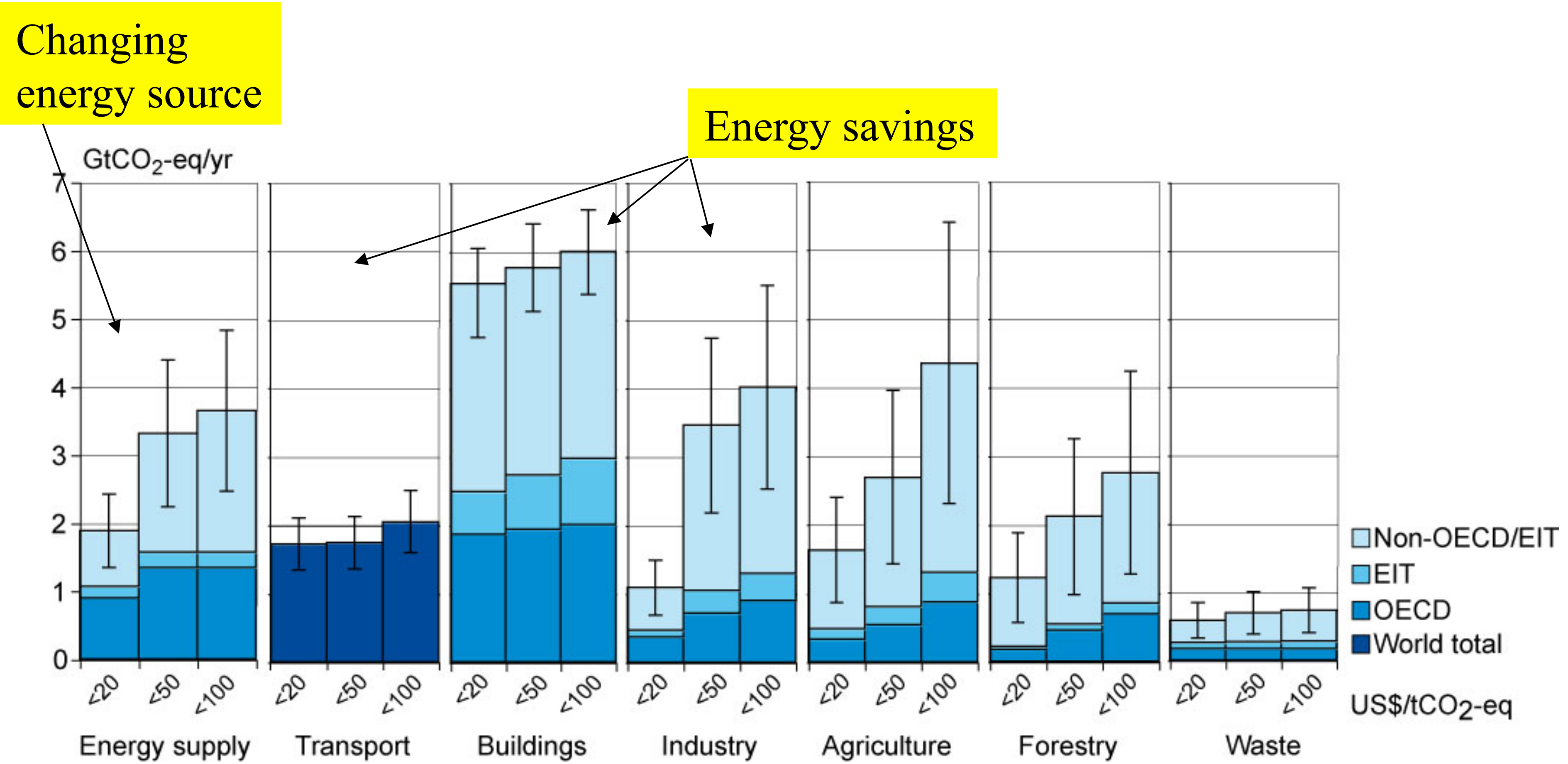
# Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

| Stababilization level (ppm $CO_2$-eq) | Global Mean temperature increase at equilibrium (ºC) | Year global $CO_2$ needs to peak | Year global $CO_2$ emissions back at 2000 level | Reduction in 2050 global $CO_2$ emissions compared to 2000 |
|---|---|---|---|---|
| 445 – 490 | 2.0 – 2.4 | 2000 - 2015 | 2000- 2030 | -85 to -50 |
| 490 – 535 | 2.4 – 2.8 | 2000 - 2020 | 2000- 2040 | -60 to -30 |
| 535 – 590 | 2.8 – 3.2 | 2010 - 2030 | 2020- 2060 | -30 to +5 |
| 590 – 710 | 3.2 – 4.0 | 2020 - 2060 | 2050- 2100 | +10 to +60 |
| 710 – 855 | 4.0 – 4.9 | 2050 - 2080 | | +25 to +85 |
| 855 – 1130 | 4.9 – 6.1 | 2060 - 2090 | | +90 to +140 |

# Implications for international agreements

| Scenario category | Region | 2020 | 2050 |
|---|---|---|---|
| A-450 ppm $CO_2$ –eq[2)] | Annex I | -25% to -40% | -80% to -95% |
| | Non-Annex I | Substantial deviation from baseline in Latin America, Middle East, East Asia | Substantial deviation from baseline in all regions |
| B-550 ppm $CO_2$ -eq | Annex I | -10% to -30% | -40% to -90% |
| | Non-Annex I | Deviation from baseline in Latin America and Middle East, East Asia | Deviation from baseline in most regions, especially in Latin America and Middle East |
| C-650 ppm $CO_2$ -eq | Annex I | 0% to -25% | -30% to -80% |
| | Non-Annex I | Baseline | Deviation from baseline in Latin America and Middle East, East Asia |

# Economic mitigation potential in 2030 could offset the projected growth of global emissions, or reduce emissions below current levels



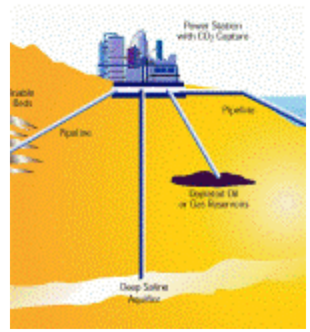

Note: estimates are for 2030 and do not include non-technical options, such as lifestyle changes.

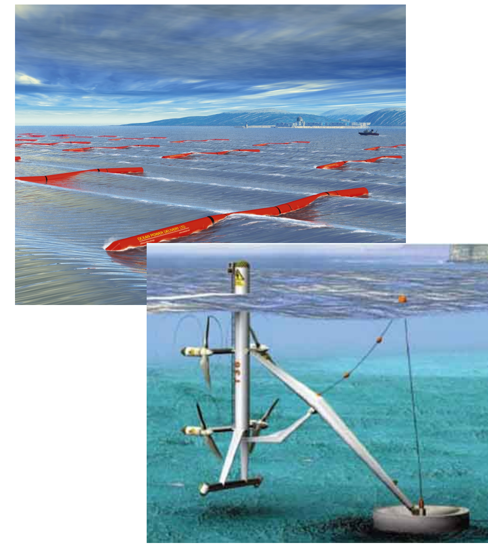
# What does US$ 50/ tCO2eq mean?

- Crude oil: ~US$ 25/ barrel
- Gasoline: ~9 euro ct/ litre (50 ct/gallon)
- Electricity:
  - from coal fired plant: ~4 euro ct/kWh
  - from gas fired plant: ~1 euro ct/kWh

# Commercial energy supply mitigation technologies

NOW 2030

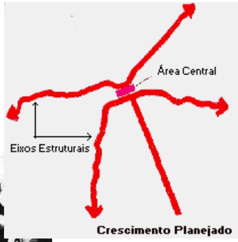


# Commercial transport mitigation technologies

NOW → 2030








# How much does biofuel really reduce CO2?

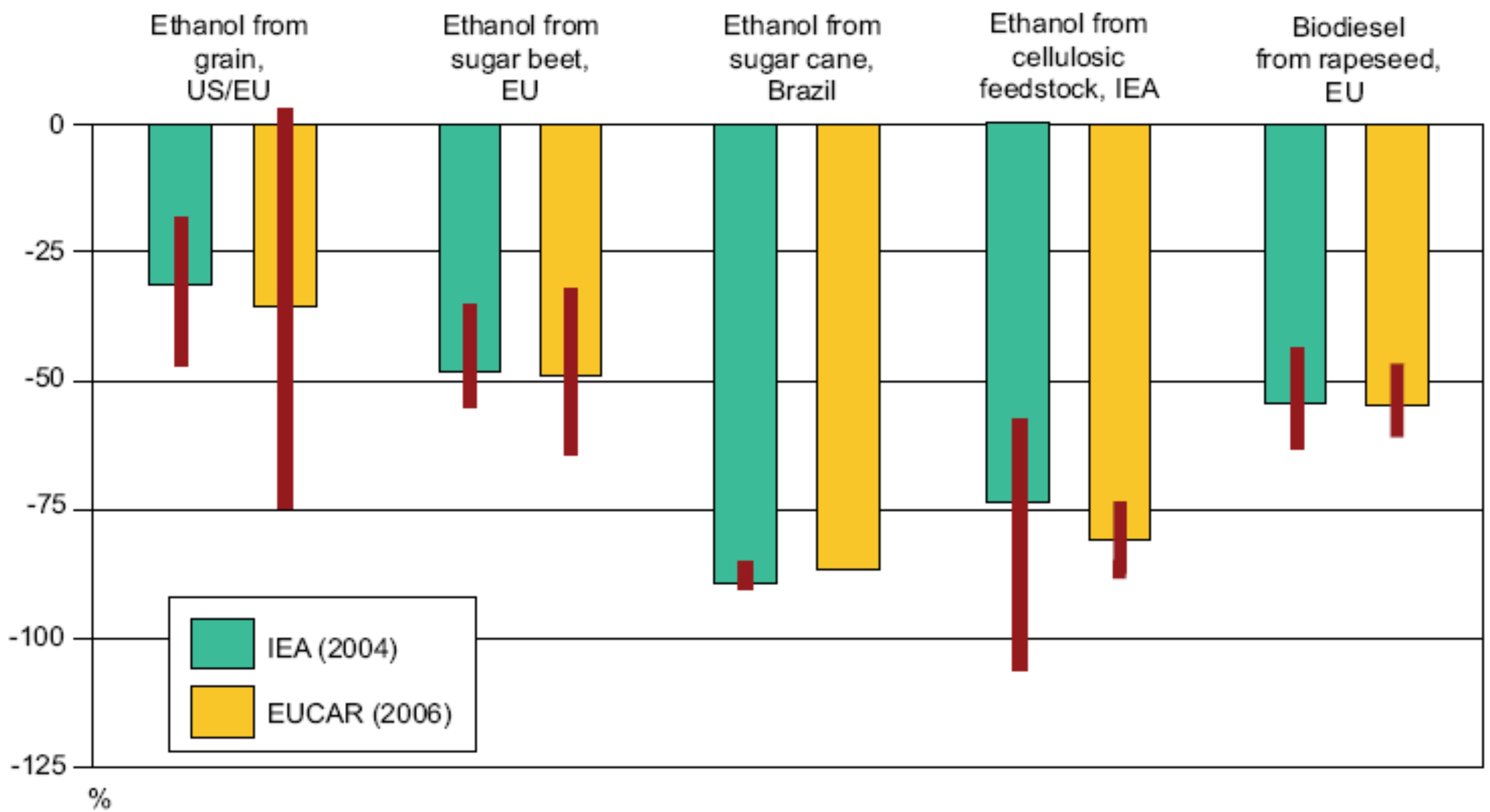


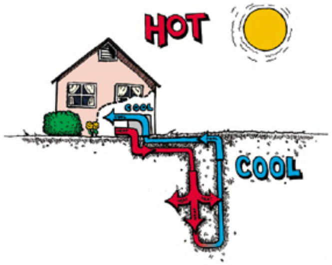

**Figure 5.10:** *Reduction of well-to-wheels GHG emissions compared to conventionally fuelled vehicles*

Note: bars indicate range of estimates.

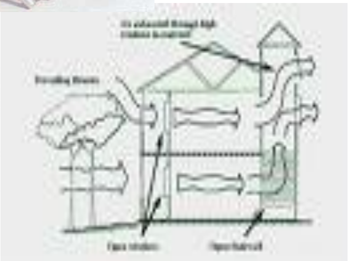
*Source: IEA, 2004c; EUCAR/CONCAWE/JRC, 2006.*

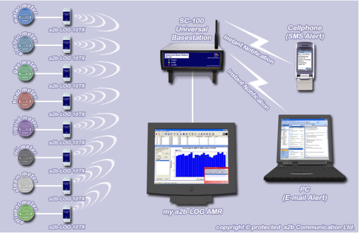
# Commercial mitigation technologies in the building sector

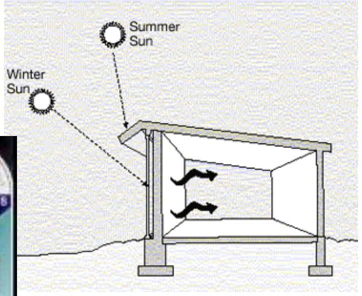
NOW → 2030



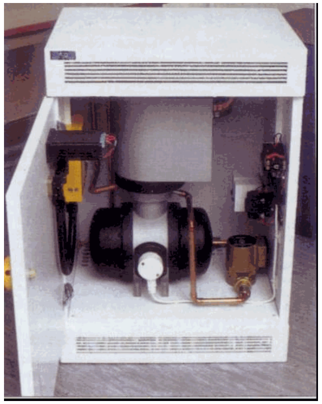


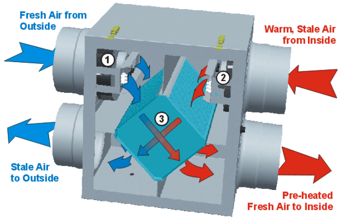










# Changes in lifestyle and behaviour patterns can contribute to climate change mitigation

- Changes in occupant behaviour, cultural patterns and consumer choice in buildings.
- Behaviour of staff in industrial organizations in light of reward systems
- Reduction of car usage and efficient driving style, in relation to urban planning and availability of public transport

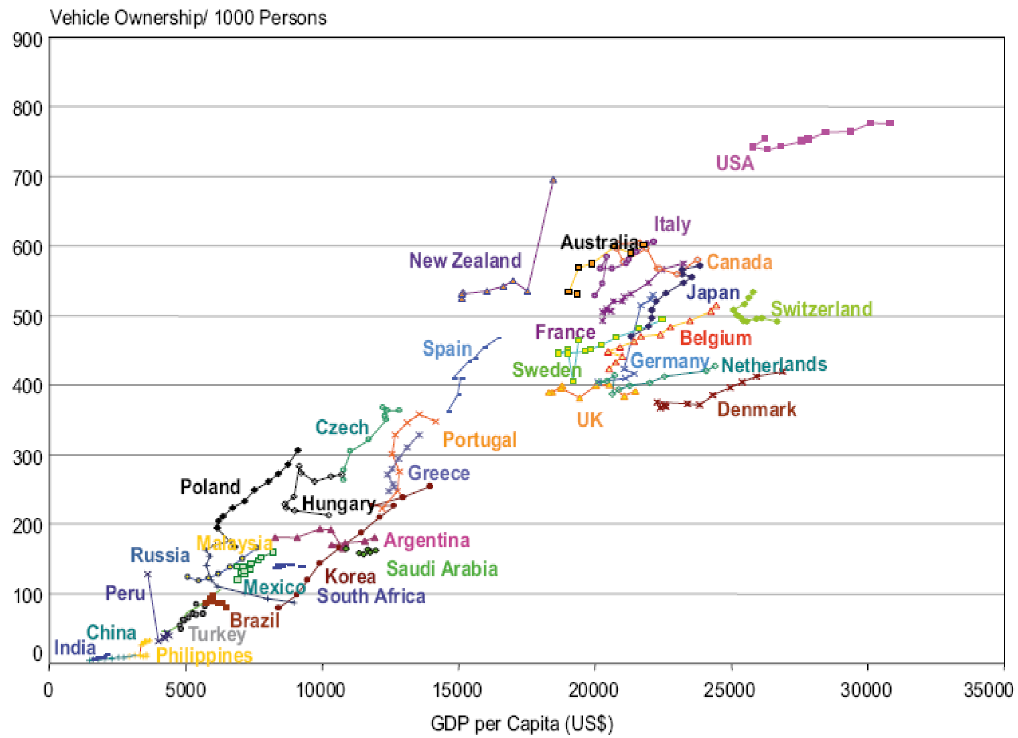



**Figure TS.14:** *Vehicle ownership and income per capita as a time line per country [Figure 5.2].*

Note: data are for 1900–2002, but the years plotted vary by country, depending on data availability.

# What are the macro-economic costs in 2030?

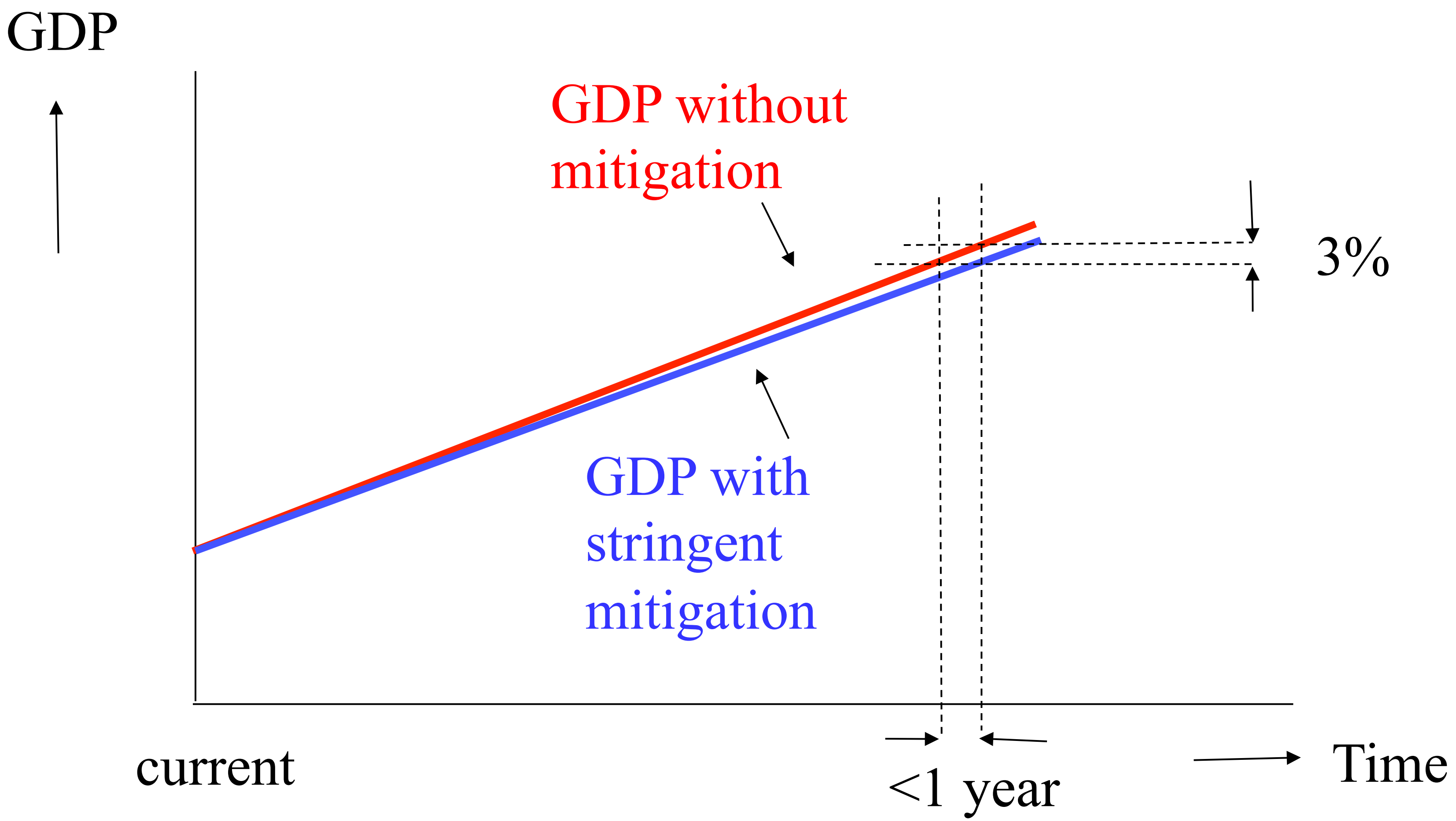
•Costs are global average for least cost appoaches from top-down models

•Costs do NOT include co-benefits and avoided climate change damages

| Trajectories towards stabilization levels (ppm $CO_2$-eq) | Median GDP reduction [1] (%) | Range of GDP reduction [2] (%) | Reduction of average annual GDP growth rates [3] (percentage points) |
|---|---|---|---|
| 590-710 | 0.2 | -0.6 – 1.2 | < 0.06 |
| 535-590 | 0.6 | 0.2 – 2.5 | <0.1 |
| 445-535[4] | Not available | < 3 | < 0.12 |

[1] This is global GDP based market exchange rates.
[2] The median and the 10th and 90th percentile range of the analyzed data are given.
[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till 2030 that would result in the indicated GDP decrease in 2030.
[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

# Illustration of cost numbers



# Technology in the long term

- The range of stabilization levels can be achieved by
  - deployment of a portfolio of technologies that are currently available and
  - those that are  expected to be commercialised in coming decades.
- This assumes that appropriate and effective incentives are in place for development, acquisition, deployment and diffusion of technologies and for addressing related barriers

# Adaptation

- Needed even with very stringent mitigation
- Limits to adaptation:
  - Certain risks can not be reduced
  - More serious impacts go beyond adaptive capacity
- Main areas:
  - Water
  - Agriculture
  - Infrastructure
  - Health
  - Tourism
  - Energy
- Adaptation and mitigation are complementary
- Costs hardly known

# Co-benefits of mitigation and relation with adaptation

- Near–term *health benefits* from reduced air pollution may offset a substantial fraction of mitigation costs
- Mitigation can also be positive for: *energy security, balance of trade improvement, provision of modern energy services to rural areas, sustainable agriculture* and *employment*
- Land-use measures positive for improving resilience to climate change and for storing carbon

# Climate change policies

- Many barriers for implementing low-cost mitigation measures
- Effectiveness of policies depends on national circumstances, their design, interaction, stringency and implementation
- Types of policies:
  - Regulations and standards
  - Taxes and charges
  - Tradable permits
  - Financial incentives
  - Voluntary agreements
  - Information instruments
  - Research and development

# Giving $CO_2$ a price is the most important

- Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.
- Such policies could include economic instruments, government funding and regulation
- For meeting EU 2 degrees target: about 100 US$/tCO2eq carbon price needed by 2030 (current EU-ETS price ~$ 25)
- But… do not forget the co-benefits

# Selected sectoral policies, measures and instruments that have shown to be environmentally effective

| Sector | Policies[1], measures and instruments shown to be environmentally effective | Key constraints or opportunities |
|---|---|---|
| Energy supply | Reduction of fossil fuel subsidies | Resistance by vested interests may make them difficult to implement |
| | Taxes or carbon charges on fossil fuels | |
| | Feed-in tariffs for renewable energy technologies | May be appropriate to create markets for low emissions technologies |
| | Renewable energy obligations | |
| | Producer subsidies | |

[1] Public RD&D investment in low emission technologies have proven to be effective in all sectors.

# Investments

- Energy infrastructure investment decisions, (20 trillion US$ till 2030; 50% in developing countries) will have long term impacts on GHG emissions.

- The widespread diffusion of low-carbon technologies may take many decades, even if early investments in these technologies are made attractive.

- Returning global energy-related CO2 emissions to 2005 levels by 2030 would require *a large shift* in the pattern of investment, although the *net additional investment required ranges from negligible to 5-10%*

- It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply

# Climate policy alone will not solve the climate change problem

- *Macro-economic policy*: taxes, subsidies, other fiscal policies, structural adjustment
- *Trade policy:* "embodied carbon", removing barriers for low-carbon products, domestic energy sources
- *Energy security policy :* efficient energy use, domestic energy sources (low-high carbon)
- *Access to modern energy:* bioenergy, poverty tariffs
- *Air quality policy:* clean fuel
- *Bank lending policies*: lending for efficiency/ renewables, avoid lock-in into old technologies in developing countries
- *Insurance policy:* Differentiated  premiums, liability insurance exclusion, improved conditions for green products

# International agreements

- ***Climate Change Convention (UNFCCC) and Kyoto Protocol*** :
  - Limited reduction of emissions industrialised countries
  - Array of national policies
  - International market for CO2 credits
  - US, Australia not participating; Canada not implementing
- ***New agreement for after 2012:***
  - Much steeper reduction needed
  - All countries to contribute, according to capability
  - Will include adaptation
  - Bali (December): start of negotiations?

The full Report can be downloaded from

www.ipcc.ch

or

www.mnp.nl/ipcc

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