Comment réduire les émissions: technologies, comportements, économie et politiques

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Introduction

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État de la planète au début du XXIe siècle

- Les 20 % les plus riches de la population mondiale représentent 86 % des dépenses totales de consommation privée, consomment 58 % de l'énergie mondiale (à raison d'environ 5 tonnes d'équivalent-pétrole par personne), 45 % de la consommation de viande et de poisson, 84 % de celle de papier, et possèdent 87 % des voitures et 74 % des téléphones.
- Les 20 % les plus pauvres de la population mondiale consomment moins de 5 % de chacun de ces biens et services. **Environ 2 milliards de personnes n'ont pas accès à l'électricité, principalement en zone rurale.**

Sources principales: GEO-3 et WEHAB

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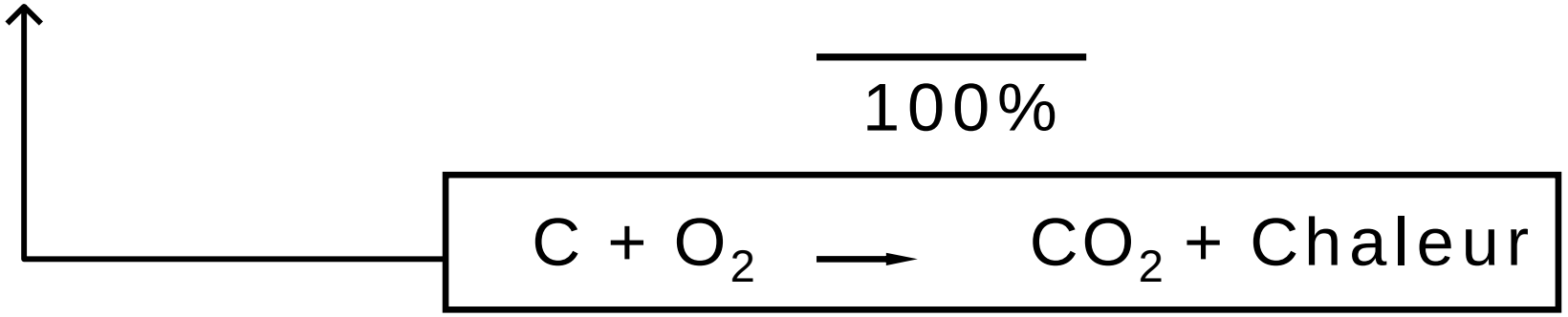
REPARTITION DES SOURCES D'ENERGIE (MONDE)

1990:

Biomasse : 14%
Hydroélec : 6%
Nucléaire : 5%

Combust. fossiles { Charbon : 24%, Pétrole : 33%, Gaz naturel : 18% } 75%

100%



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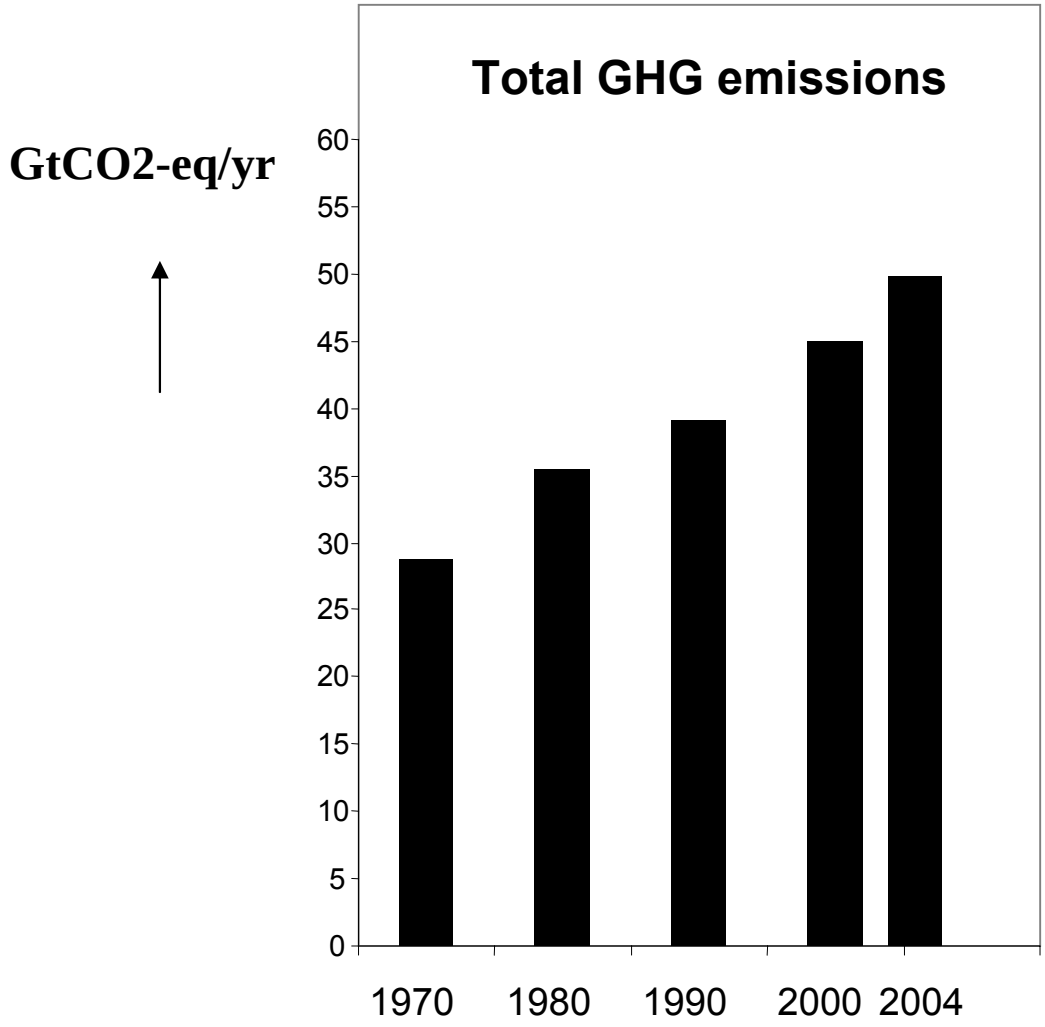
Source GIEC 1996

Quantité de CO_2 émise par unité d'énergie consommée

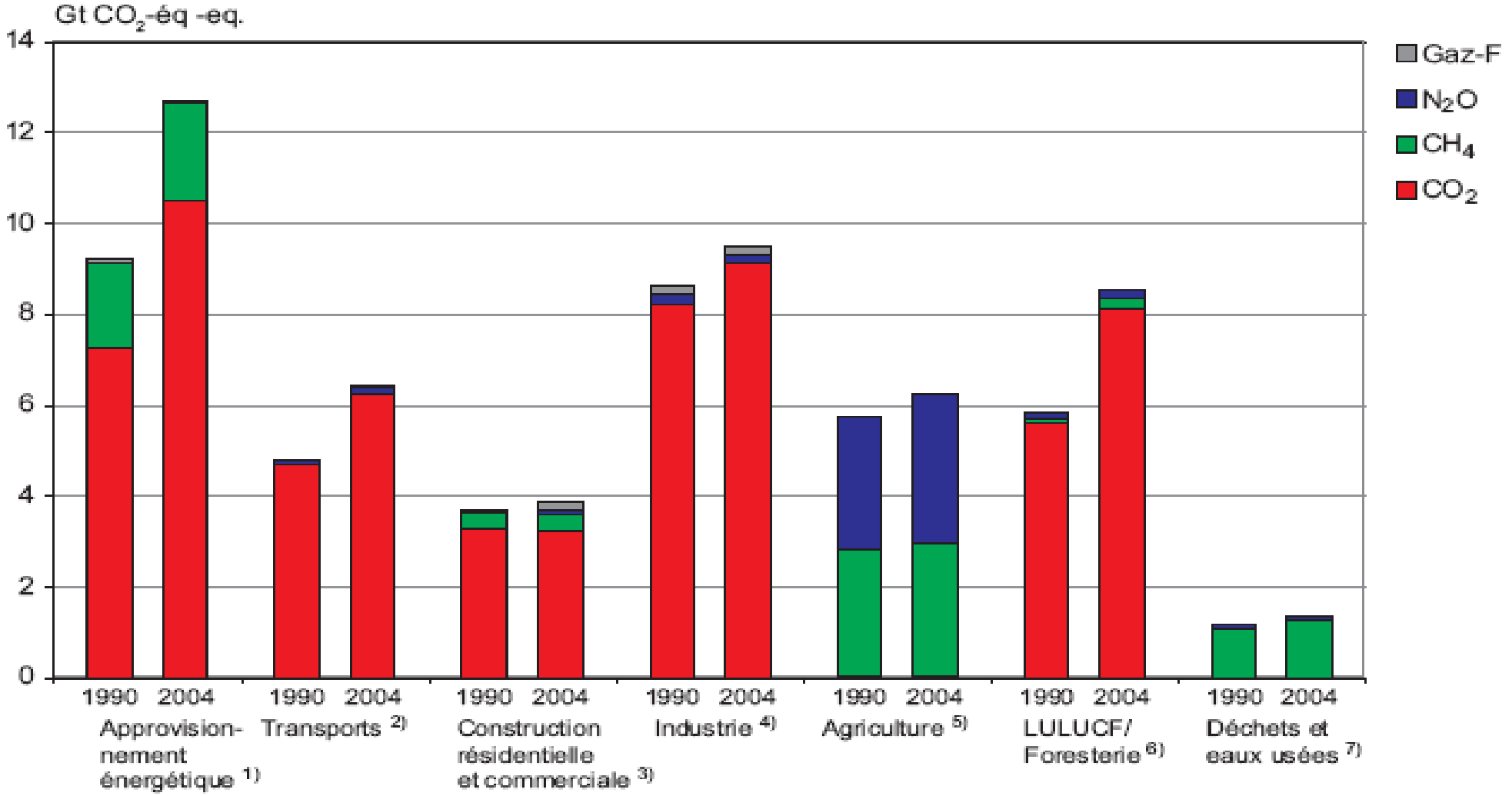
Combustibles	kg CO_2 / Gigajoule
Charbon	95
Gasoil	74
Essence	69
LPG	63
Gaz naturel	56

Source : VITO (1991)

Between 1970 and 2004 global greenhouse gas emissions have increased by 70 %

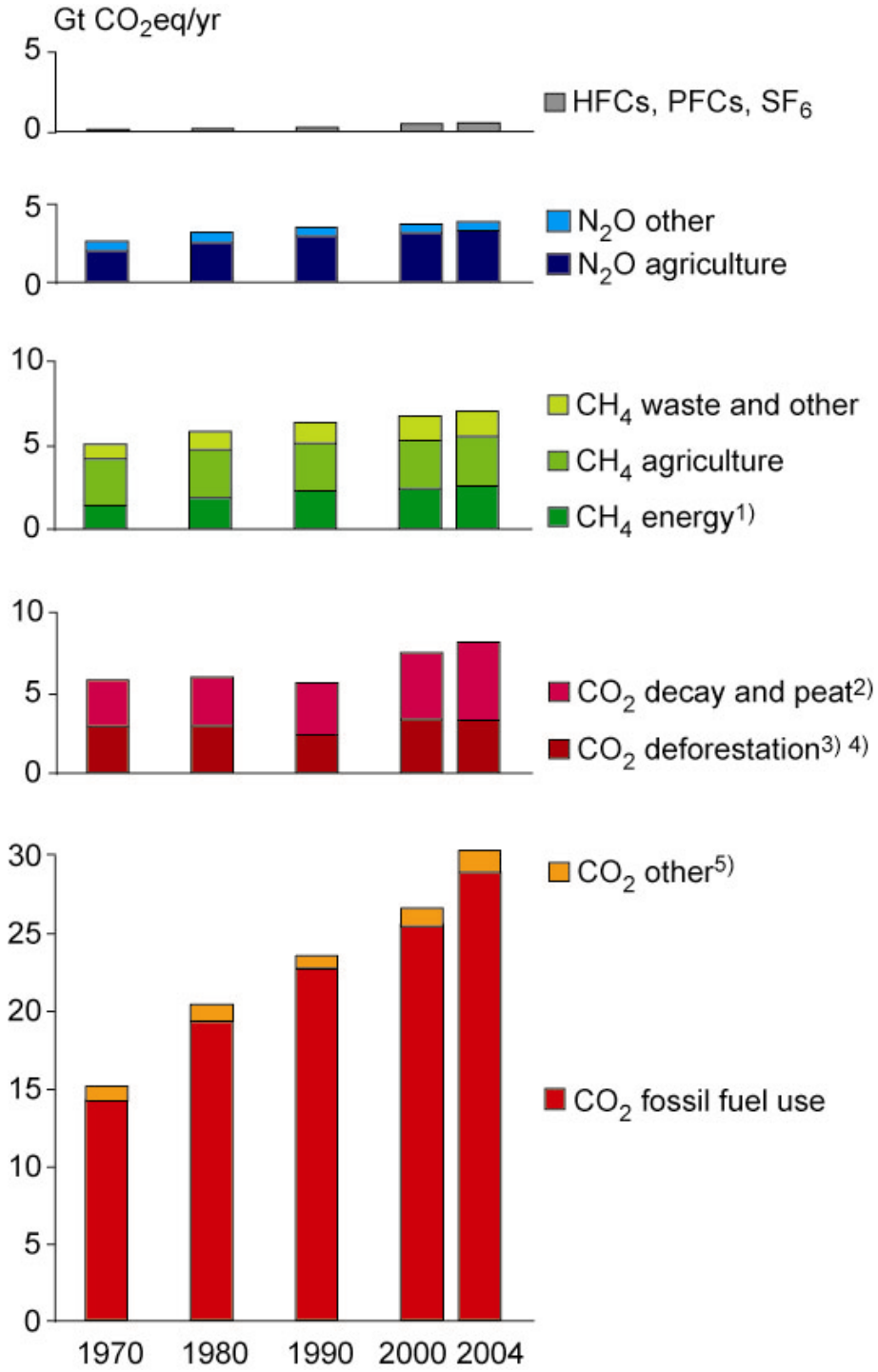


Emissions mondiales par secteur et par gaz pour 1990 et 2004

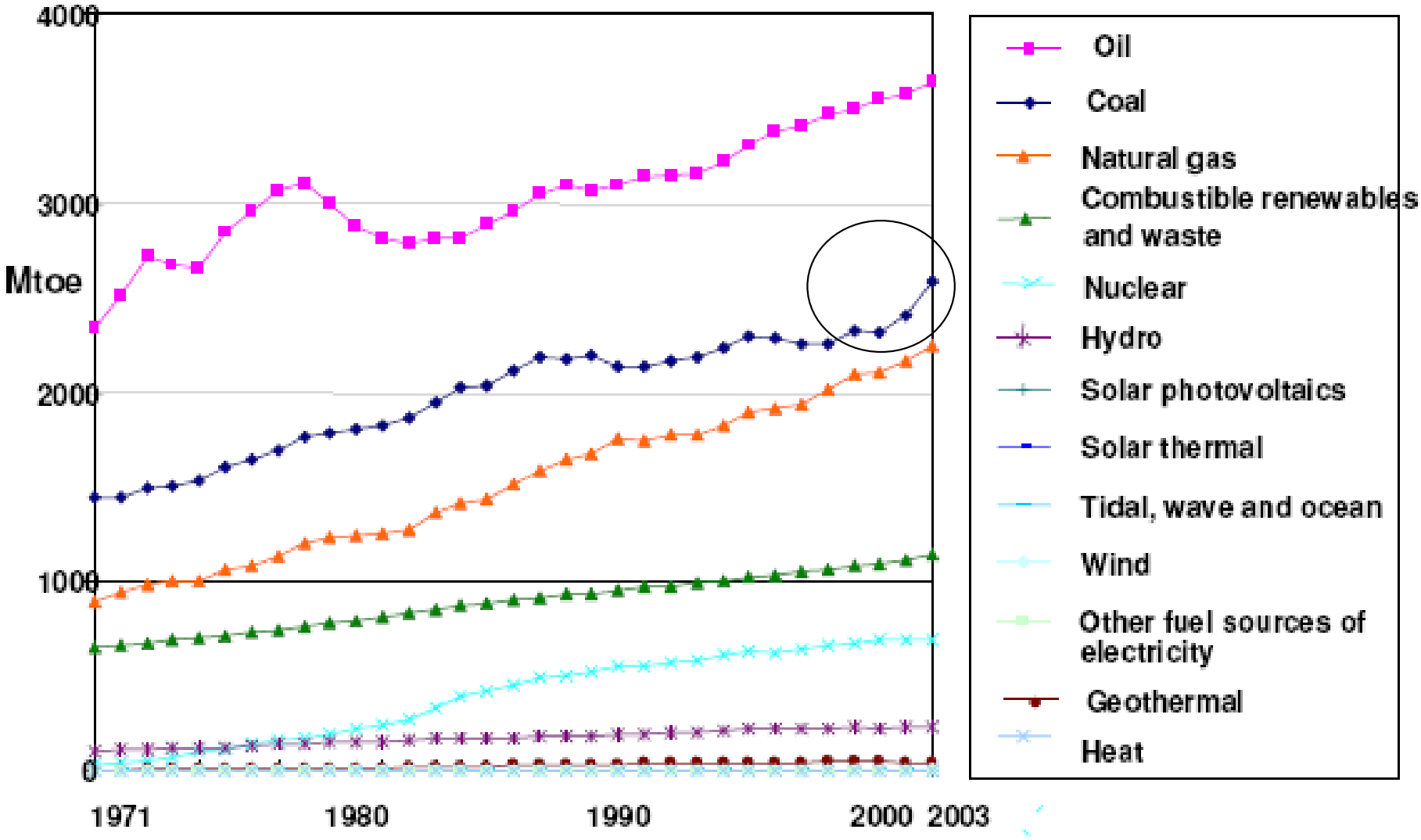


Source: IPCC AR3 WG3 TS Fig 2a

Carbon dioxide is the largest contributor



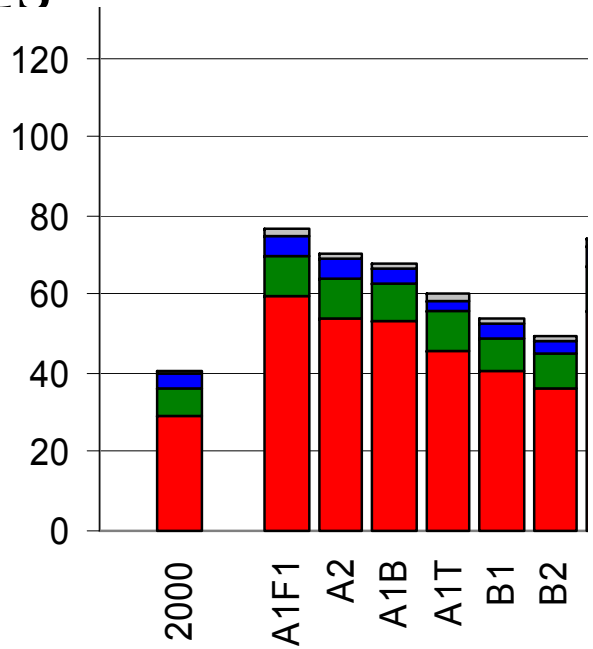
World primary energy consumption by fuel type



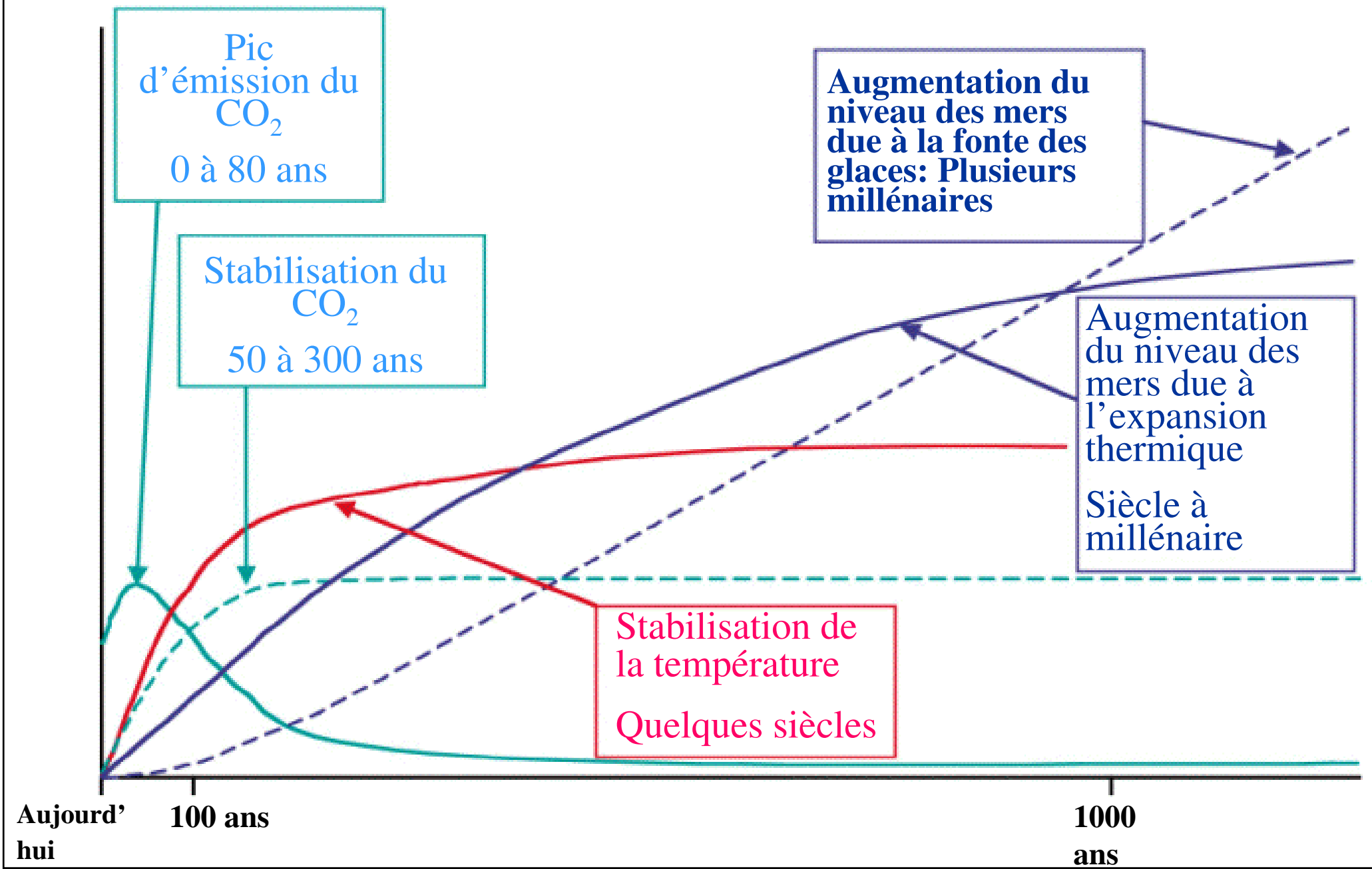
Future emissions will grow further

- 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 2000



Difficulté:
l'inertie significative du système climatique



Réduire par rapport à quelle référence ?

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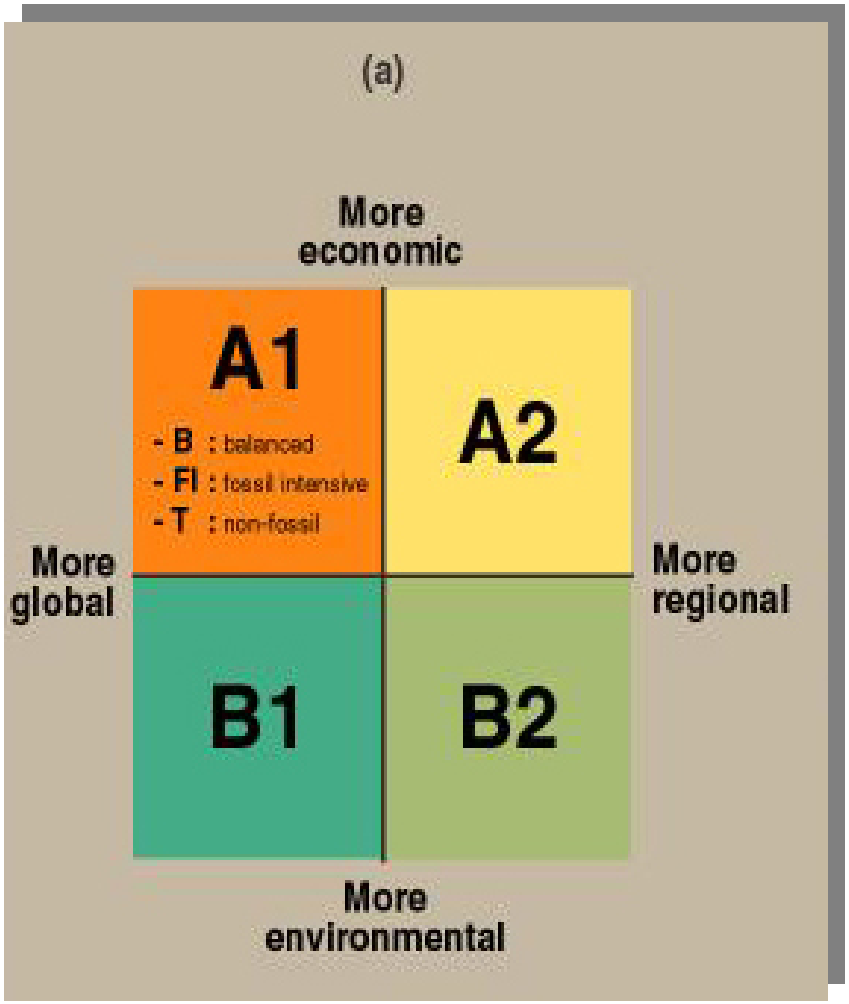
Les scénarios SRES A1,A2,B1,B2:

A1: A world of rapid economic growth and rapid introductions of new and more efficient technologies

A2: A very heterogenous world with an emphasis on familiy values and local traditions

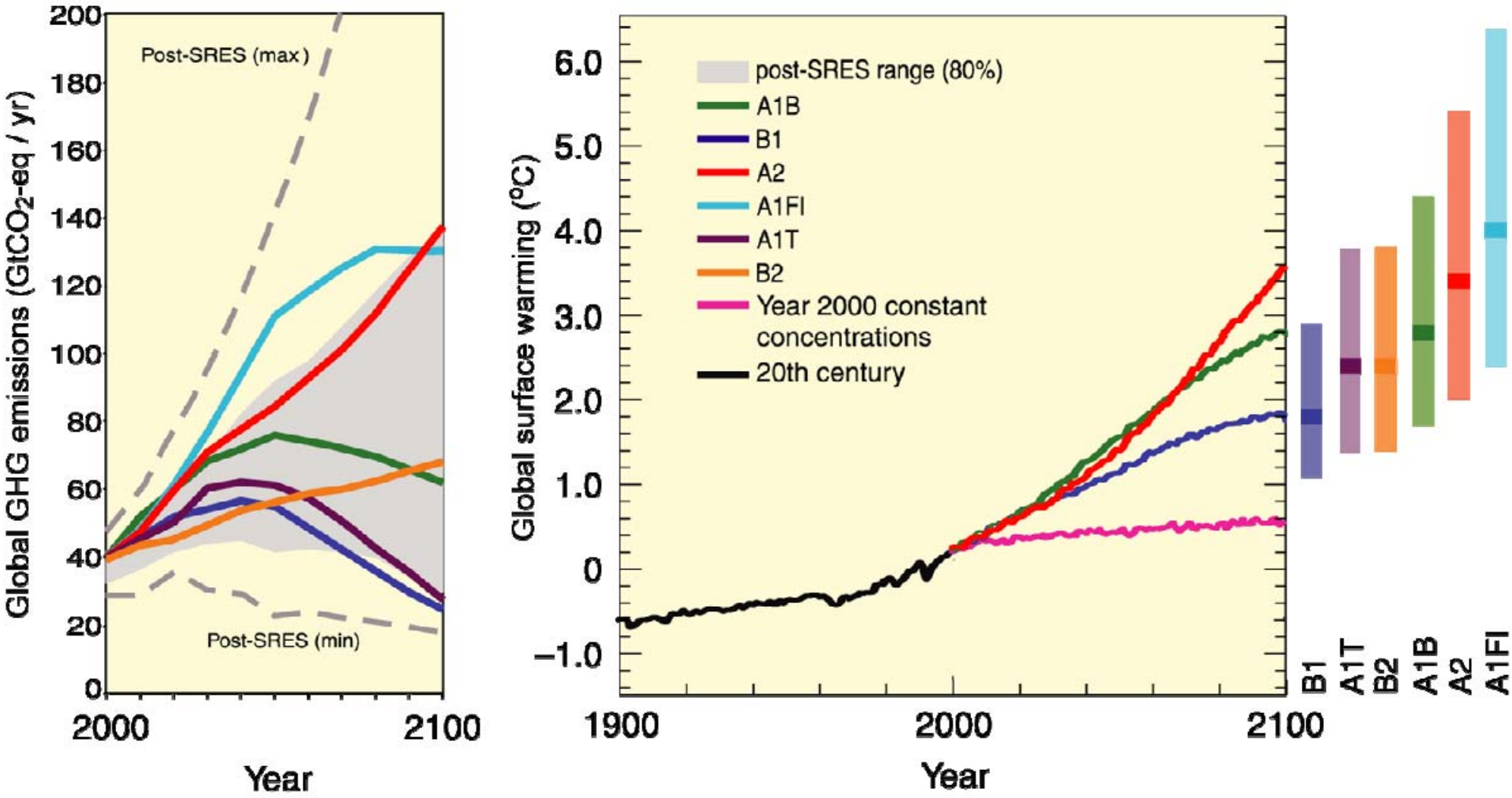
B1: A world of „dematerialization“ and introduction of clean technologies

B2: A world with an emphasis on local solutions to economic and environmental sustainability



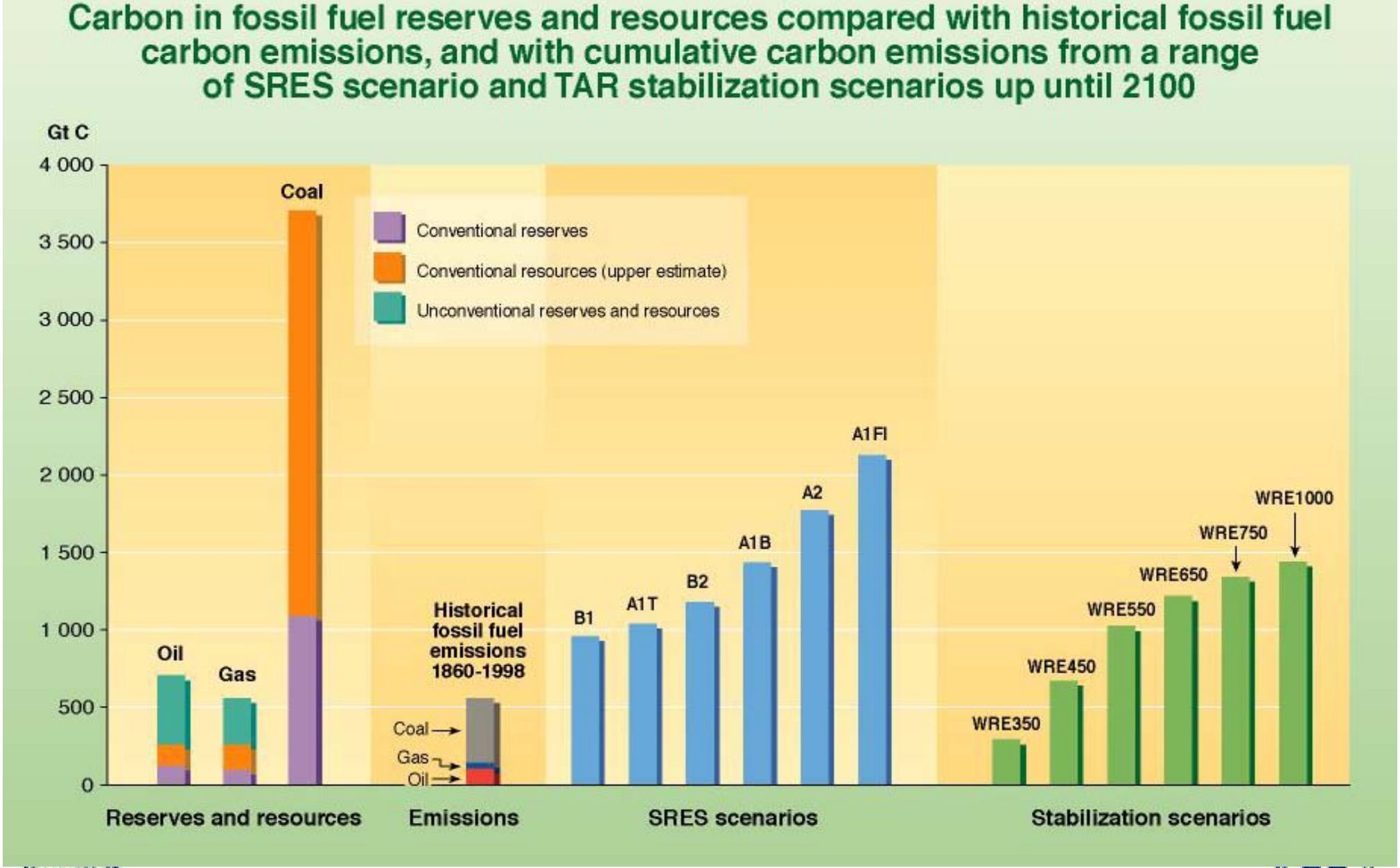
Source: IPCC, AR4

Projections du climat futur en l'absence de mesures



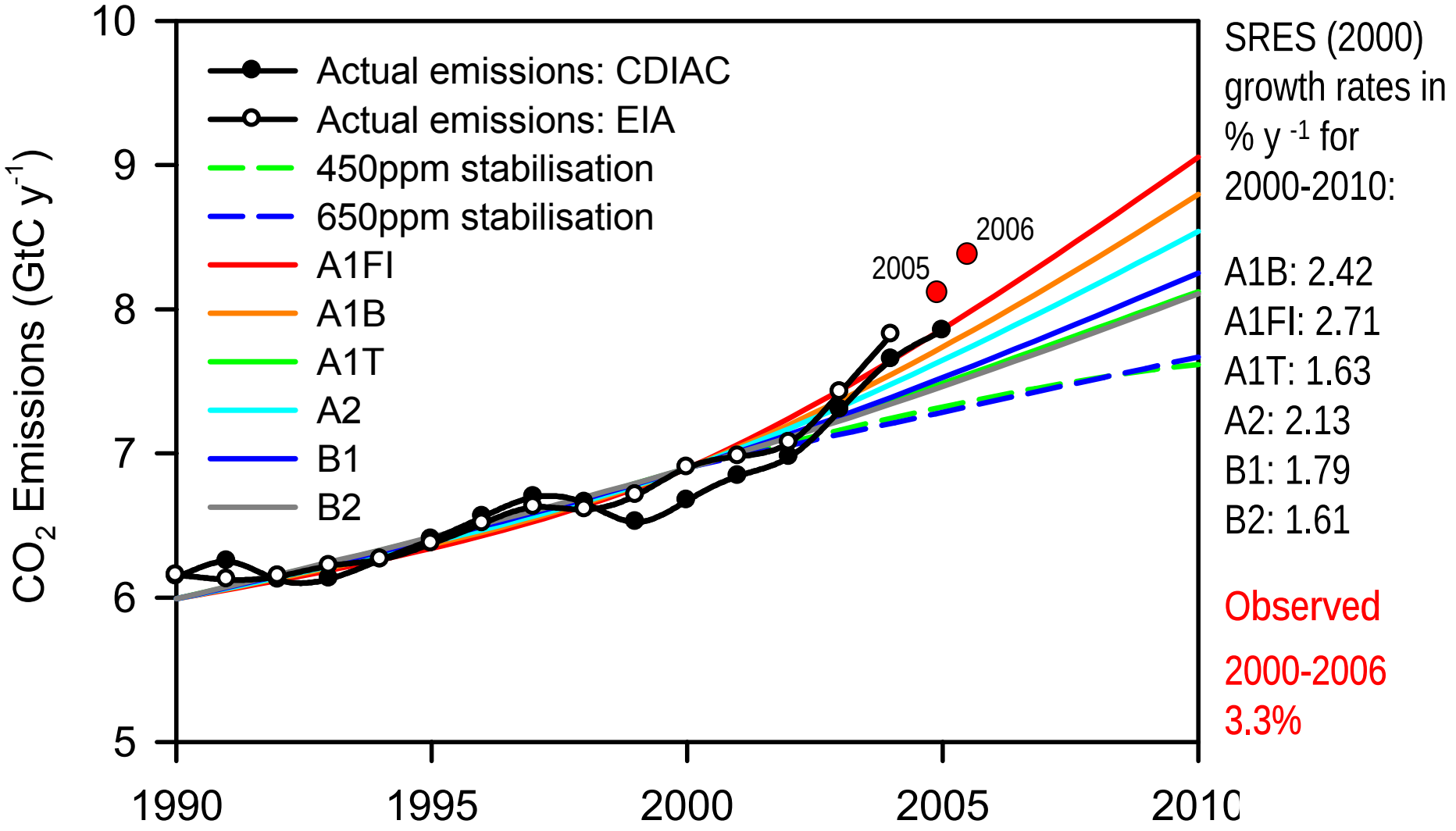
WMO

UNEP



Source: IPCC (2001)

Trajectory of Global Fossil Fuel Emissions



Raupach et al. 2007, PNAS

Réduire dans quelle proportion ?

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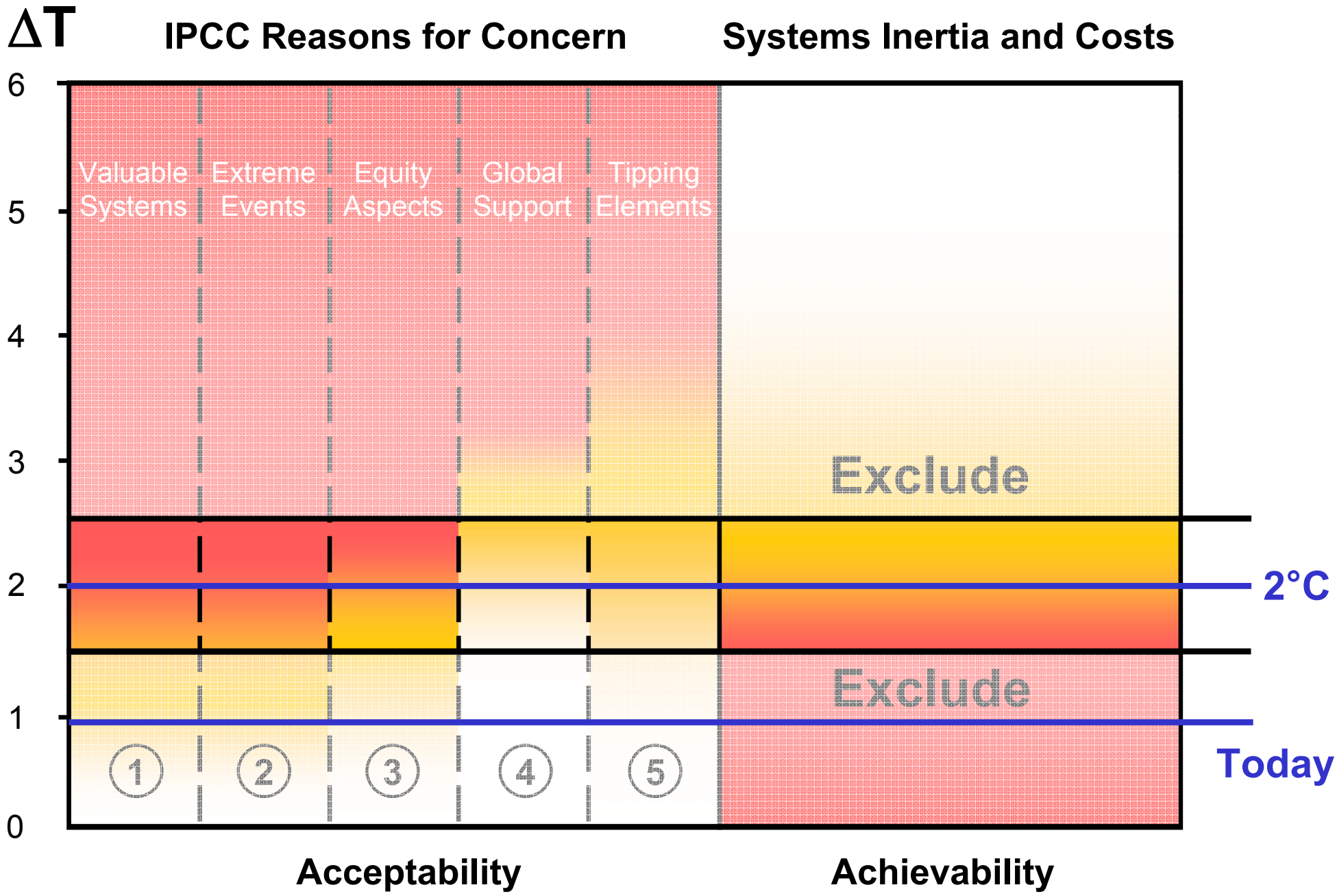
AVOIDING DANGEROUS CLIMATE CHANGE

EDITED BY Hans Joachim Schellnhuber, Wolfgang Cramer,
Nebojsa Nakicenovic, Tom Wigley and Gary Yohe

Free downloading at
www.defra.gov.uk/environment/climatechange/internat/sciencesassess.htm

CAMBRIDGE

Confining Global Warming



Source: J. Schellnhuber (2007)

Stabilisation levels and equilibrium global mean temperatures

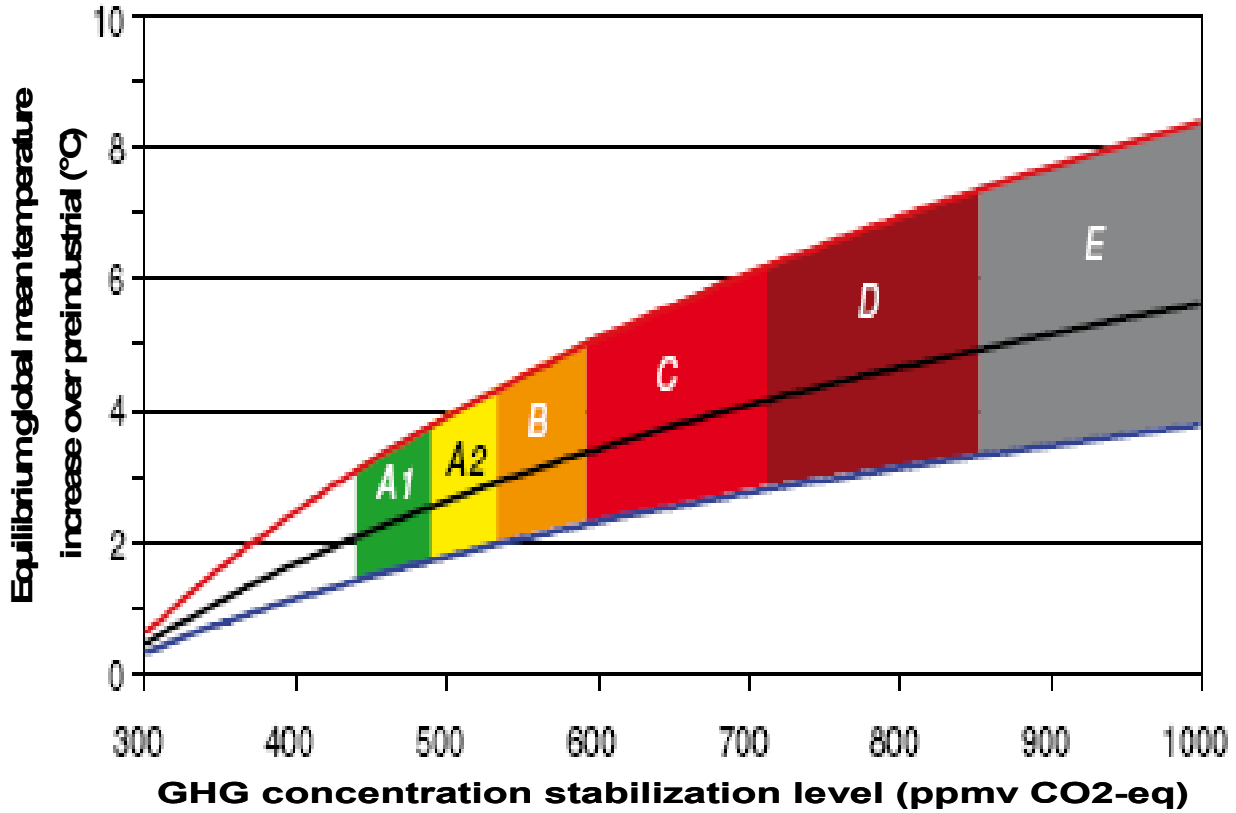
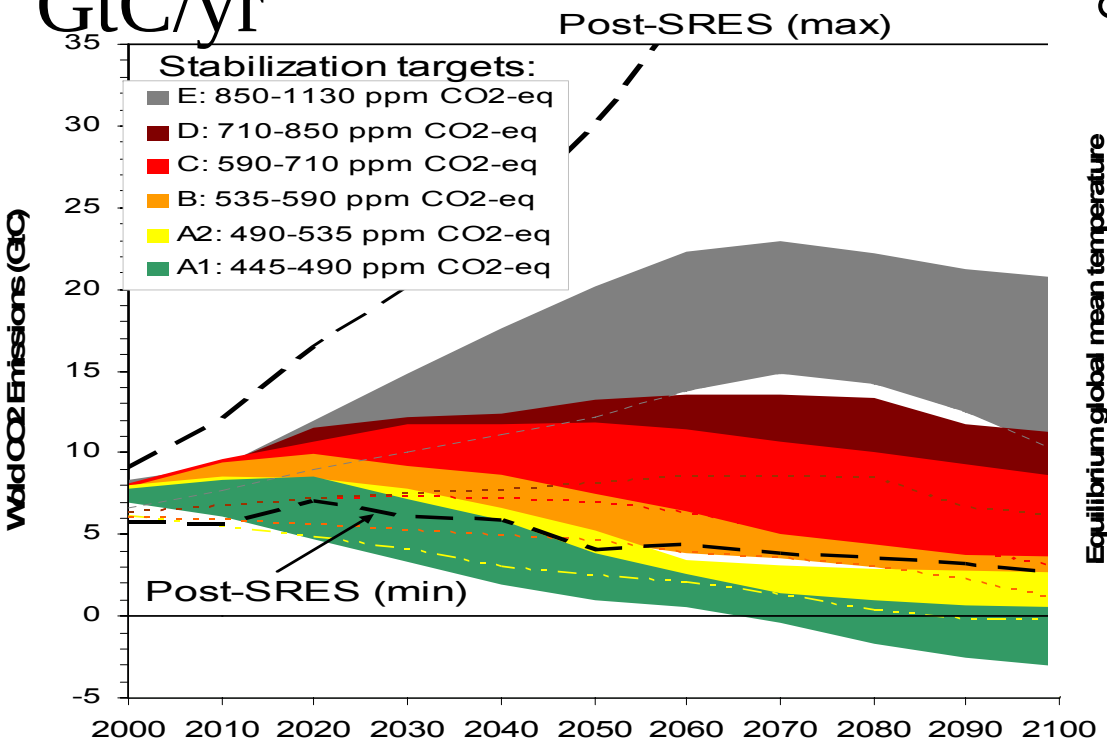


***Figure SPM 8**: Stabilization scenario categories as reported in Figure SPM.7 (coloured bands) and their relationship to equilibrium global mean temperature change above pre-industrial, using (i) "best estimate" climate sensitivity of 3 ℃ (black line in middle of shaded area), (ii) upper bound of likely range of climate sensitivity of 4.5 ℃ (red line at top of shaded area) (iii) lower bound of likely range of climate sensitivity of 2 ℃ (blue line at bottom of shaded area). Coloured shading shows the concentration bands for stabilization of greenhouse gases in the atmosphere corresponding to the stabilization scenario categories. The data are drawn from AR4 WGI, Chapter 10.8.*

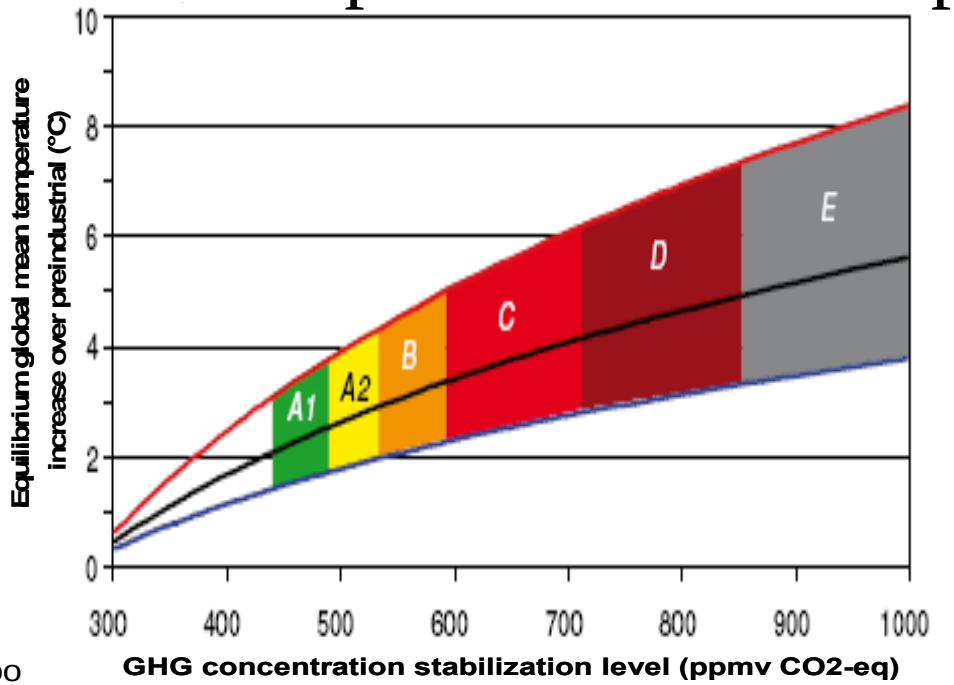
Stabilisation and equilibrium global mean temperatures

- Equilibrium temperatures reached after 2100
- Uncertainty of climate sensitivity important

GtC/yr



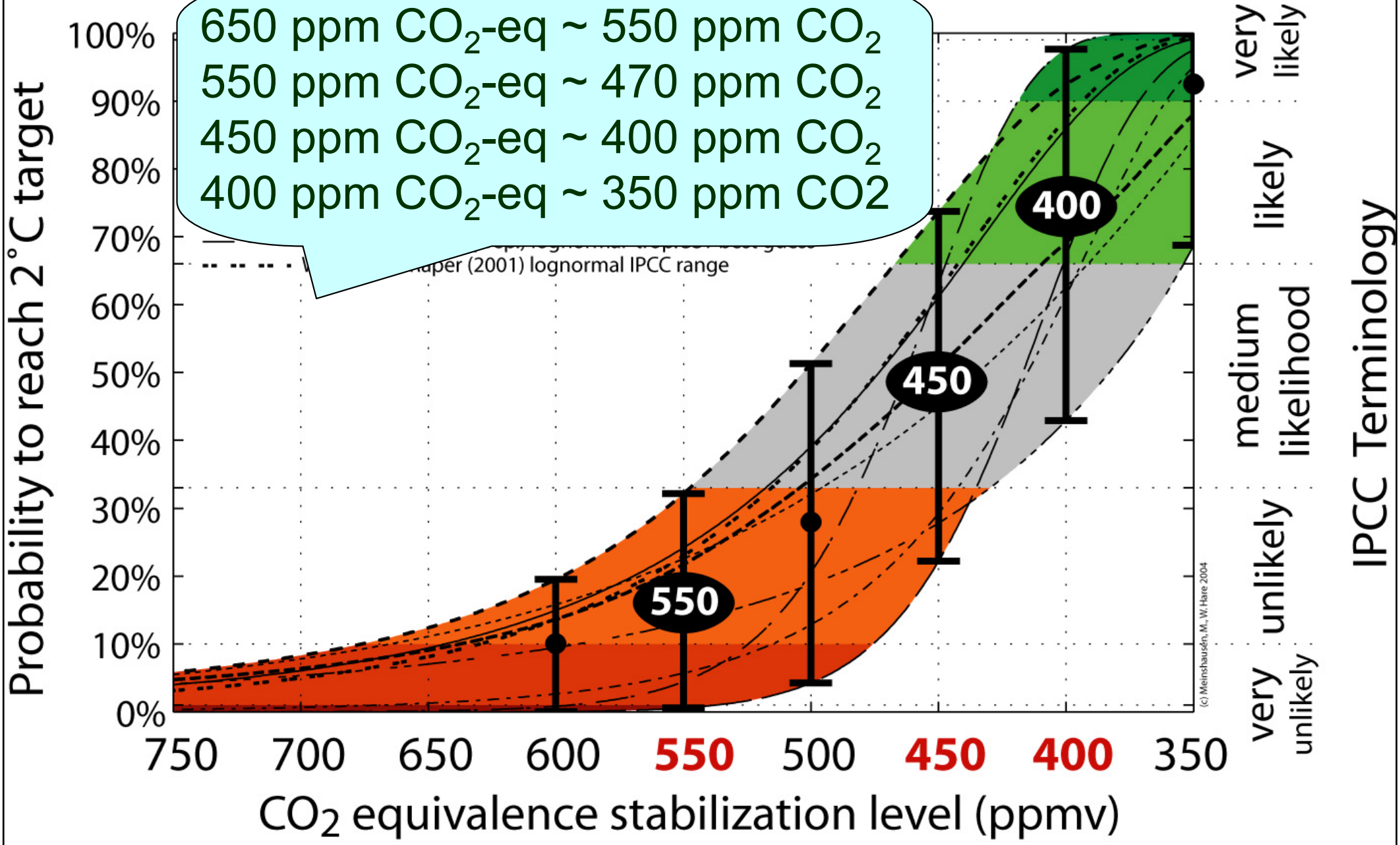
°C above pre-industrial temp.



Multigas and CO2 only studies combined

1. Introduction – 2° is it possible ?

650 ppm CO_2-eq ~ 550 ppm CO_2
550 ppm CO_2-eq ~ 470 ppm CO_2
450 ppm CO_2-eq ~ 400 ppm CO_2
400 ppm CO_2-eq ~ 350 ppm CO2



Long term mitigation (after 2030)

- The lower the stabilization level, the more quickly emissions would need to peak and to decline thereafter
- Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

Stab level (ppm CO2-eq)	Global Mean temp. increase at equilibrium (°C) above pre-ind.	Year CO2 needs to peak	Reduction in 2050 compared to 2000
445 – 490	**2.0 – 2.4**	**2000 - 2015**	**-85 to -50%**
490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	+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

Jim Hansen: Assessment of Target CO_2

Phenomenon	Target CO_2 (ppm)
1. Arctic Sea Ice	300-325
2. Ice Sheets/Sea Level	300-350
3. Shifting Climatic Zones	300-350
4. Alpine Water Supplies	300-350
5. Avoid Ocean Acidification	300-350

→ Initial Target CO_2 = 350* ppm

***assumes CH_4, O_3, Black Soot decrease**

Source: Jim Hansen 200802

Vous pouvez essayer:

- jcm.chooseclimate.org (ou www.climate.be/jcm)

(modèle interactif du Dr Ben Matthews (UCL-ASTR, rendu possible par la Politique scientifique fédérale)

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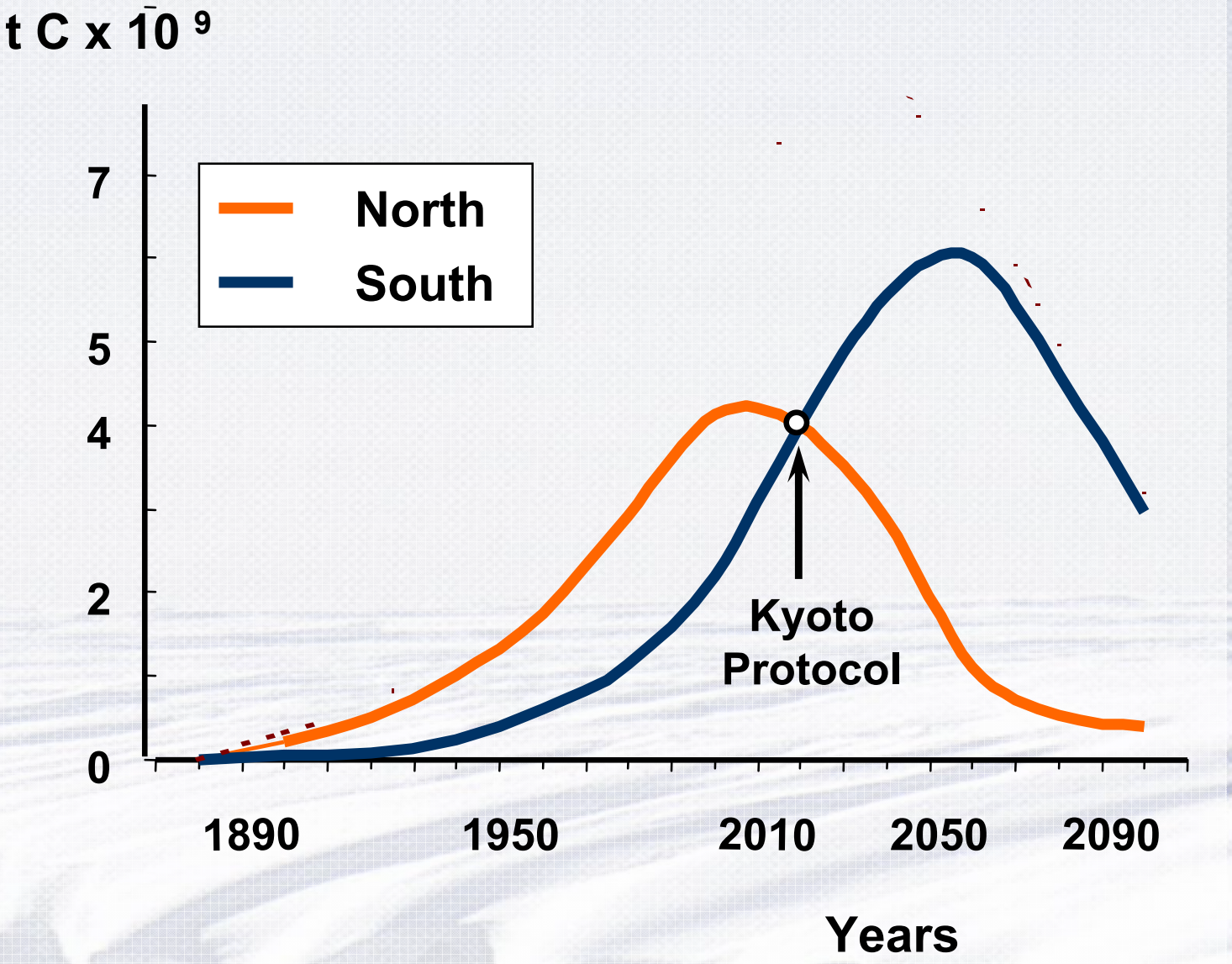
North + South carbon emissions

450 ppmv stabilization scenario

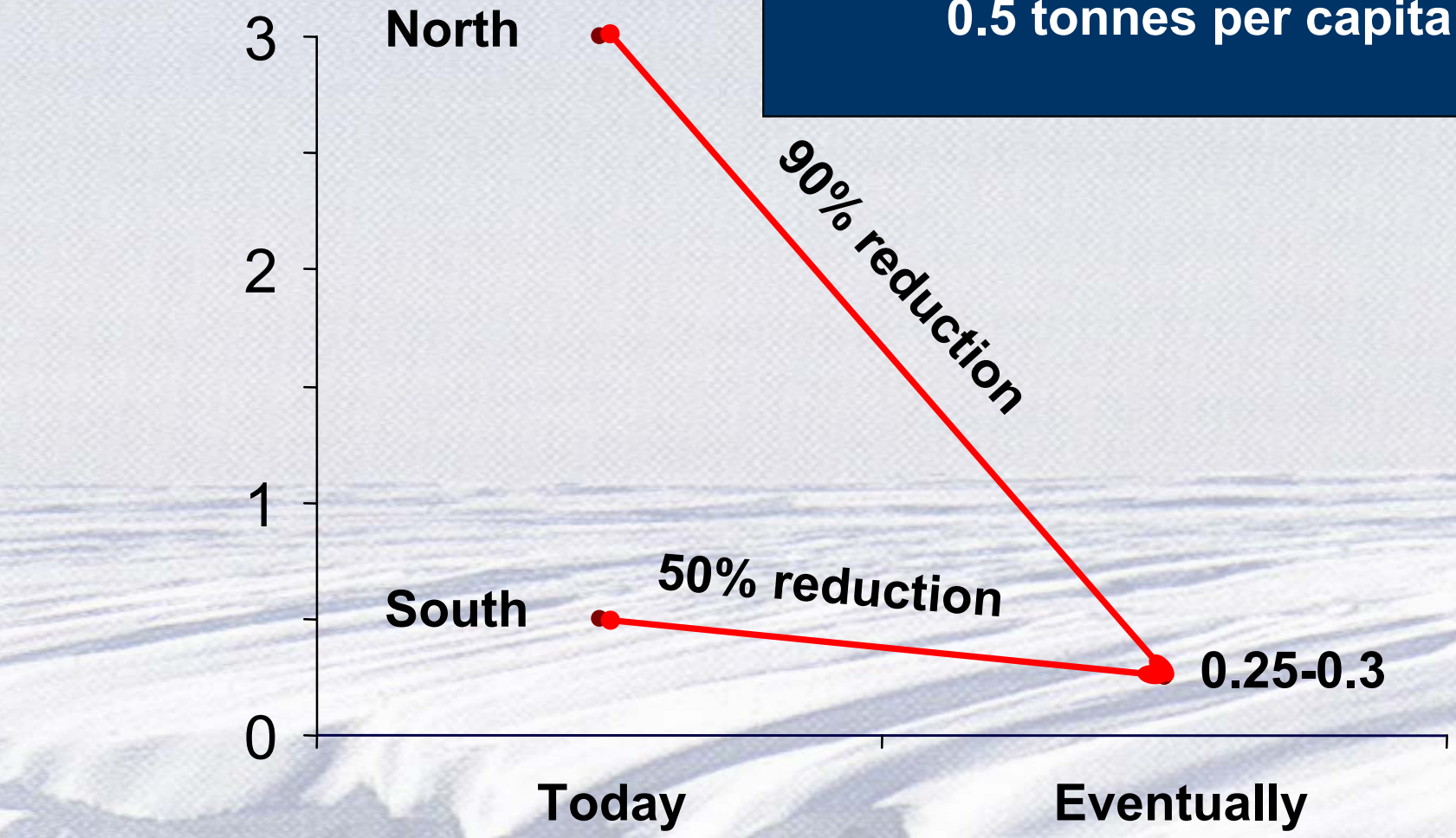


Source : *Sivan Kartha et al,* 1998

II.4 THE ULTIMATE CHALLENGE

carbon emissions

ultimate climate challenge
0.5 tonnes per capita



Source : *Sivan Kartha et al,* 1998

Qu’est-ce qui est possible, d’après le GIEC?

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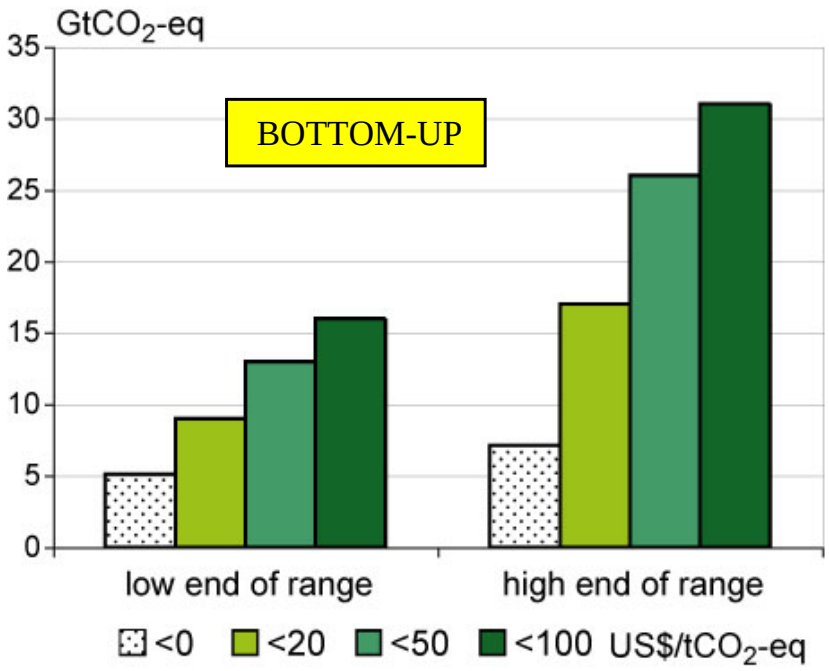
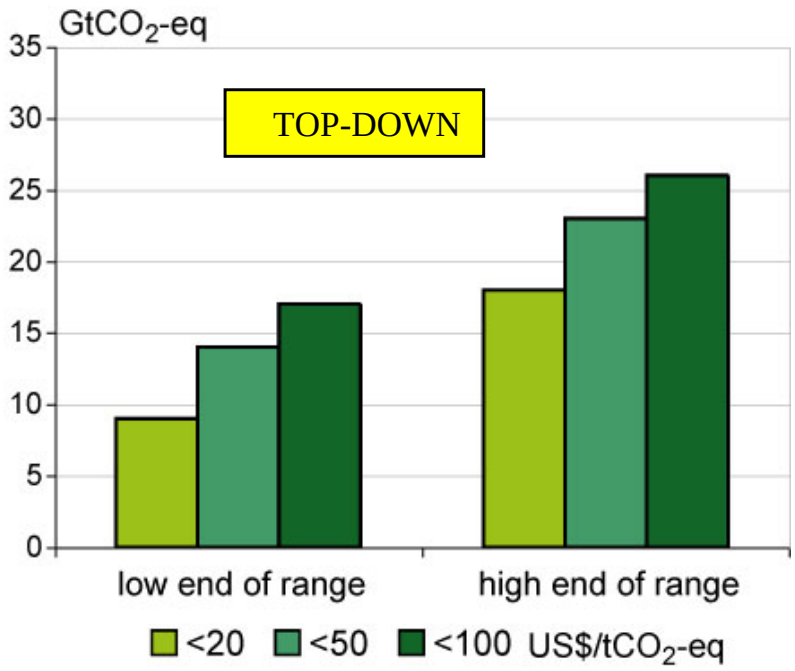
Mitigation potential

- *Mitigation potential:*
  - Emission reduction, relative to emission baselines, that is economically attractive at a given "price of carbon"
- *Market potential:*
  - Based on private costs and private rates of return
  - Expected to occur under forecast market conditions
  - Including policies and measures currently in place
  - Barriers limit actual uptake
- *Economic potential:*
  - Takes into account social costs and benefits and social rates of return,
  - Assuming that market efficiency is improved by policies and measures and
  - Barriers are removed

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

- Both bottom-up and top-down studies





Global economic potential in 2030

Note: estimates do not include non-technical options such as lifestyle changes

What does US$ 50/ tCO2eq mean?

- Crude oil: ~US$ 25/ barrel
- Gasoline: ~12 ct/ litre (50 ct/gallon)
- Electricity:
  - from coal fired plant: ~5 ct/kWh
  - from gas fired plant: ~1.5 ct/kWh

Réduire comment?
- Les technologies

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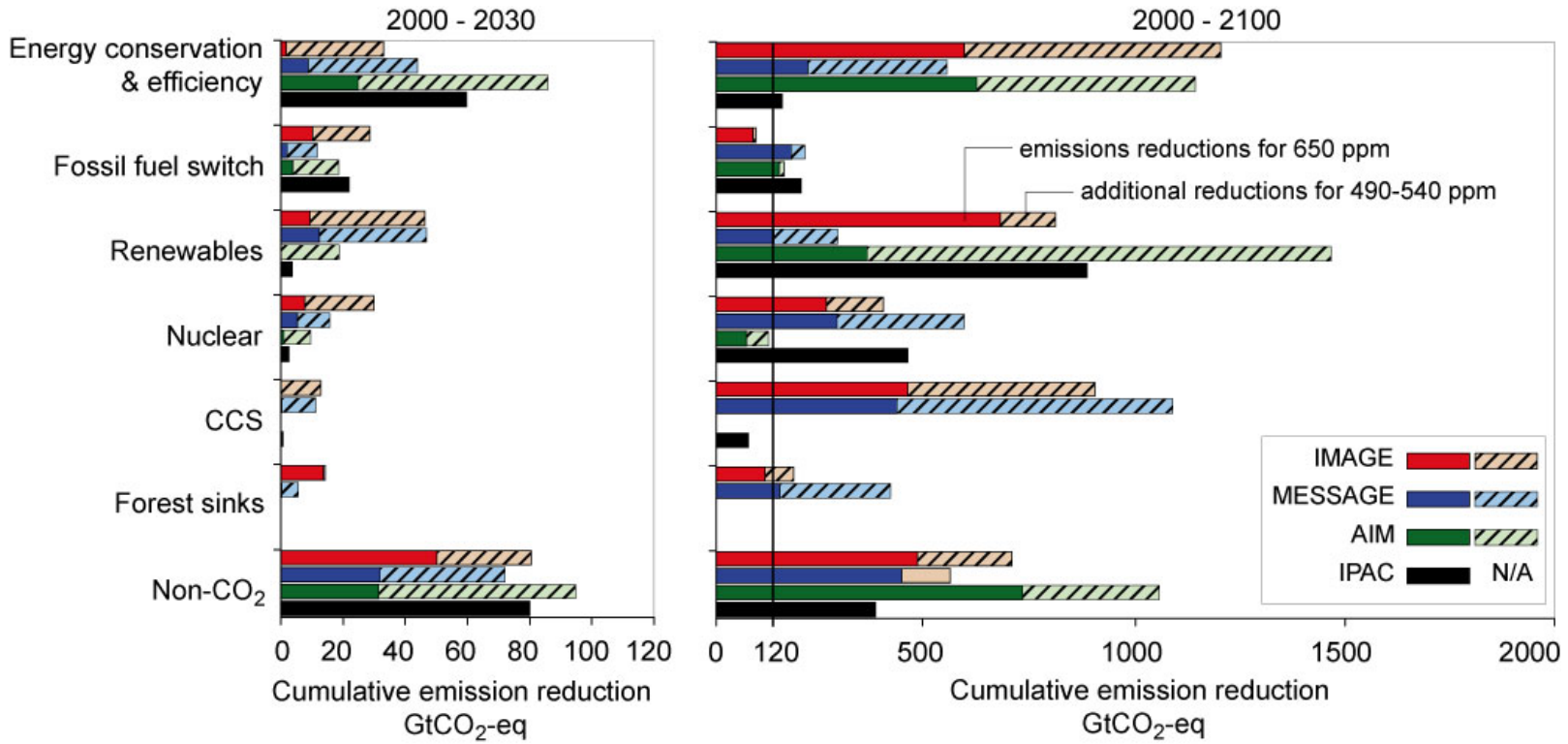
Role of Technology, following IPCC AR4

- **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**

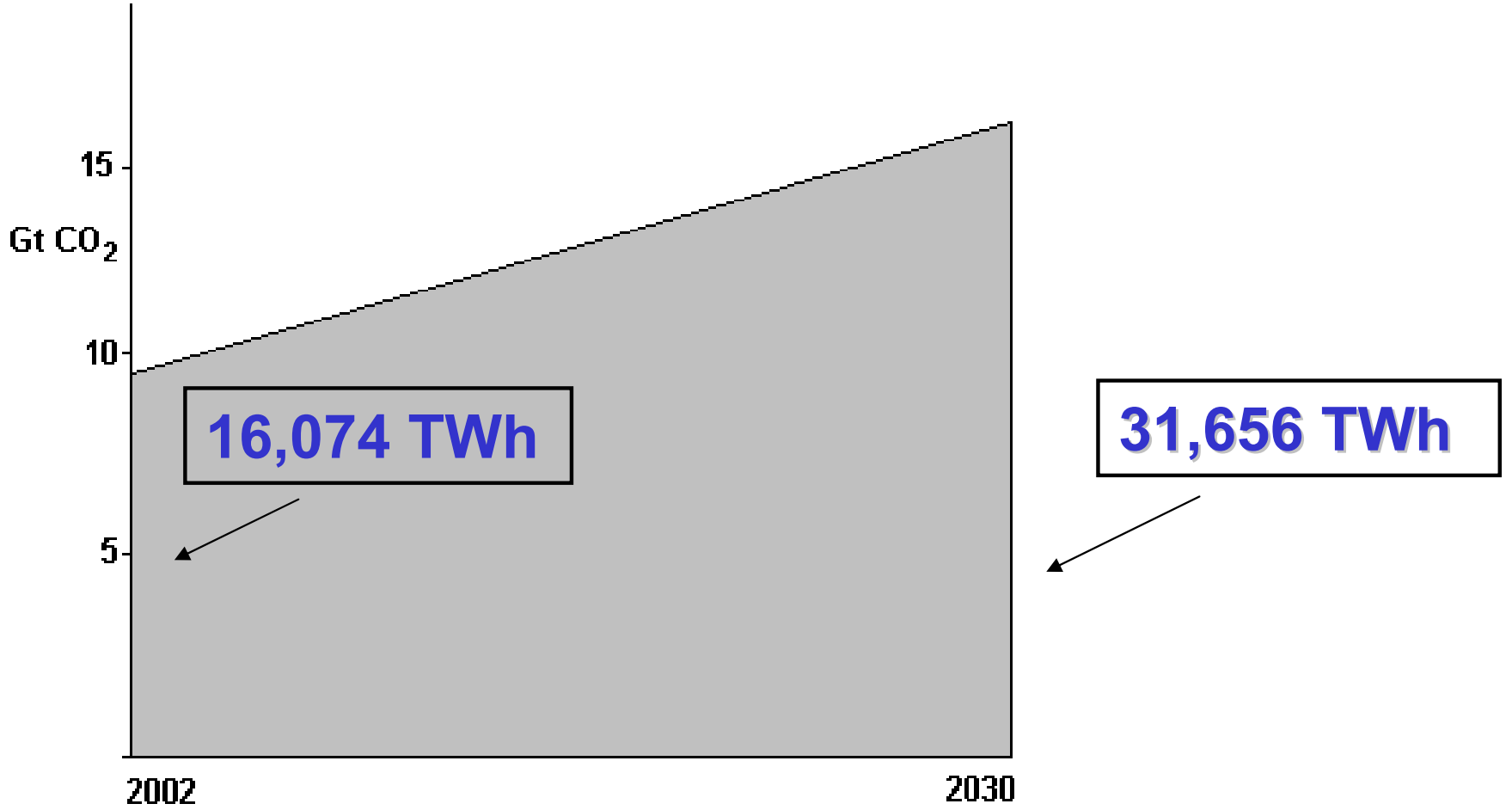


How can emissions be reduced?

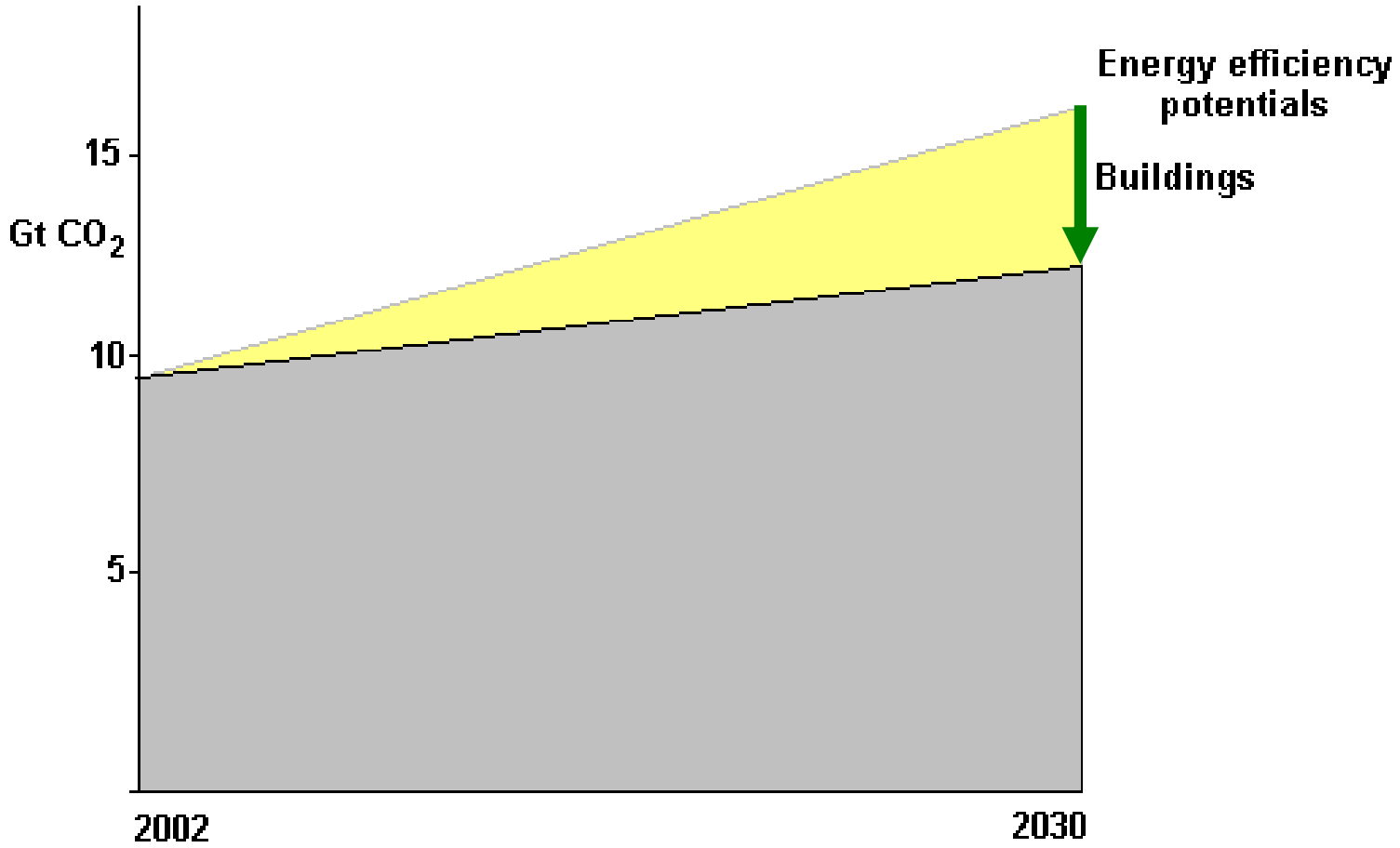
Sector	Key mitigation technologies and practices currently commercially available. (Selected)	Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)
Energy Supply	efficiency; fuel switching; nuclear power; renewable (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; early applications of CO2 Capture and Storage (CCS)	CCS for gas, biomass and coal-fired electricity generating facilities; advanced nuclear power; advanced renewables (tidal and wave energy, concentrating solar, solar PV)

Electricity sector emissions, 2002 to 2030

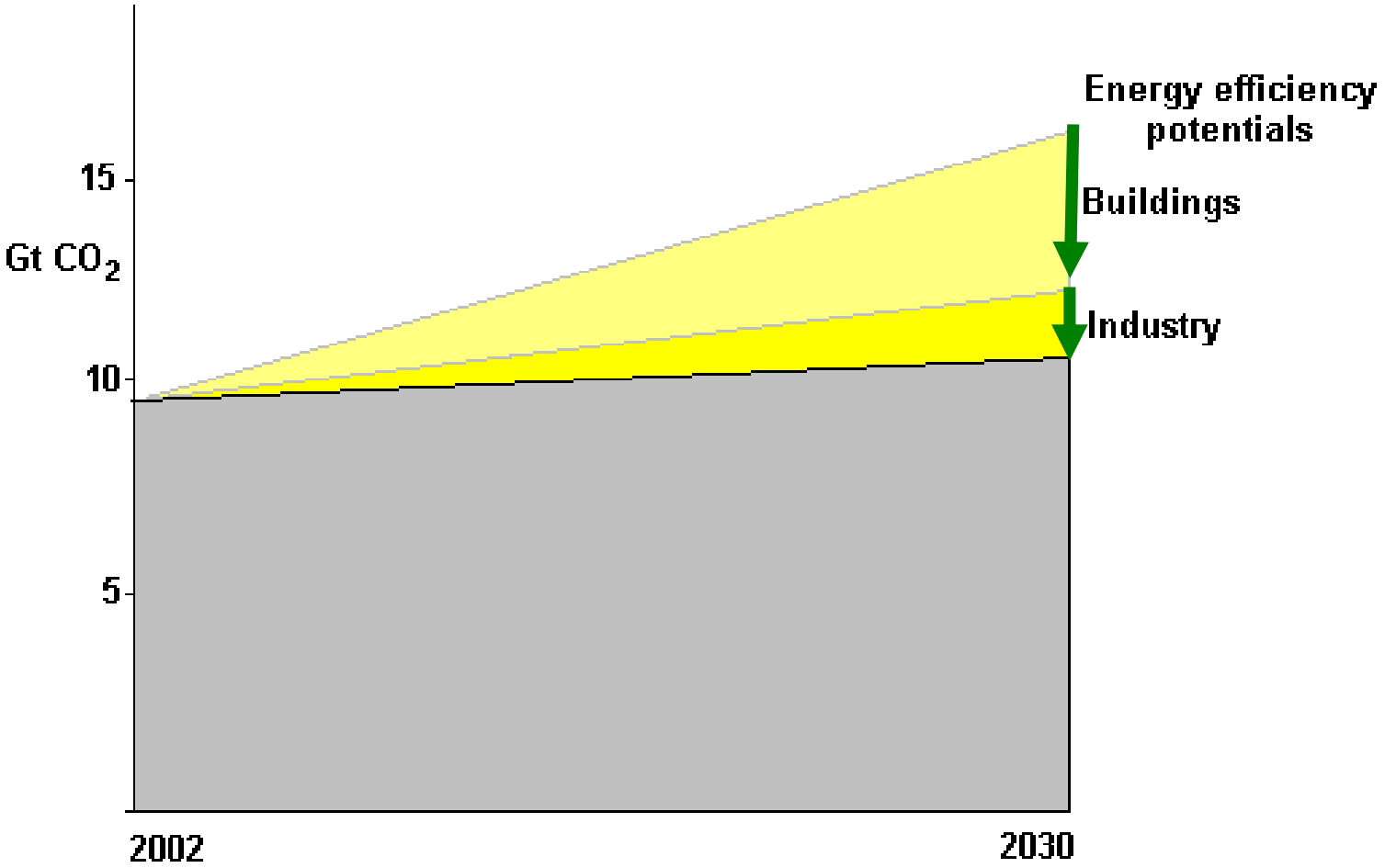
(IEA/WEO 2004 baseline)



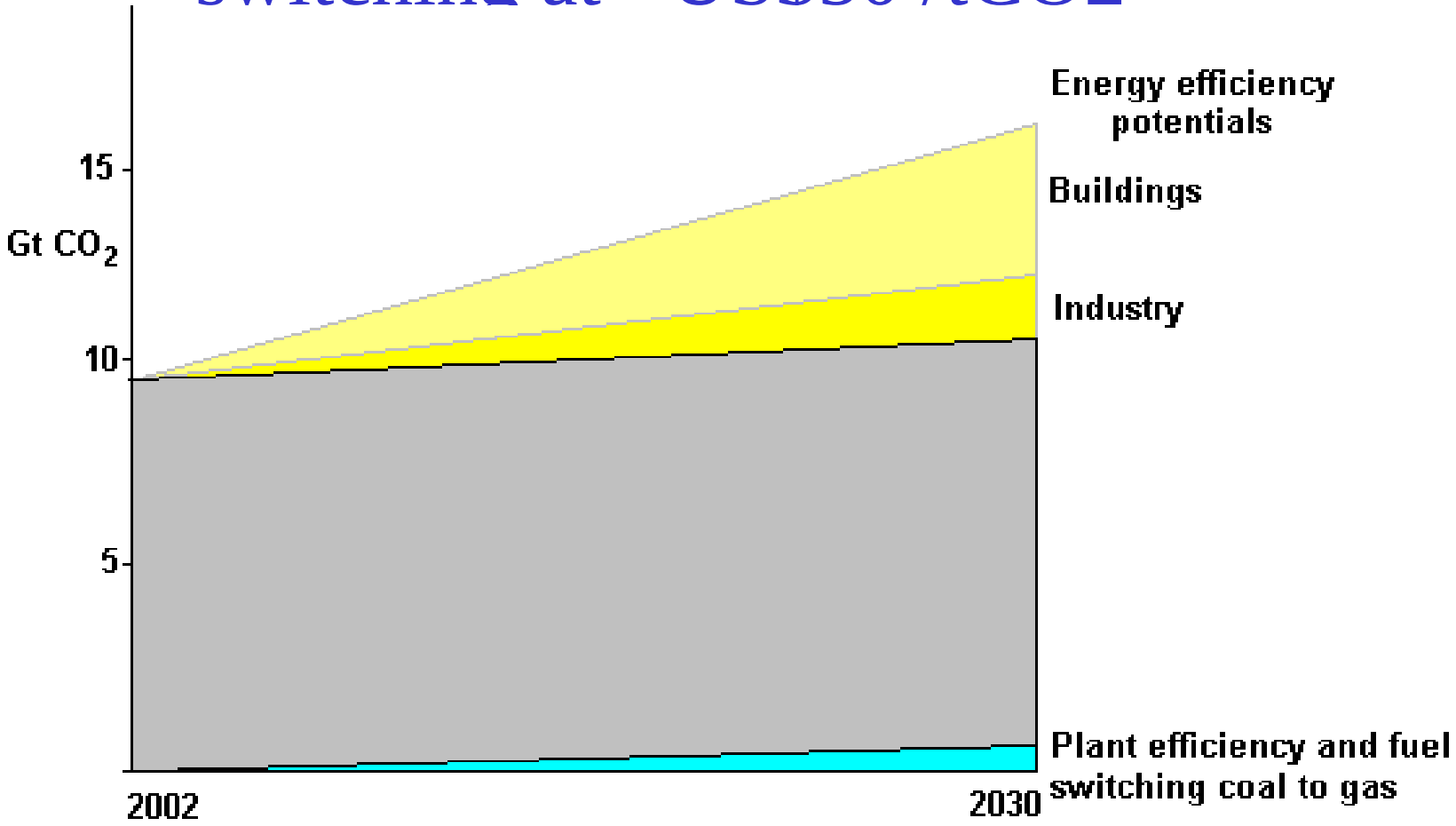
Potential emission reductions from additional electricity saving in Building sector at <US$ 50 /t CO_2



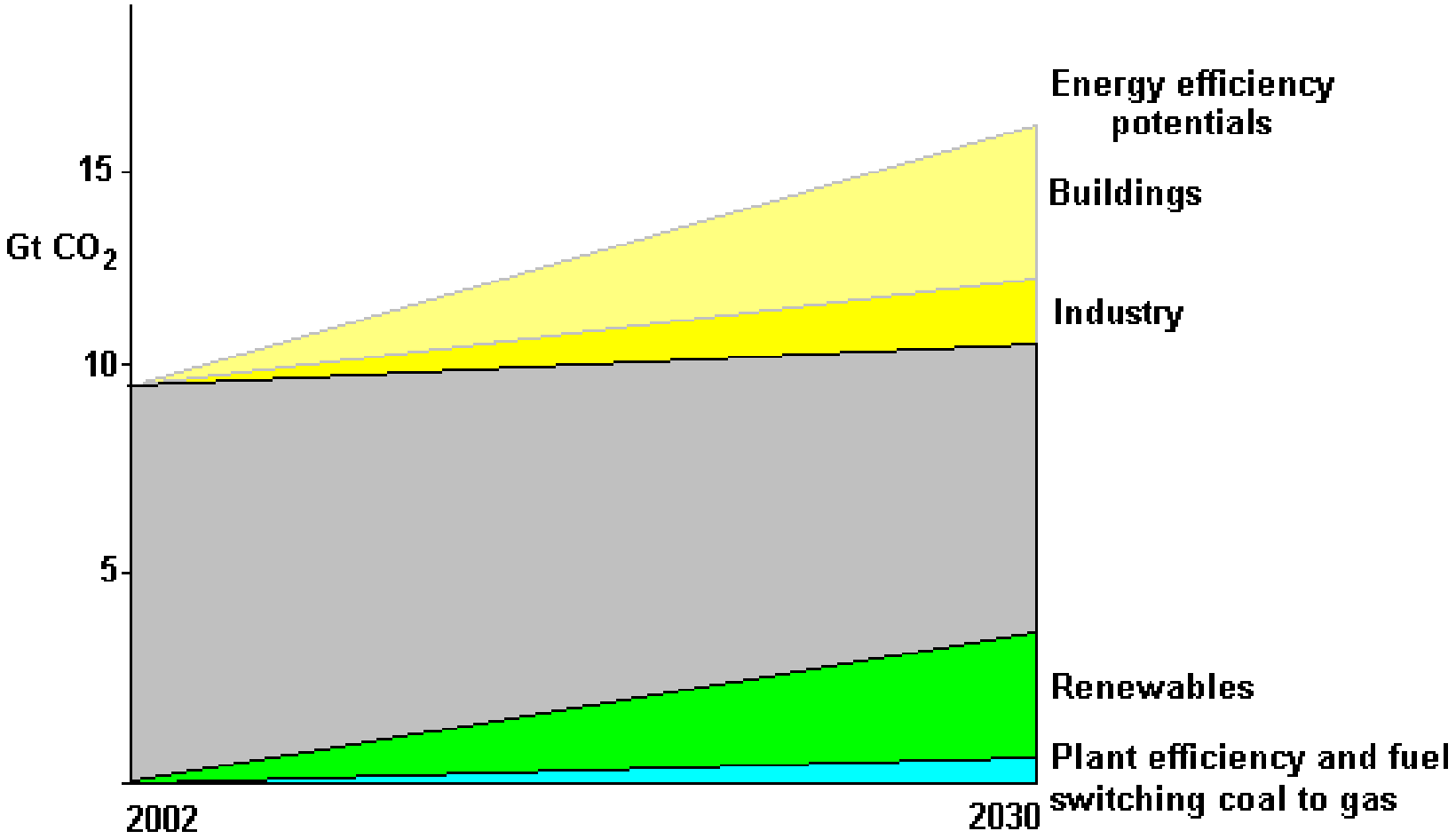
Potential emission reductions from additional electricity saving in the industrial sector at <US$ 50 /t CO2



Potential emission reductions from additional improved generation plant efficiency and fuel switching at <US$50 /tCO2

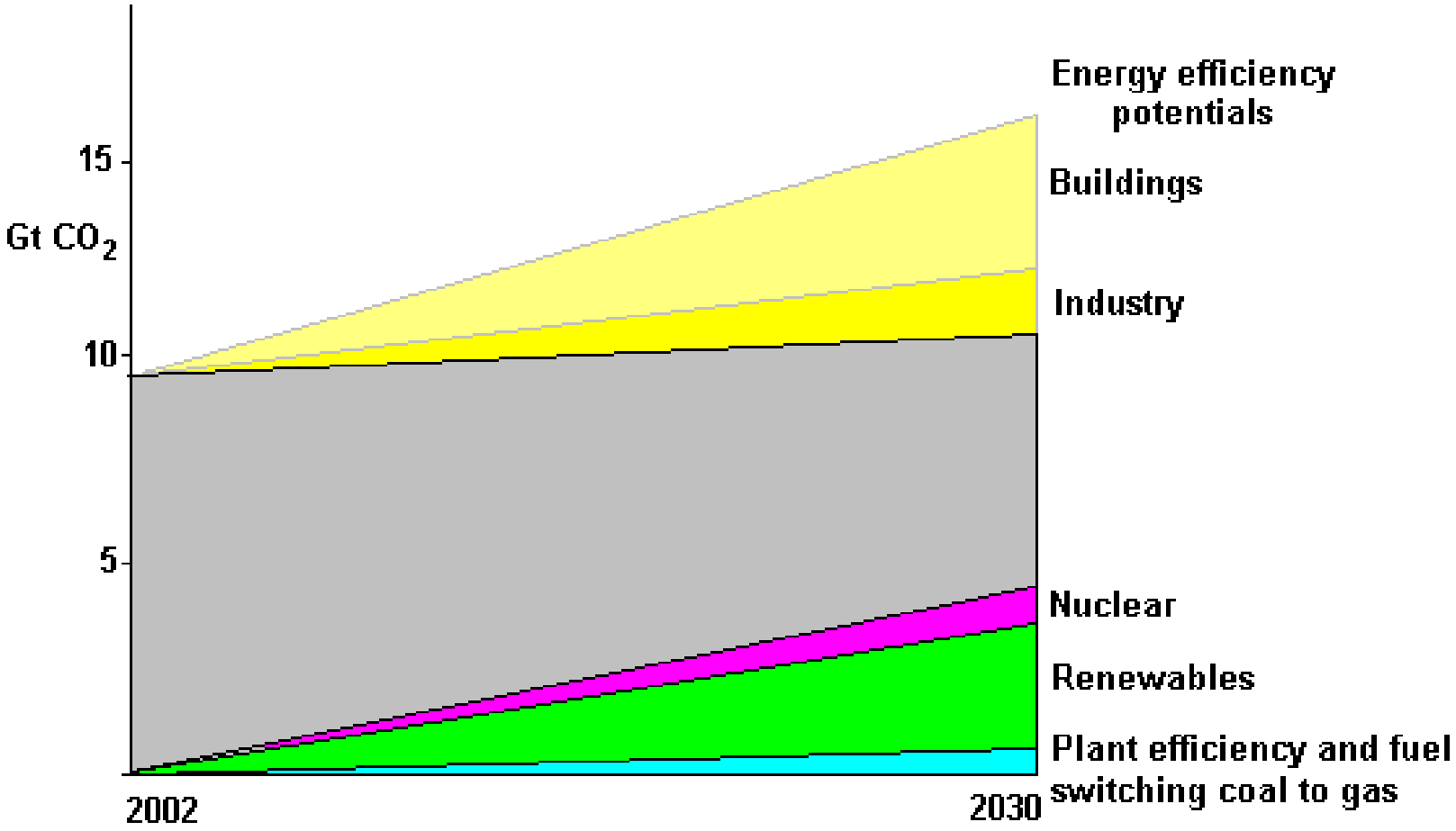


Potential emission reductions from additional hydro, wind, geothermal, bioenergy, solar at <US$ 50 /tCO2



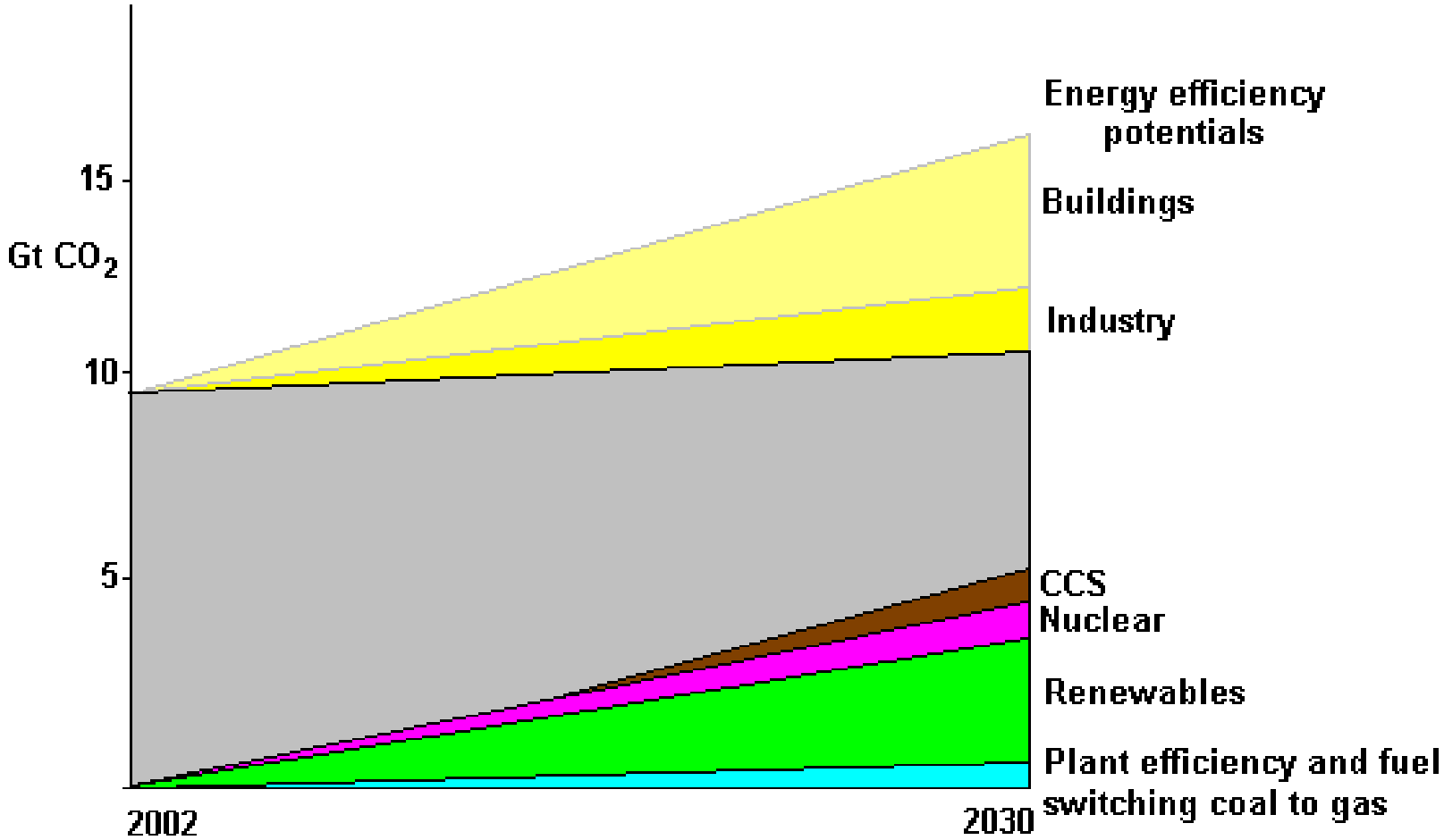
The share of renewables in the total electricity supply can rise from 18% in 2005 to 30 – 35% by 2030 (at carbon price < US$50/tCO2eq).

Potential emission reductions from additional nuclear power at <US$ 50 /tCO2



Nuclear share can increase from 16% of the electricity supply in 2005 up to 18% in 2030 (at carbon price < US$50/tCO2eq).

Potential emission reductions from additional CCS in new coal and gas plants at <US$ 50 /tCO2



Fossil fuel share of electricity generation without CCS drops to < 50% of total supply by 2030 (at carbon price < US$50/tCO2eq).

How can emissions be reduced?

Sector	**(Selected) Key mitigation technologies and practices currently commercially available.**	**Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)**
Transport	More fuel efficient vehicles; hybrid vehicles; biofuels; modal shifts from road transport to rail and public transport systems; cycling, walking; land-use planning	Second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries

Mitigation potential in the transport sector till 2030

- Goods transport, public transport: not quantified
- Vehicle efficiency: net benefits (many cases), but big barriers
- Aviation: efficiency, but not offsetting growth
- Biofuel potential :
  - Depends on production pathway, vehicle efficiency, oil and carbon prices
  - 3% of global transport energy in 2030; 5-10% , if cellulose biomass is commercialised
  - Watch out for: local land and water availability, competition with food

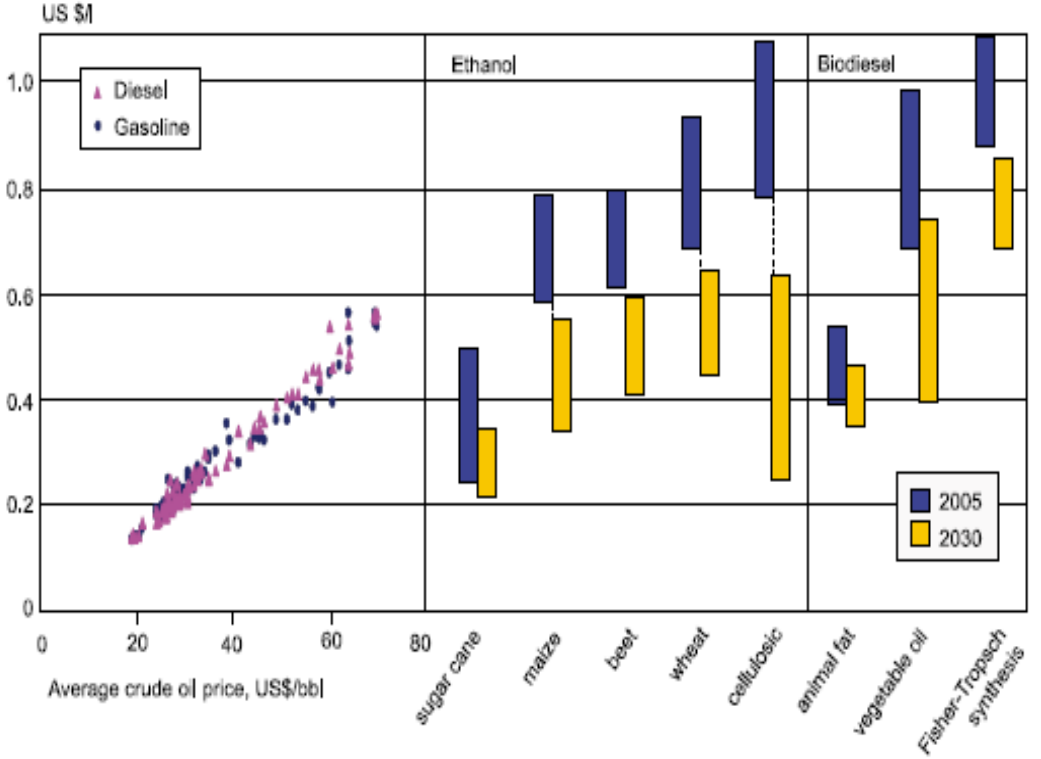


Figure TS.16: Comparison between current and future biofuels production costs versus gasoline and diesel ex-refinery (fob) prices for a range of crude oil prices [Figure 5.9].
Note: prices excl. taxes

How can emissions be reduced?

Sector	**(Selected) Key mitigation technologies and practices currently commercially available.**	**Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)**
Industry	More efficient electrical equipment; heat and power recovery; material recycling; control of non-CO_2 gas emissions	Advanced energy efficiency; CCS for cement, ammonia, and iron manufacture; inert electrodes for aluminium manufacture
Buildings	Efficient lighting; efficient appliances and airconditioners; improved insulation ; solar heating and cooling; alternatives for fluorinated gases in insulation and appliances	Integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control; solar PV integrated in buildings

Mitigation potential in the industry and buildings sector till 2030

- Industry:
  - Potential predominantly in energy intensive industries.
  - Many efficient installations in developing countires
  - Barriers include slow stock turnover and (for SMEs) lack of financial resources, inability to absorb technical information
- Buildings:
  - About 30% of projected GHG emissions by 2030 can be avoided with net economic benefit.
  - New buildings: >75% savings compared to current (at low to zero additional cost)
  - Barriers include availability of technologies, financing, cost of reliable information and limitations in building designs

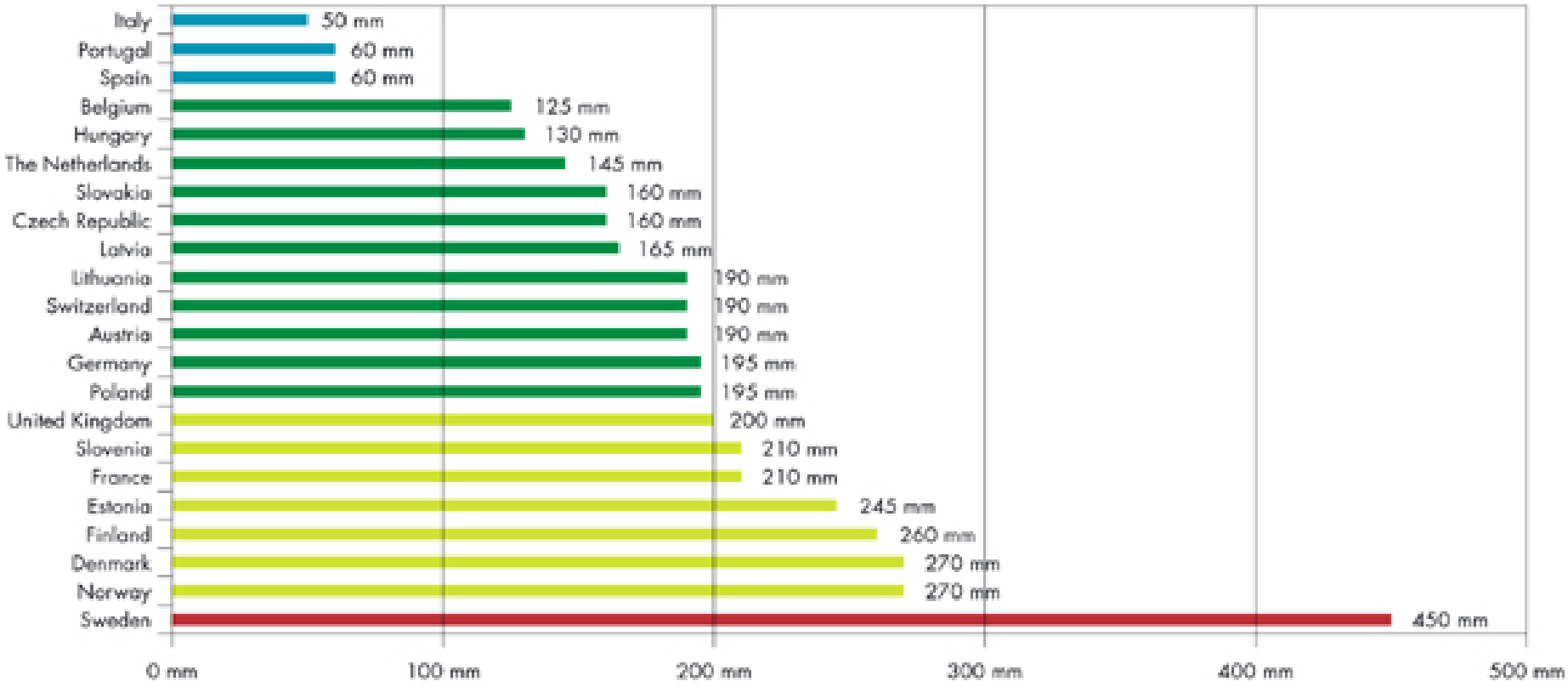
Normes d'isolation du toit (www.eurima.org)

New build residential buildings

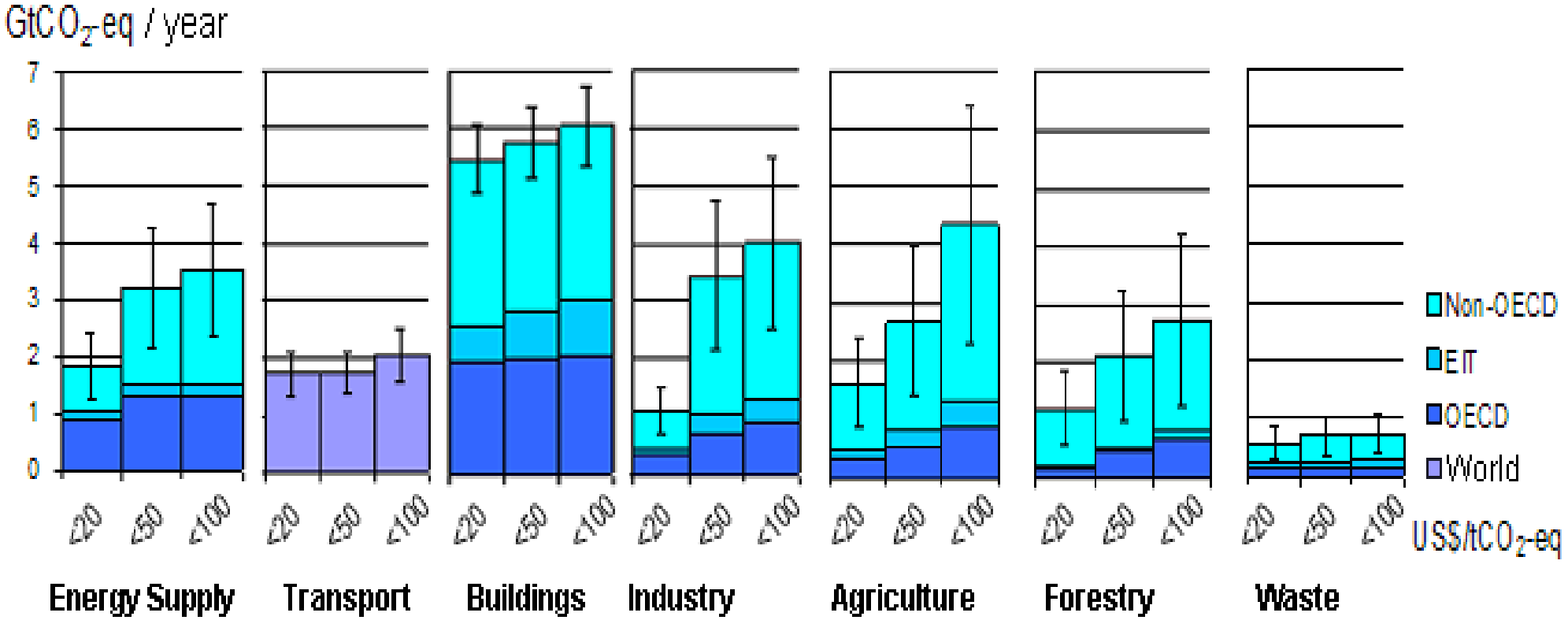
Roof constructions

applied insulation thickness

2004



All sectors and regions have the potential to contribute by 2030



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

Réduire comment?
- Les comportements

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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

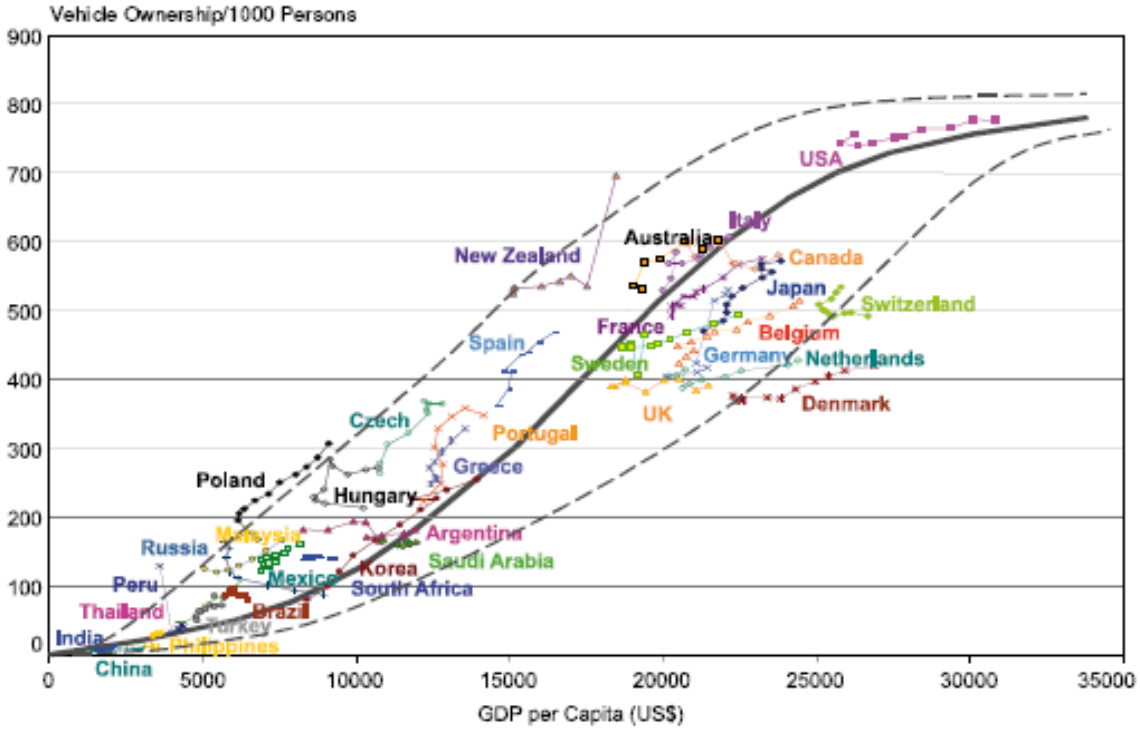

Figure TS.14: Vehicle ownership and income per capita as a time line per country [Figure 5.2]. Note: data are for 1900-2002, but plotted years vary per country, depending on data availability.

L'information sur l'environnement et les conseils pour économiser l'énergie font-ils changer les ménages de comportement ?

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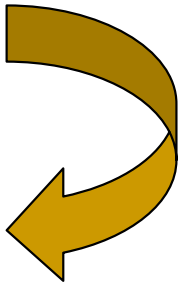
UCL Université catholique de Louvain

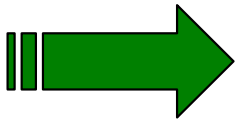
SBI

VITO Vlaamse Instelling voor Technologisch Onderzoek

INFORMATION



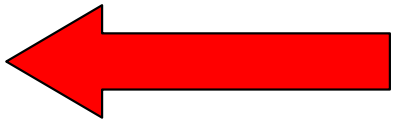
PRISE DE CONSCIENCE



Leviers de changement

ACTION

CHANGEMENT DE PRATIQUE



Freins au changement

Méthodologies

- Enquête par questionnaire (n:1000)
  - Enquête par téléphone
  - Échantillon représentatif
  - Septembre 2004
- Entretiens approfondis
  - « généraux »
  - « audit énergétique »
- Procédures techniques, dont 40 audits énergétiques

Approche sociologique des pratiques

- « Habitus »
  - Bourdieu : principe unificateur de traduction d'une position sociale en un style de vie unitaire
  - Corcuff : prendre en compte les discontinuités et la pluralités des dispositions d'une personne
- Sociologie anglo-saxonne de la consommation
  - Halkier : expérience = interactions + interprétations + pratiques
  - Warde : pratique = compréhensions + procédures + engagements

Connaissances en matière énergétique et pratiques correspondantes

- Au total, **pas d'association claire** entre des pratiques d'économie d'énergie et
  - Connaissance sur le changement climatique
  - Connaissance sur les énergies renouvelables
- Importance des normes sociales sur le confort, l'aspect pratique et la propreté (Shove, 2003)

Connaissances en matière énergétique et pratiques correspondantes

- Appareils en veille
  - **Bonne connaissance** générale (81%), moindre connaissance détaillée (nucléaire, PC, …)
  - **Usage fréquent** (17% souvent, 37% toujours)
  - *"[On devrait] probablement faire plus attention, encore plus attention"*

Connaissances en matière énergétique et pratiques correspondantes

- Bain et douche
  - Pas connaissances sur le climat ≠ selon le nombre de bains
  - + connaissance sur le climat si + douches
- Chauffage
  - **+ connaissance si ↓ température (nuit, absence)**
  - Pas de connaissance ≠ si ↓ température (aération)
  - Pas de connaissance ≠ selon température estimée du séjour

Connaissances en matière énergétique **et pratiques** correspondantes : électro-ménagers

- + connaissance sur le climat si
  - + gros électro-ménagers
  - usage + fréquent machine à laver et lave-vaisselle
- Pas de connaissance sur le climat ≠ pour
  - Éteindre les lampes
  - Avoir des lampes économiques
  - Avoir des électro-ménagers avec labels A ou B
  - Utilisation du séchoir par semaine * personne
  - TV en mode stand-by

Connaissances en matière énergétique et pratiques correspondantes

- Importance des normes sociales sur le confort, l'aspect pratique et la propreté (Shove, 2003)
- « en ce qui concerne l'environnement, on peut tirer autant de sonnettes d'alarme qu'on veut, seuls ceux qui veulent les entendre les entendront » (Catherine)
- Proposer l'hypothèse d'une relation inversée : pratiques avec effet moindre sur l'environnement favorisent une ouverture à l'information sur l'environnement
- Quid information « personnalisée » ?

Perceptions des consommateurs sur les politiques environnementales (2)

- Beaucoup pensent que c'est le rôle des autorités de veiller au bien commun, y compris des générations futures
- ½ demandent des campagnes de sensibilisation et information
- ½ ne connaissent pas les déductions fiscales
- Tous demandent une centralisation de l'information sur les économies d'énergie

⇒ Coopération entre les différents pouvoirs pour augmenter la visibilité et la légitimité d'une politique énergétique

Perceptions des consommateurs sur les politiques environnementales (3)

- Certains notent le peu de contrôle des normes sur l'isolation
- Beaucoup demandent une diminution du gaspillage dans les bâtiments publics et privés

⇒ Cohérence entre les différents pouvoirs pour accroître le soutien social et politique aux économies d'énergie faites par les ménages

Audit énergétique : évaluation (chauffage, eau chaude, électricité)

- N=40, intéressés par (la réduction de) leur consommation d'énergie
- Après 1 an :
  - 11 % des recommandations appliquées
  - 23 % des recommandations « planifiées »
- Quelques changements mineurs :
  - + isolation des tuyaux
  - + pommeaux de douche économiques

Information personnalisée et peu d'action : pourquoi ?

- **Autres travaux à réaliser jugés prioritaires**
  - Pour augmenter le confort, l'esthétique, faciliter la vie quotidienne, gagner du temps…
  - Le temps de retour de l'investissement est un critère peu important pour les ménages

Information personnalisée et peu d'action : pourquoi ?

- Analyse sociologique des entretiens compréhensifs (n=12) et comparaison avec le Danemark
- **Nécessité que chaque consommateur en parle avec proches (**une conscience discursive, Giddens)
  - Information pratique nécessaire et compétences pratiques nécessaires (isolation) : conscience pratique faible !
  - Contexte important (optionnel, mal contrôlé, 'oubli')
  - Importance des perceptions: *"Nous ne sentons pas d'inconfort" / "L'utilité de l'isolation, tu la sens !"*
  - → Hypothèse (politique sur le tri des déchets) **obligation**, une modalité de conscience discursive

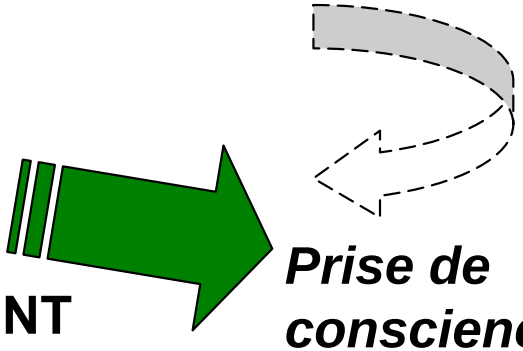
Information personnalisée et peu d'action : pourquoi ?

- **Besoin d'information cohérente**
  - Avec intermédiaires (chauffagiste, architecte, …)
  - Avec famille, amis, ...
  - Avec information recueillie soi-même (Internet, …)
  - Déjà entendu avant, de sources compétentes
  - → Hypothèse : **comparaison sociale**, une modalité de conscience discursive : importance des réseaux sociaux

Information personnalisée et peu d'action : pourquoi ?

- **Besoin de soutien social et de l'entourage**
  - Lampes économiques → bougies?
  - Besoin de raisons légitimées socialement (≠ économie et environnement)
  - Économiser l'énergie est incompatible avec le fait de montrer un statut social élevé
  - Besoin du soutien des membres de la famille
- **Augmentation de l'estime de soi**
  - Faire des recommandations son propre projet
  - En continuité avec investissements précédents

Information cohérente, pratique

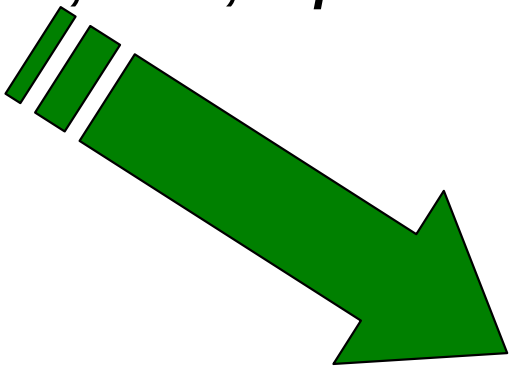


ACTION

CHANGEMENT

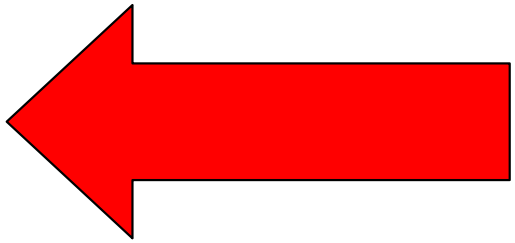
Prise de conscience

Leviers de changement : confort, facilité, habitudes, entourage, identité, revenu, 'vert', aspects techniques



ACTION

CHANGEMENT



Freins au changement : consommation, confort, facilité, habitudes, entourage, identité, revenu, 'vert', aspects techniques, information, locataire

Mais…

- Plusieurs leviers sont nécessaires pour un changement
- Un seul frein suffit pour que le changement ne se produise pas

Conclusion

- Ni les connaissances environnementales générales ni les informations personnalisées ne provoquent à elles seules des comportements plus économes en énergie
- Proposer l'hypothèse d'une relation inversée : pratiques avec effet moindre sur l'environnement favorisent une ouverture à l'information sur l'environnement
- Une politique d'économie d'énergie susciterait :
  - Une conscience discursive (via l'obligation perçue)
  - Du soutien social et une légitimité sociale

Conclusion (2)

- Conditions pour compenser les états d'âme (Martuccelli) et la compartimentalisation des pratiques (Halkier) :
  - Convergence de l'information (Goldblatt, 2003) : les conseils pour épargner l'énergie doivent être préalablement corroborés et soutenus par des conversations (Bartiaux, forth in JCP)
  - Soutien social (Gram-Hanssen *et al*., 2007) de la part des personnes ou des réseaux que les 'consommateurs' valorisent le plus pour leur(s) travaux de rénovation énergétique (chauffagiste, beau-père, collègues, amis…) dans le but de se conformer à la normalité sociale définie dans les réseaux d'appartenance
  - Faire passer les nouvelles connaissances d'une conscience pratique à une conscience discursive (Giddens): importance du contexte socio-technique et des politiques

Conclusion (2)

- Questionner le rôle central donné à l'information et aux politiques basées sur les labels et la sensibilisation
- Pour dé-compartimentaliser les pratiques : Personal Carbon Allocation
  http://www.eci.ox.ac.uk/research/energy/pct.php

Perceptions des consommateurs sur les politiques environnementales

- 21 % ont fait le maximum pour économiser l'énergie
- ¾ pensent que les familles ou les autorités publiques devraient entreprendre des actions
- + 60 % sont d'accord
  - De diminuer la température d'1°
  - D'améliorer l'isolation
  - D'installer un système de chauffage + efficace

⇒ grande <u>acceptabilité</u> potentielle d'une politique énergétique

Réduire comment?
- Aspects économiques

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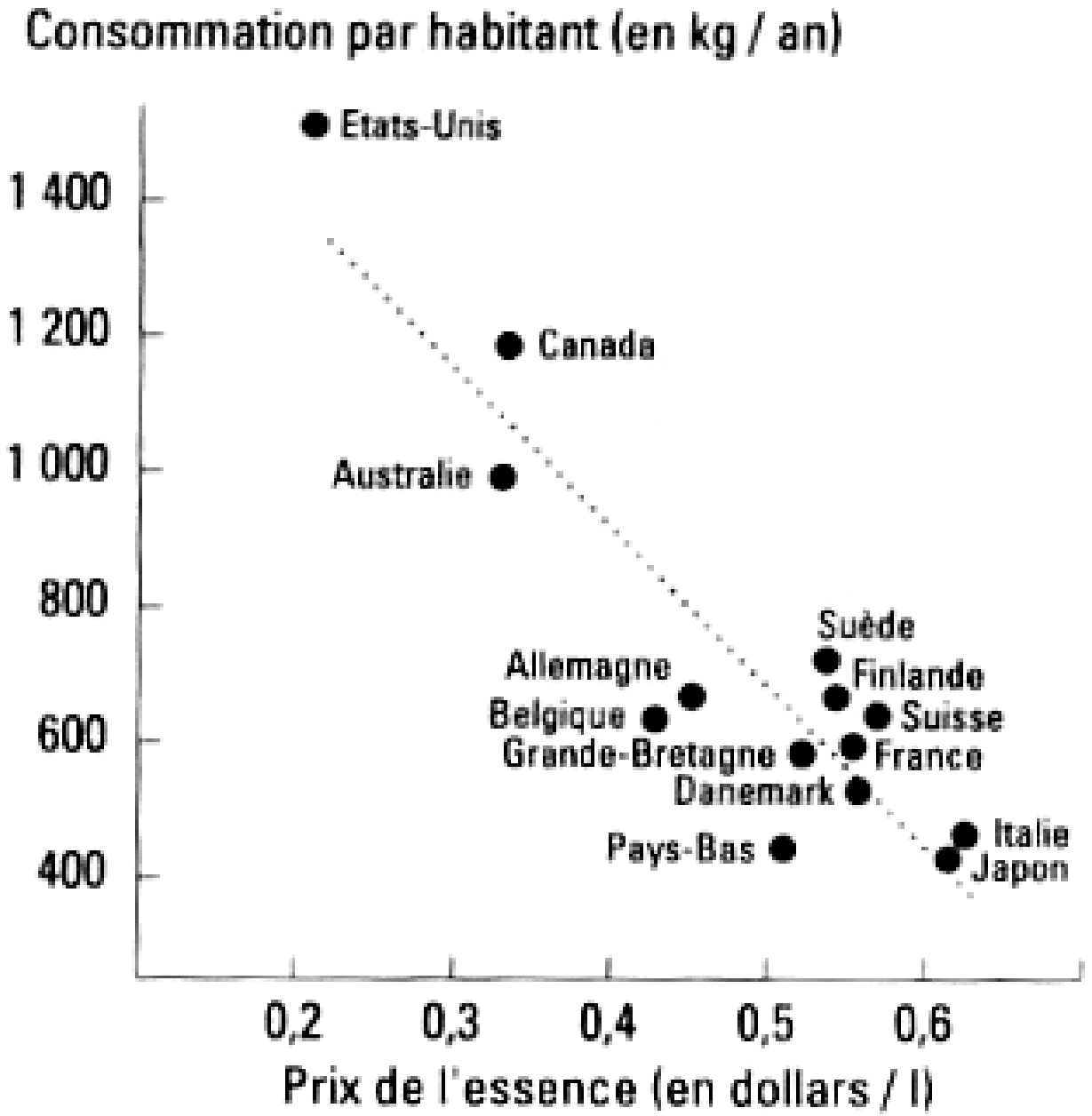
Corrélation entre le prix du carburant et la consommation



Le Monde

MARDI 12 SEPTEMBRE 2000

Pétrole : le retour des économies d'énergies

● Lionel Jospin annonce un « plan d'économies d'énergies » avant la fin de l'année pour faire face à la hausse du pétrole ● L'OPEP décide d'augmenter sa production ● Le prix du baril est en légère baisse ● Les manifestations contre le coût des carburants se multiplient en Europe

The importance of a “price of carbon”

- 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 stabilisation at around 550 ppm CO2eq carbon prices should reach 20-80 US$/tCO2eq by 2030 (5-65 if “induced technological change” happens)
- At these carbon prices large shifts of investments into low carbon technologies can be expected

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.

What are the macro-economic costs in 2050?

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	0.5	-1 – 2	< 0.05
535-590	1.3	Slightly negative - 4	<0.1
445-535[4]	Not available	< 5.5	< 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 2050 that would result in the indicated GDP decrease in 2050.
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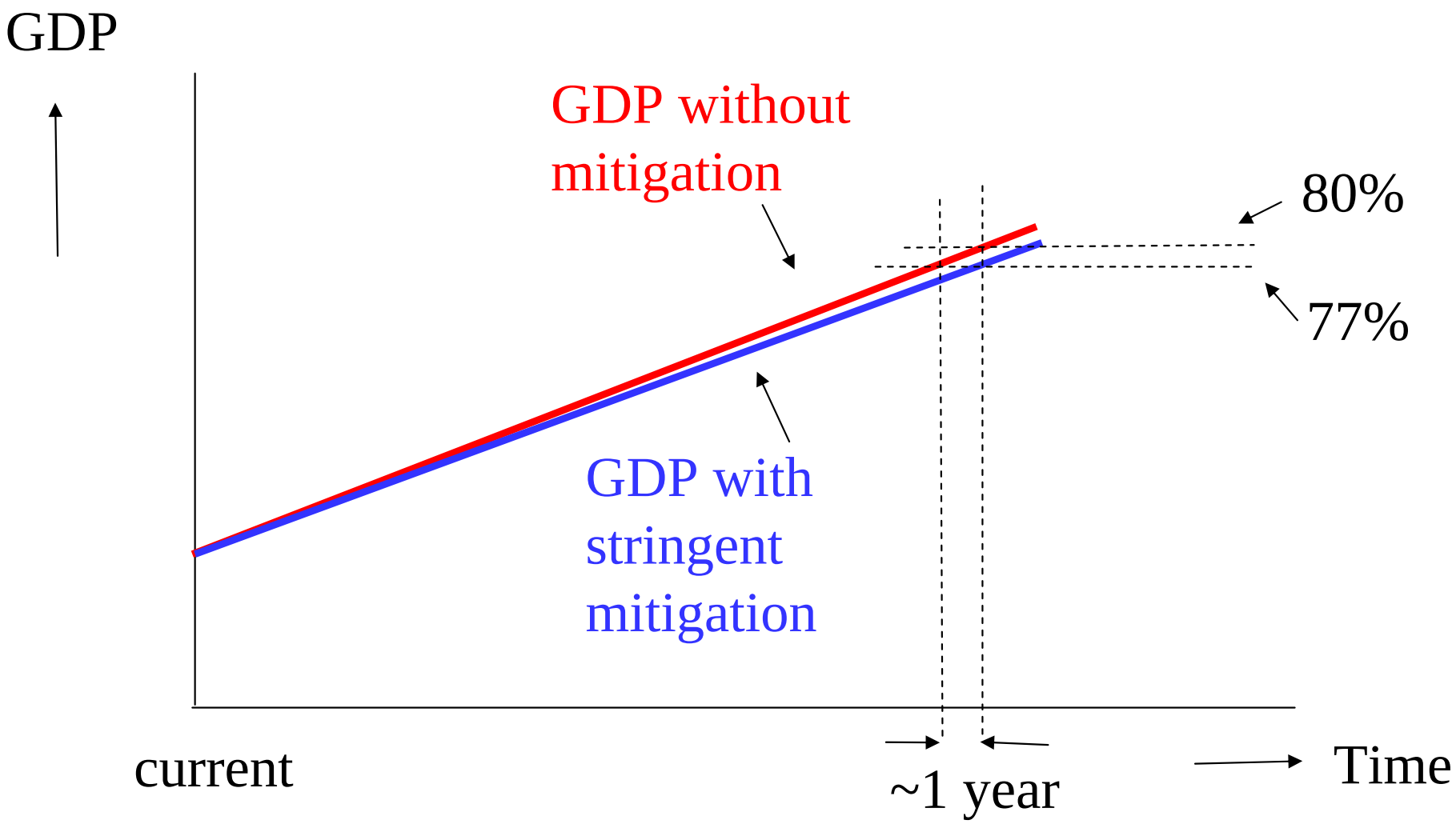
Illustration of cost numbers



There are also co-benefits of mitigation

- 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*

Réduire comment?
- Aspects politiques

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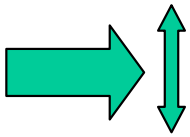
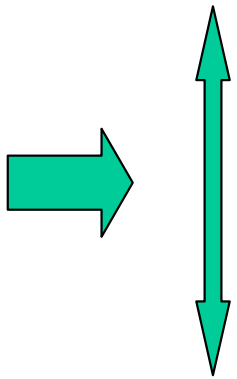
Policies are available to to governments to realise mitigation of climate change

- Effectiveness of policies depends on national circumstances, their design, interaction, stringency and implementation
  - Integrating climate policies in broader development policies
  - Regulations and standards
  - Taxes and charges
  - Tradable permits
  - Financial incentives
  - Voluntary agreements
  - Information instruments
  - Research and development

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.

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

Sector	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities
Transport	Mandatory fuel economy, biofuel blending and CO_2 standards for road transport	Partial coverage of vehicle fleet may limit effectiveness
	Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing	Effectiveness may drop with higher incomes
	Influence mobility needs through land use regulations, and infrastructure planning	Particularly appropriate for countries that are building up their transportation systems
	Investment in attractive public transport facilities and non-motorised forms of transport	

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

An effective carbon-price signal could realise significant mitigation potential in all sectors

- 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 stabilisation at around 550 ppm CO2eq carbon prices should reach 20-80 US$/tCO2eq by 2030
  (5-65 if “induced technological change” happens)
- At these carbon prices large shifts of investments into low carbon technologies can be expected

Investments

- Energy infrastructure investment decisions, (20 trillion US$ till 2030) 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

The importance of technology policies

- The lower the stabilization levels (550 ppm CO2-eq or lower) the greater the need for more efficient *RD&D efforts* and *investment* in new technologies during the next few decades
- Government support is important for effective technology development, innovation and deployment through
  - financial contributions,
  - tax credits,
  - standard setting
  - market creation.
- BUT, government funding for most energy research programmes has been declining for nearly two decades: now about half of 1980 level.

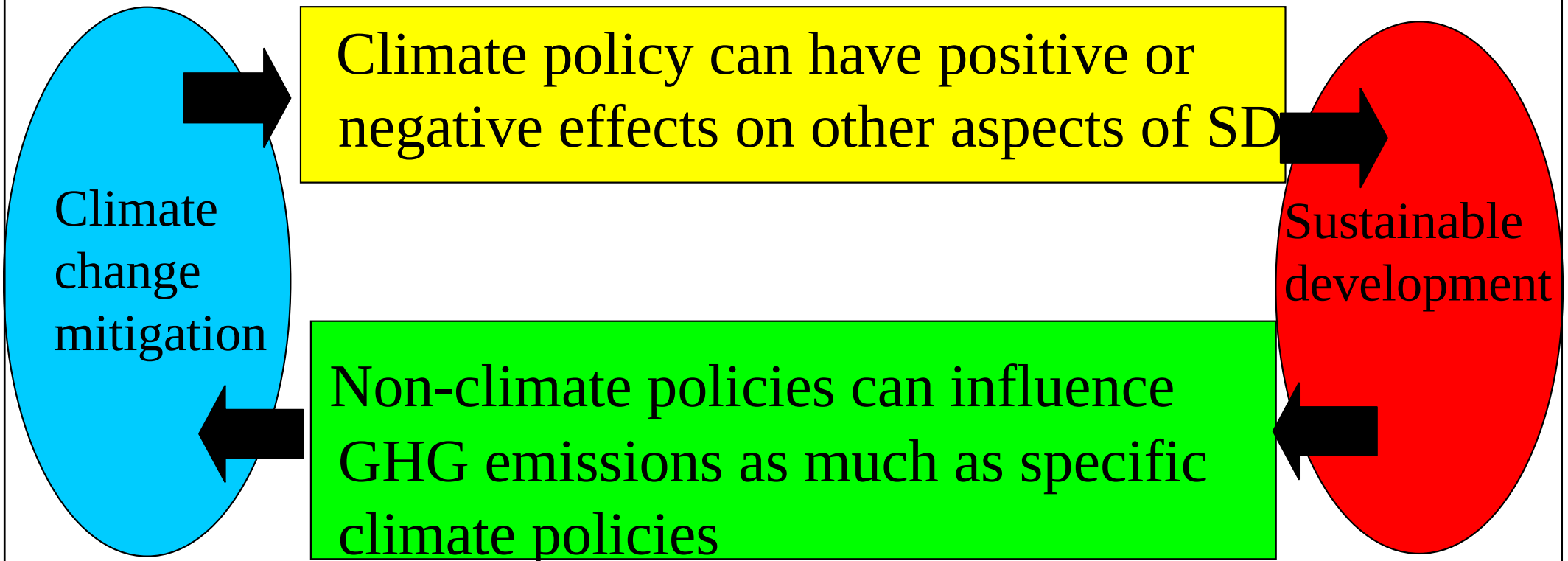
Non-climate policies can influence GHG emissions as much as specific climate policies

Sectors	Non-climate policies -- Candidates for integrating climate concerns	Possible influence (% of global emissions)
Macro-economy	Taxes, subsidies, other fiscal policies	All GHG emissions (100%)
Electricity	Diversification to low-carbon sources, demand management, limit distribution losses	Electricity sector emissions (20 %)
Oil-imports	Diversification energy sources/decrease intensity -> enhance energy security	GHGs from oil product imports (20 %)
Insurance (buildings, infrastructure)	Differentiated premiums, liability insurance exclusion, improved conditions for green products	GHG emissions buildings, transport (20%)
Bank lending	Sector/ country strategies, avoid lock-in into old technologies in developing countries	Notably development projects (25%)
Rural energy	Policies promoting LPG, kerosene and electricity for cooking	Extra emissions over biomass (<2 %)

Examples of side-effects of climate mitigation

OPTIONS	*SYNERGIES*	*TRADEOFFS*
Energy: efficiency, renewables, fuel-switching 	• air quality • supply security • employment • costs (efficiency)	• particulate emissions (diesel) • biodiversity (biofuels) • costs (renewables)
waste: landfill gas capture, incineration 	• health & safety • employment • energy advantages	• ground water pollution • costs

Two-way Relationship Between Climate Change and Sustainable Development



International agreements

- Notable achievements of the ***UNFCCC/Kyoto Protocol*** that may provide the foundation for future mitigation efforts:
  - global response to the climate problem,
  - stimulation of an array of national policies,
  - the creation of an international carbon market and
  - new institutional mechanisms

- ***Future agreements***:
  - Greater cooperative efforts to reduce emissions will help to reduce global costs for achieving a given level of mitigation, or will improve environmental effectiveness
  - Improving, and expanding the scope of, market mechanisms (such as emission trading, Joint Implementation and CDM) could reduce overall mitigation costs
  - Assessed literature on future agreements on basis of criteria for enevironmental/ cost effectiveness, distributional/ institutional feasibility

Pour en savoir plus...

- www.climate.be/vanyp : bientôt: dias JPvY
- www.ipcc.ch : IPCC ou GIEC
- www.unfccc.int : Convention & Protocole
- www.cfdd.be : Conseil fédéral développement durable
- www.climat.be : campagne climat du Gvt
- jcm.chooseclimate.org : modèle interactif du Dr B. Matthews, UCL-ASTR
- www.realclimate.org: réponse aux sceptiques

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