Climate Change, Resources and Social Housing

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the International Initiative for a Sustainable Built Environment

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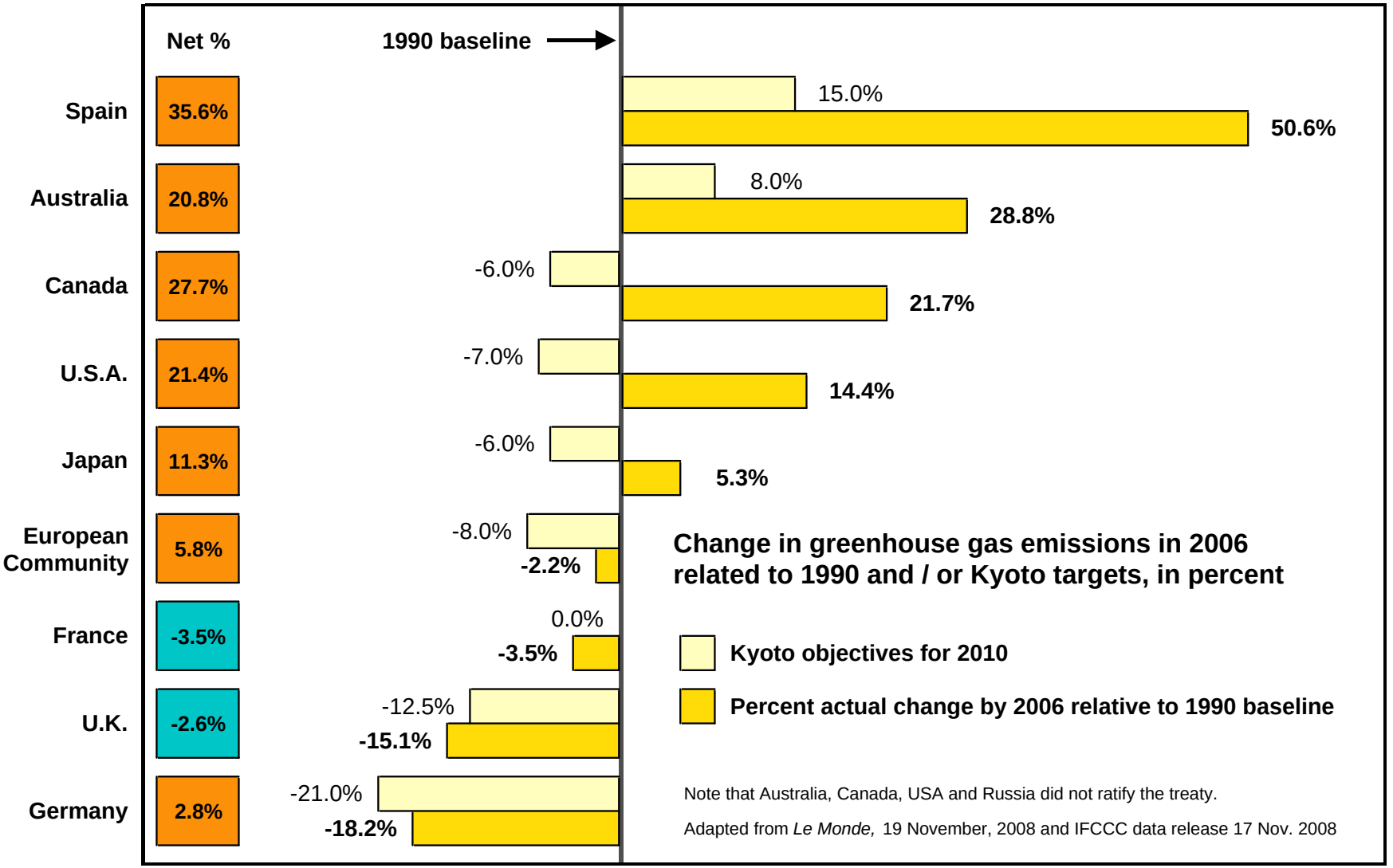
iiSBE at a glance

- An international non-profit organization;
- Focus on guiding the international construction industry towards sustainable building practices;
- Emphasis is on research and policy, with a special emphasis on information dissemination, building performance and its assessment;
- 23 Board members from over 16 countries;
- Secretariat is in Ottawa and Paris;
- Local chapters exist in Chile, Czech Republic, Israel, Italy, Portugal, Spain and Taiwan, others are being formed in Poland, France, Malaysia, Greece, Turkey and Canada;
- Andrea Moro is President, Nils Larsson is XD;
- No paid staff, very active network

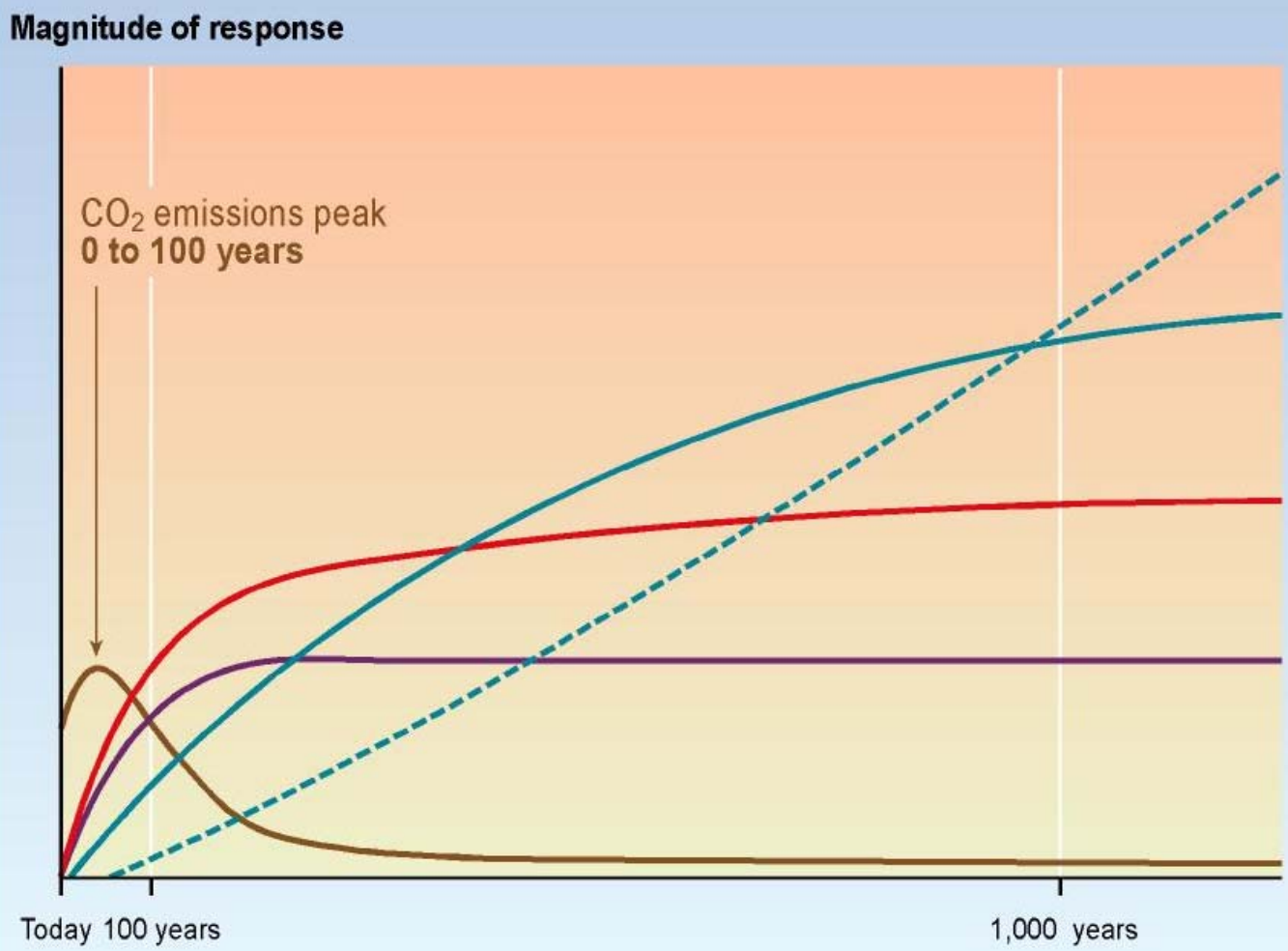
Introduction

- This presentation provides an overview of context factors in the 21st Century that social housing will have to operate within;
- Climate change issues and resource scarcities are two main issues;
- Such a broad approach may at first seem to be too abstract to be relevant, but given the lifespan of most buildings, the buildings we plan today and their inhabitants will certainly be affected by them.

2006 emissions for selected countries, compared to 1990 baselines and/or Kyoto targets.



CO_2 concentration, temperature, and sea level continue to rise long after emissions are reduced



Time taken to reach equilibrium

Sea-level rise due to ice melting:
several millennia

Sea-level rise due to thermal expansion:
centuries to millennia

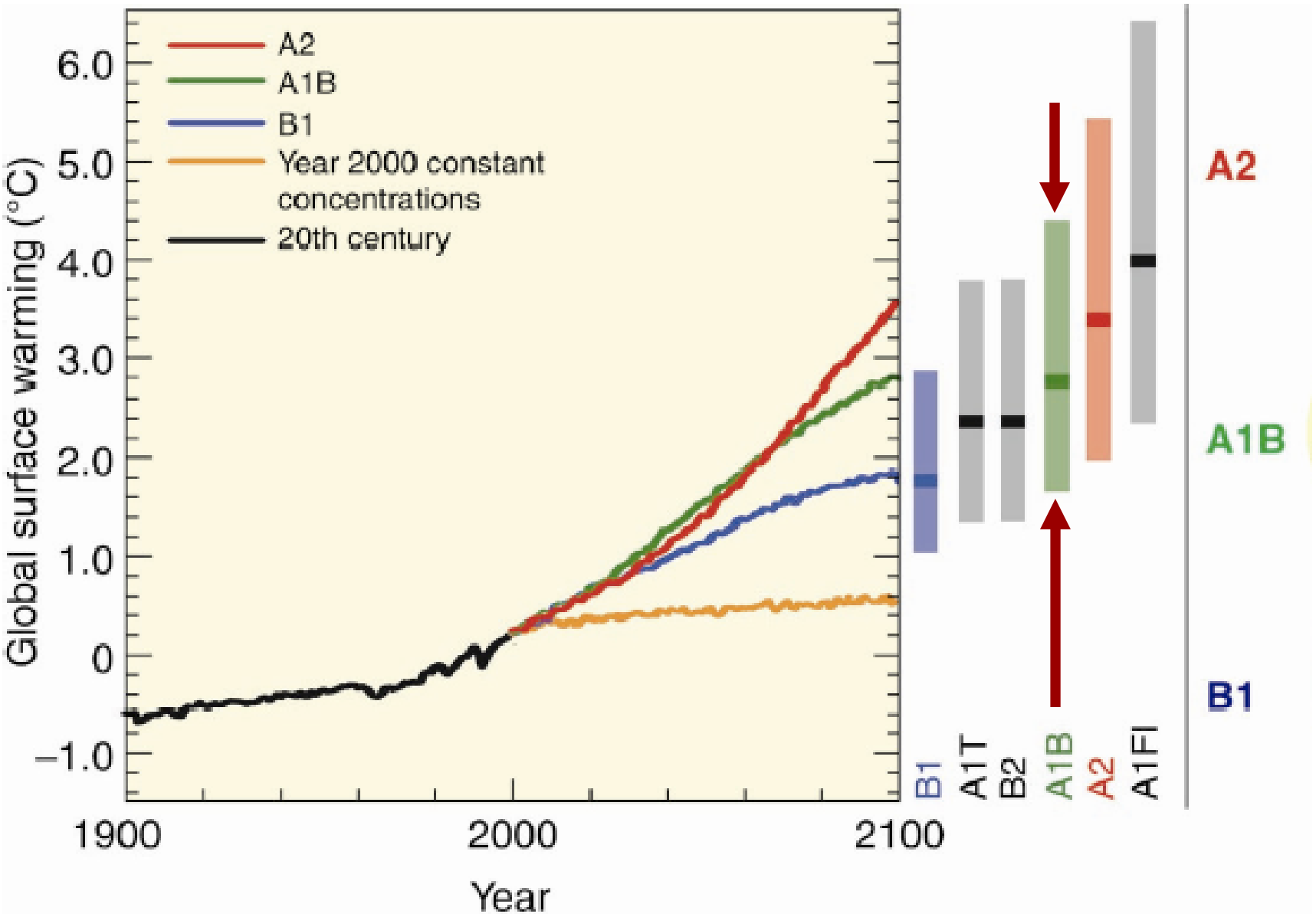
Temperature stabilization:
a few centuries

CO_2 stabilization:
100 to 300 years

CO_2 emissions

Source: IPCC

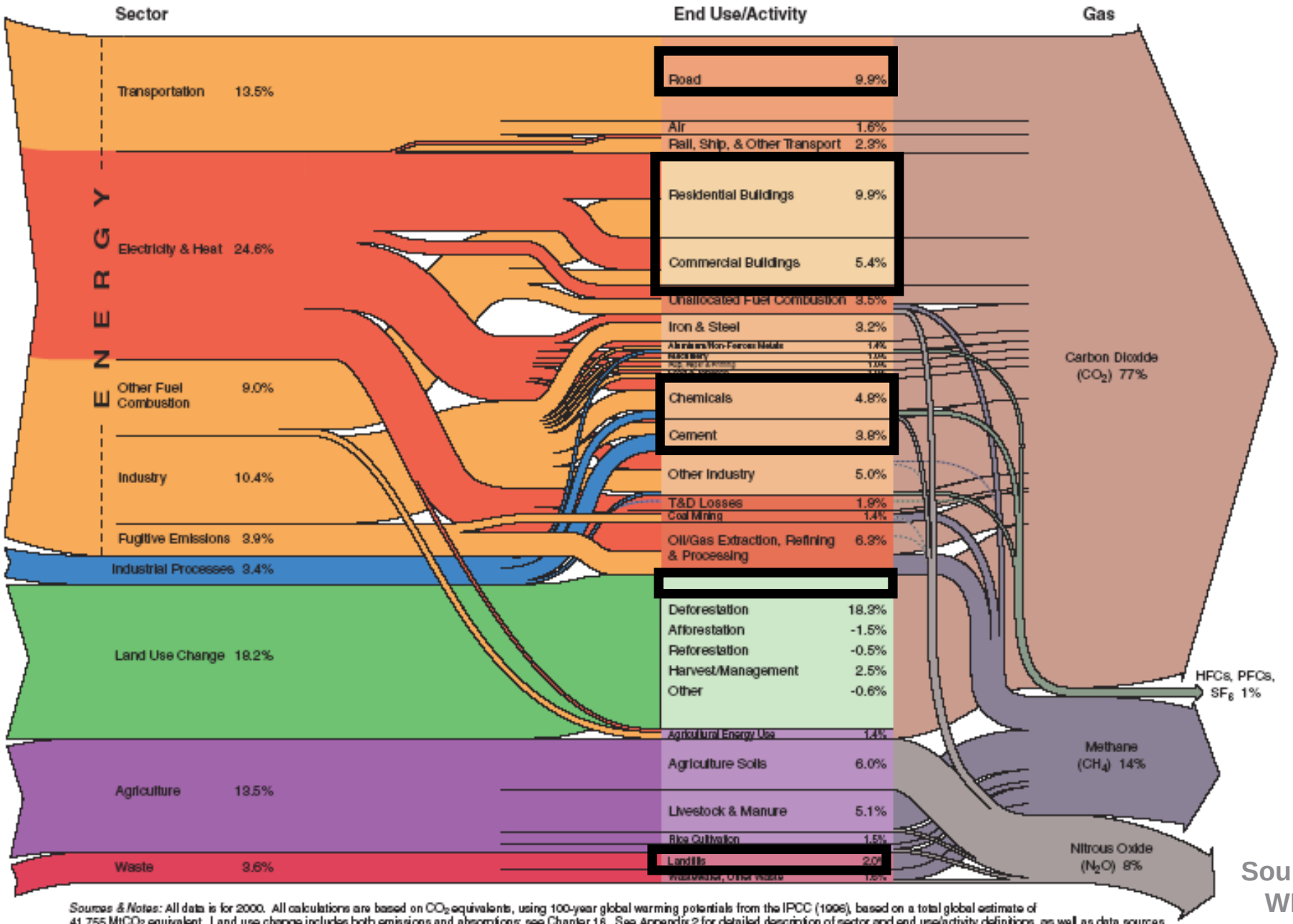
Predicted surface warming by IPCC scenario, 2007



How important is the building sector?

- It is frequently said that the building sector is responsible for anywhere from 30% to 40% of global resource consumption and energy use;
- However, this could be increased if we include building-related transport;
- On the other hand, and as an example, it is estimated that the building sector in Malaysia is only responsible for 18% of the total there, because of much lower heating and cooling needs (although the use of cooling is rising);
- The exact figures are not so important, but the fact remains that the building sector is hugely important if we are to address climate change;
- And social housing is central to the lives of those who may be especially vulnerable to the effects of climate change.

World GHG Emissions Flow Chart

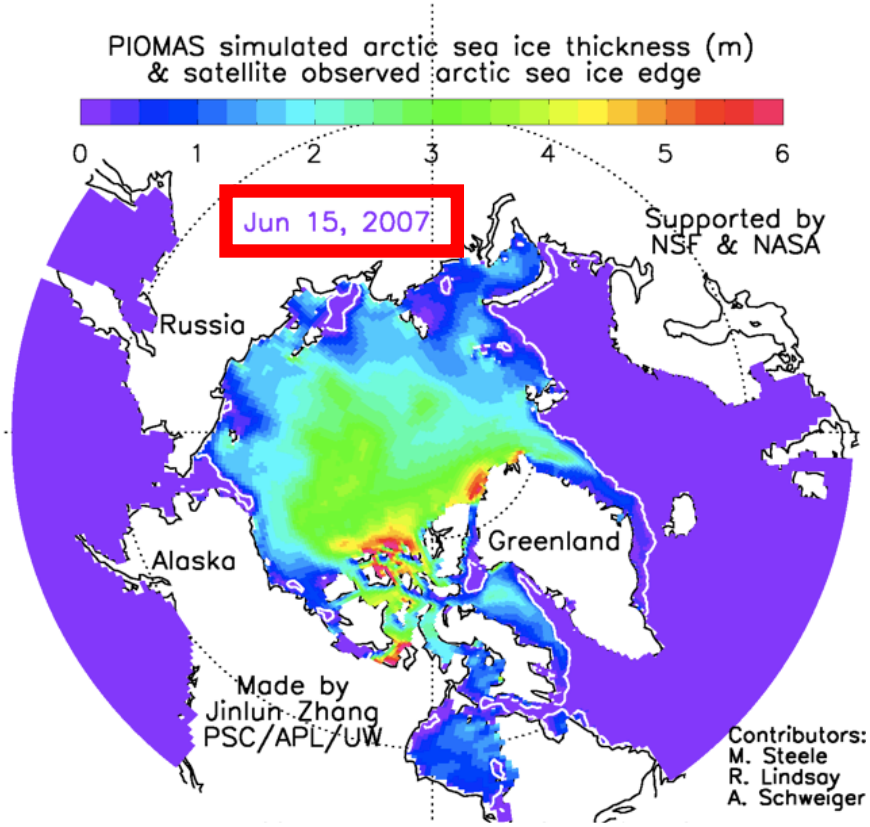


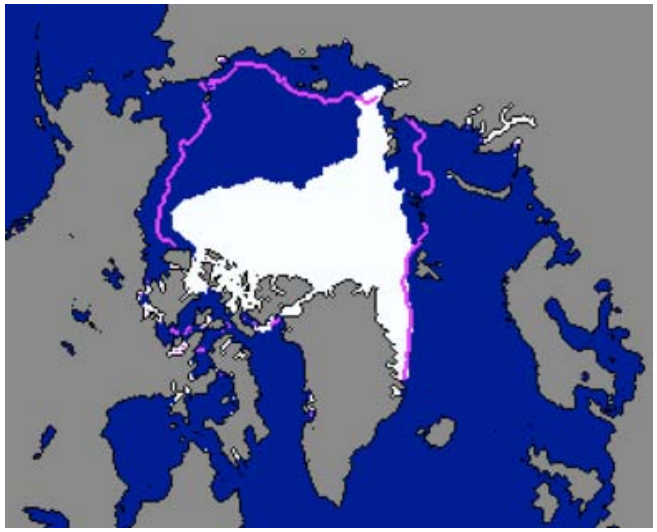
Sources & Notes: All data is for 2000. All calculations are based on CO_2 equivalents, using 100-year global warming potentials from the IPCC (1996), based on a total global estimate of 41,755 $MtCO_2$ equivalent. Land use change includes both emissions and absorptions; see Chapter 16. See Appendix 2 for detailed description of sector and end use/activity definitions, as well as data sources. Dotted lines represent flows of less than 0.1% percent of total GHG emissions.

Source: WRI

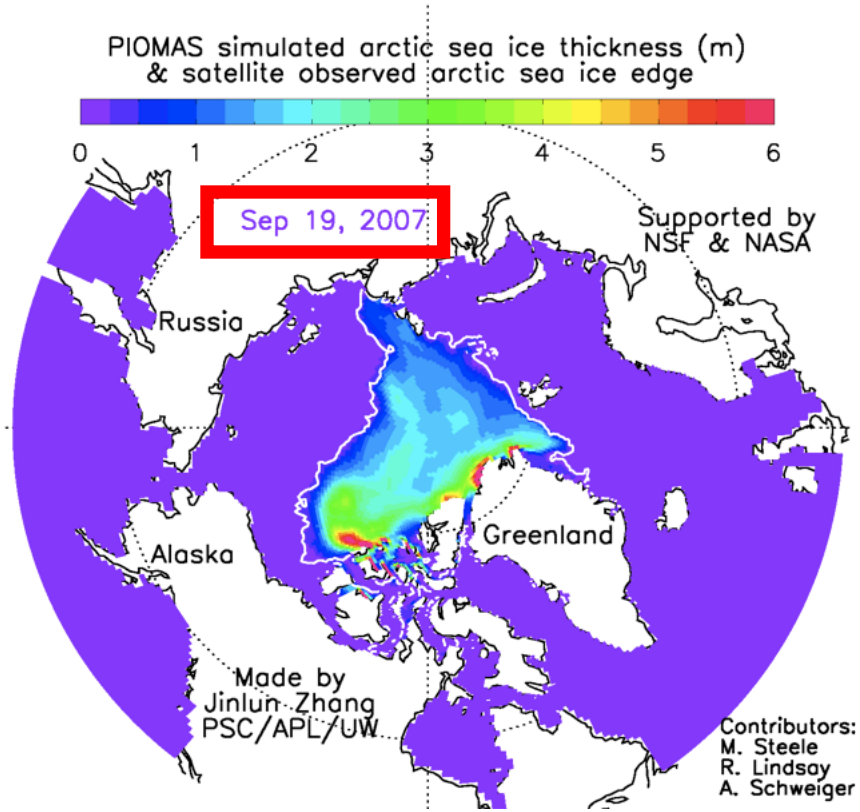
Is Climate Change Real?

Melting of Arctic sea ice





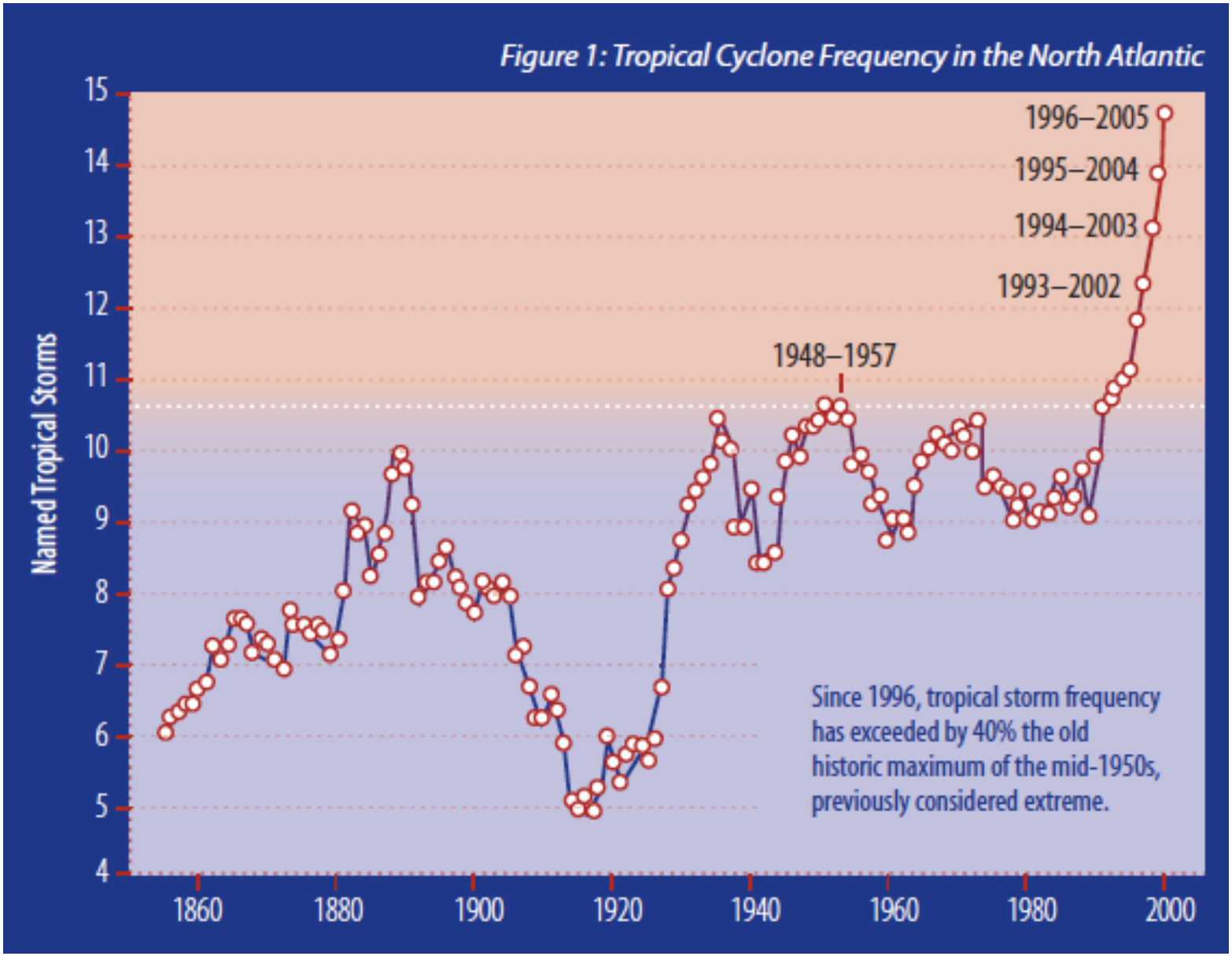
Colour line indicates median ice edge



There is empirical evidence that warming is occurring - the summer melting of sea ice in the Arctic in 2007 was the most rapid and extensive ever recorded.

Source: Polar Science Center at the University of Washington's Applied Physics Laboratory

Frequency of tropical storms in the North Atlantic



Source: U.S. Atlantic Oceanic and Atmospheric Administration, cited by CSIS

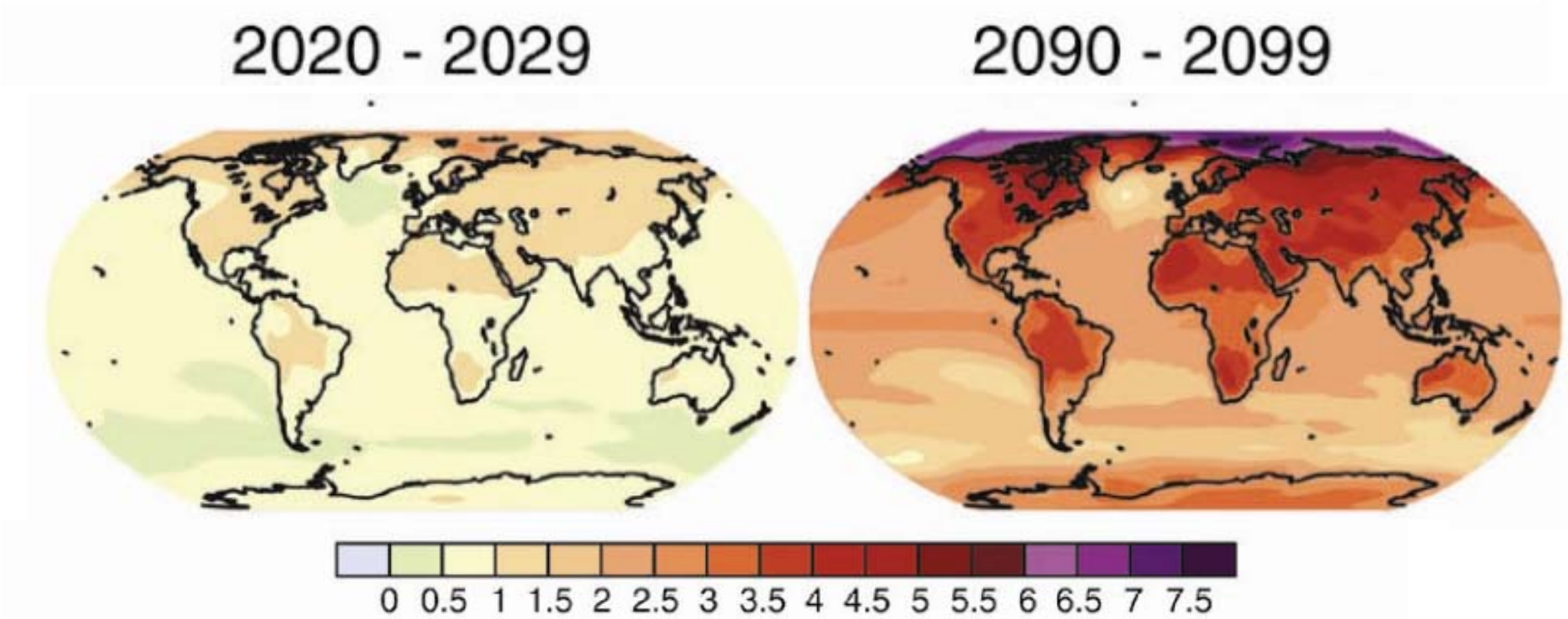
Other evidence that climate change is real: migration

- Migration between countries has gone on for many years;
- Mass migration tends to be from poor to rich countries, and the migrants are therefore usually referred to as economic refugees;
- But in fact, many are climate change refugees; and their numbers are likely to greatly increase in the next decades - examples include:
  - Mexico to USA
  - NW Africa to Spain
  - Bangladesh to India (a border fence is being completed)
- The Red Cross and Red Crescent estimated that in 2001 there were about 25 m. “environmental refugees”;
- For the future, both IPCC and Stern use the estimate developed by Myers at Oxford University, of up to 200 m. climate refugees by 2050;
- How do we cope with re-settling even half of this number?

The Africa-Europe migration route
(source: BBC)

Overview of effects

The A1B global temperature projection by region and for two decades in this century



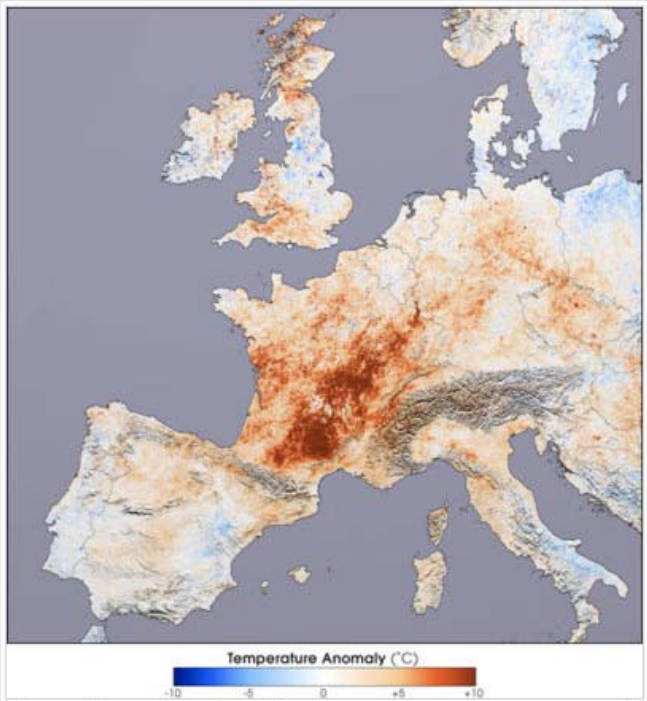
Climate Change 2007:
The Physical Science Basis
Working Group I Contribution to the
IPCC Fourth Assessment Report

Predicted climate change impacts: from IPCC 2007

Phenomenon[a] and direction of trend	Likelihood of future trends based on projections for 21st century using SRES scenarios	Examples of major projected impacts for industry, settlements and society
Warmer and fewer cold days and nights over most land areas	*Virtually certain*[e]	Reduced energy demand for heating; increased demand for cooling, declining air quality in citiesÉ
Warmer and more frequent hot days and nights over most land areas	*Virtually certain*[e]	
Warm spells / heat waves. Frequency increases over most land areas	*Very likely*	Reduction in quality of life for those people in warm areas without appropriate housing; impacts on the elderly, very young and poor.
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Very likely*	Disruption of settlements, transport and societies due to flooding; pressures on urban and rural infrastructure; loss of property.
Area affected by droughts increases	*Likely*	Water shortagesÉ reduced hydro generation, potential for population migration.
Intense tropical cyclone activity increases	*Likely*	Disruption by flood and high winds, loss of insurance, population migration, loss of property.
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*[i]	Costs of coastal protection v. relocation, loss of insurance, population migration, loss of property

Specific impacts of high temperatures

- Higher temperature melts icefields and permafrost;
- Evaporation rates are increased, which aggravates water shortages;
- Generally, higher temperatures leads to more use of mechanical cooling which creates more demand for electricity, which creates more GHG emissions, which….
- Heat waves can cause higher death rates, especially in the older population. The estimated extra mortality in eight European countries from the 2003 heat wave was 34,897 *;
- The same study reported that electricity demand rose significantly because of the intense use of cooling systems, and that hydroelectric production was reduced by 19% because of reduced river flow rates, and nuclear production was reduced by 4% because the water temperatures of river cooling water rose above acceptable levels.



Change of temperature in Europe from the average.

* J-L. Salagnac, Building Research & Information, July/August 2007

Effects of higher temperatures

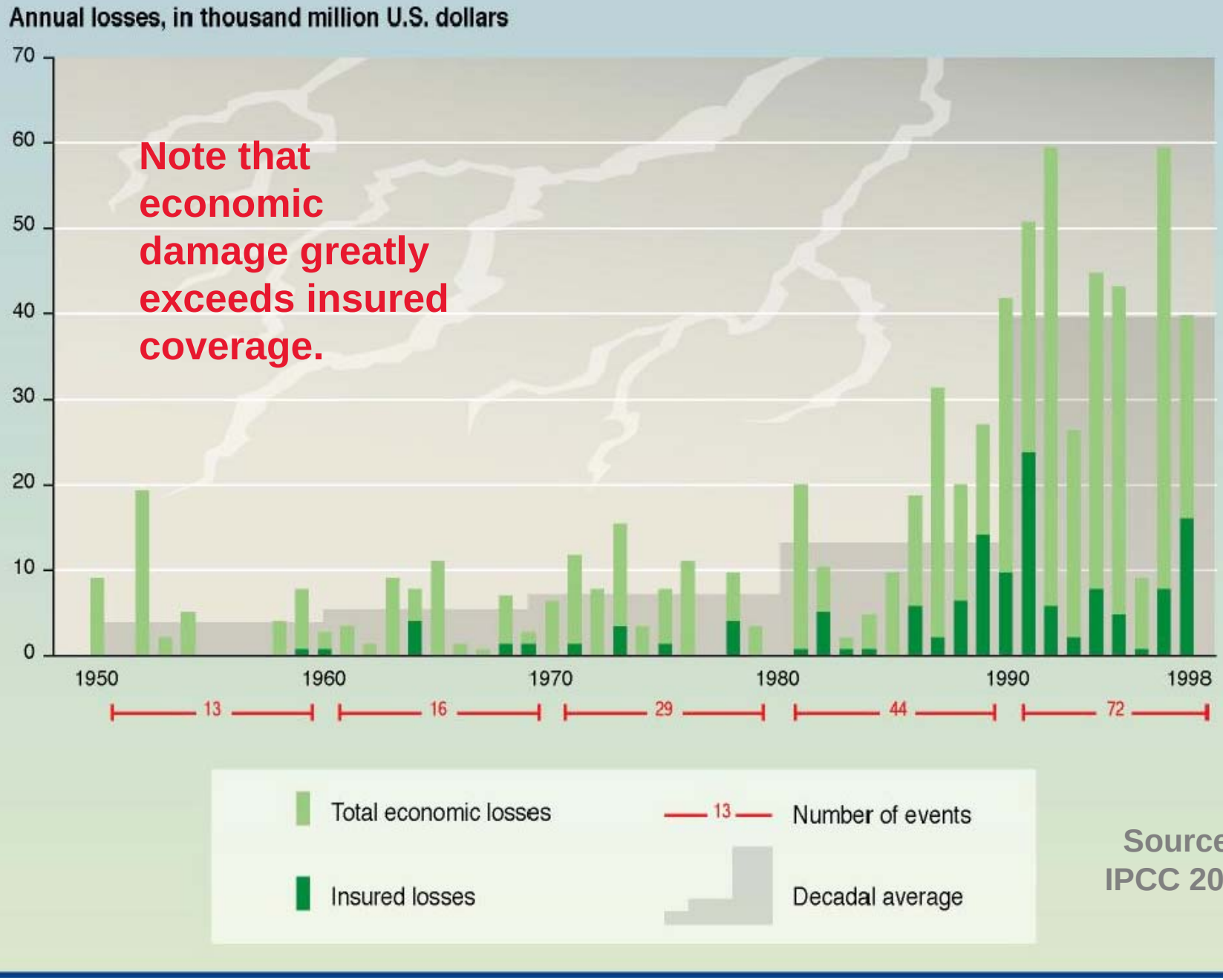
- It looks very likely that the rate of adoption of mechanical cooling in European housing will increase, on the basis of protecting the health of occupants and demands for comfort;
- This can have major negative impacts, because most mechanical cooling is powered by electricity, and the generation of electricity is very inefficient;
- So we need to explore other options:
  - Reduce urban heat island effect, which can increase average urban temperatures by up to 12 deg.C;
  - Use district cooling;
  - Use non-electric powered CHP cooling systems;
  - Accept marginally higher summer temperatures in buildings.

Storms and winds

Impacts of storms and high winds

- Storms produce wind damage and, in coastal areas, storm surges with consequent flooding damage;
- Just think about New Orleans, which is still in a very bad state;
- There is still some uncertainty about how much of recent increases in storm events is due to climate change, but two things are indisputable: more heat energy in the oceans breeds more storm events, and there has been a general increase in insurance payouts over the last 30 years;
- And many insurance companies are reducing coverage or refusing new policies in risky areas;

Global costs of extreme weather events (inflation-adjusted)



Source: IPCC 2000

Water runoff, supplies and drought

IPCC 2007: Three statements on water

By mid-century, annual average river runoff and water availability are projected to increase by 10-40% at high latitudes and in some wet tropical areas, and decrease by 10- 30% over some dry regions at mid-latitudes and in the dry tropics…

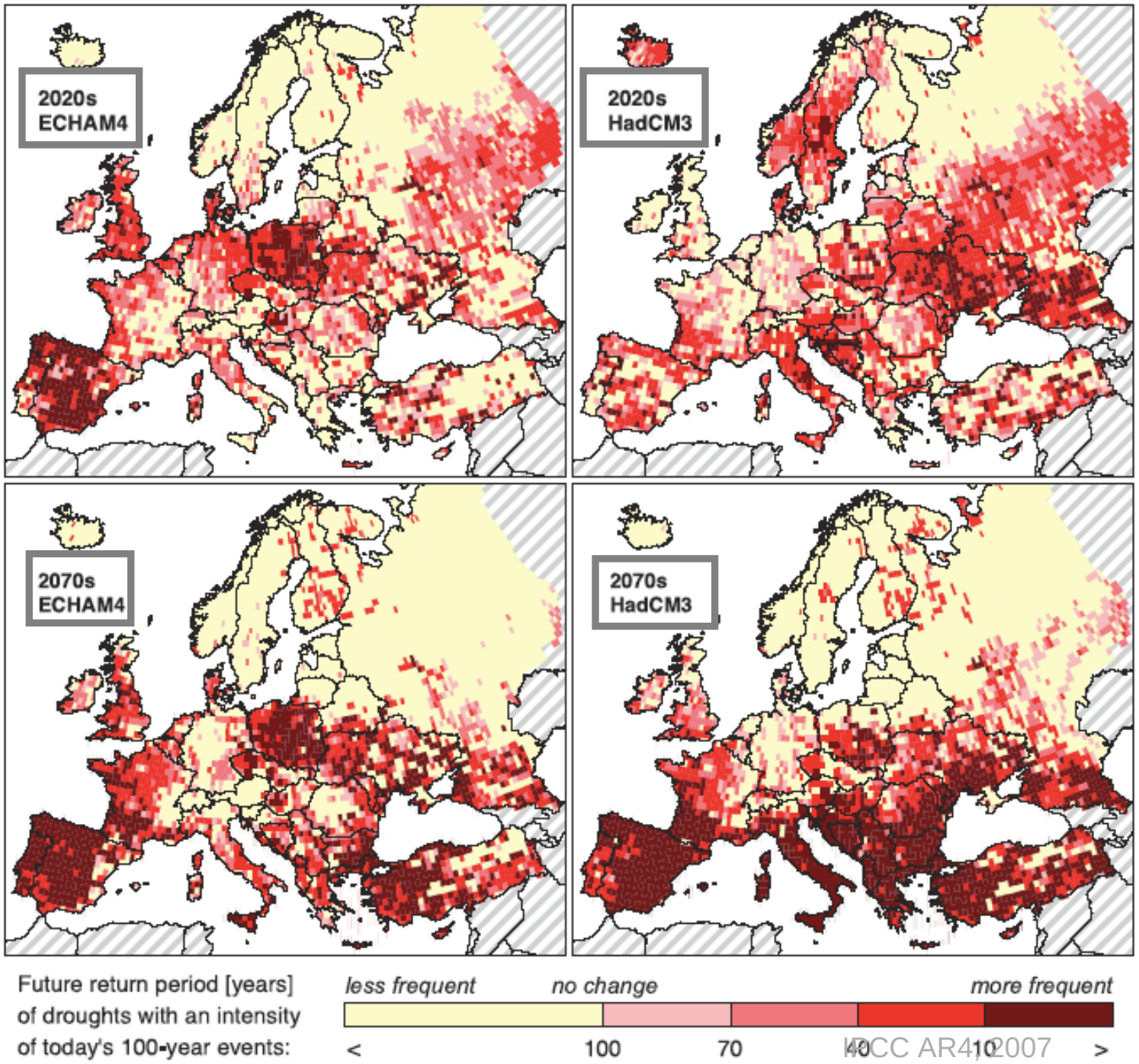
Drought-affected areas will likely increase in extent. Heavy precipitation events, which are very likely to increase in frequency, will augment flood risk….

In the course of the century, water supplies stored in glaciers and snow cover are projected to decline, reducing water availability in regions supplied by meltwater from major mountain ranges, where more than one-sixth of the world population currently lives.

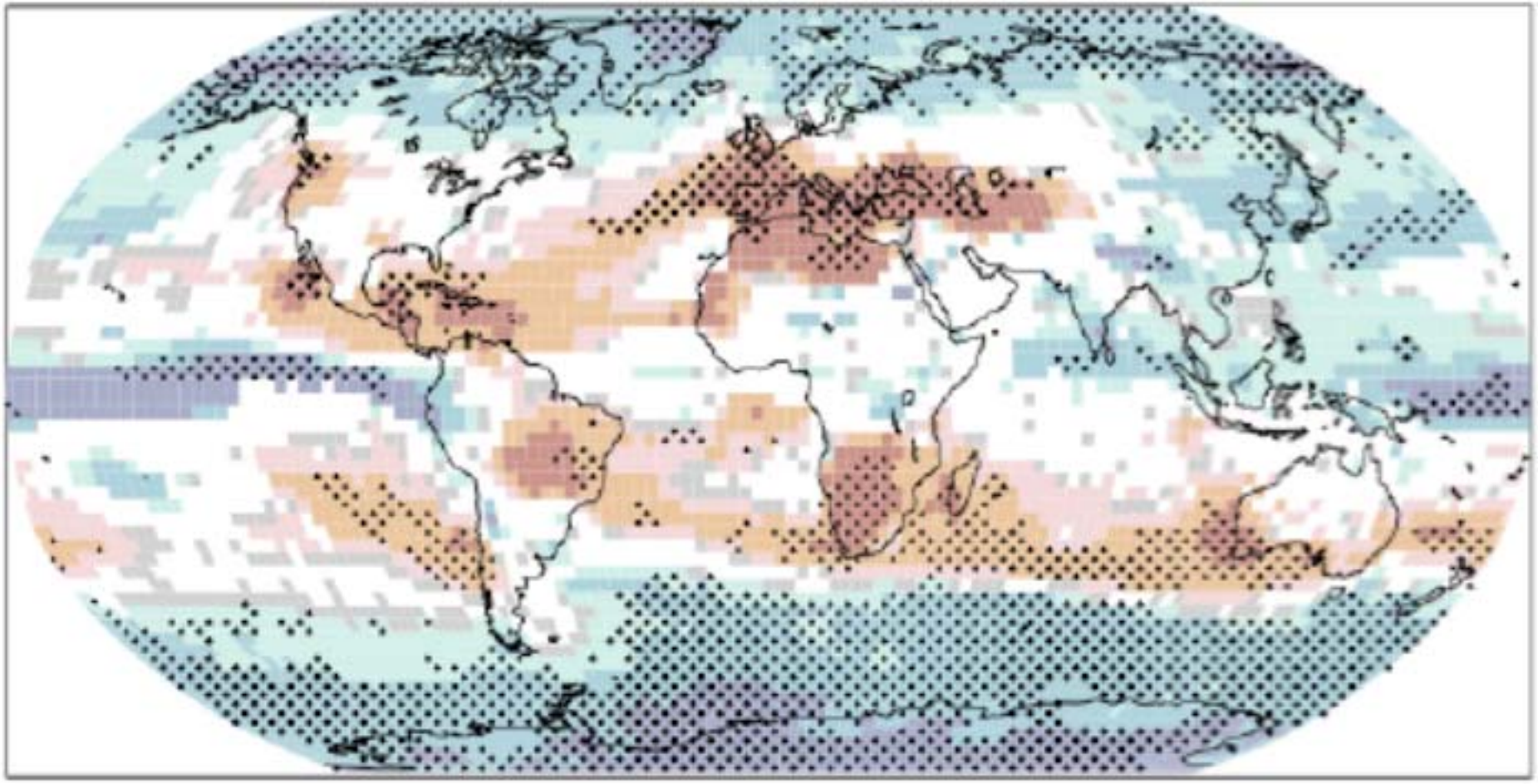
Precipitation, floods, drought etc.

- In the future we may have too much or too little precipitation, and less predictable weather;
- Recently, both China and Australia had simultaneous droughts and flooding, and parts of Europe baked while other parts shivered;
- Heavier winter and spring precipitation in northern Europe and North America can overload rivers, while being too rapid to replenish aquifers;
- Land and mud slides can also result;
- Drier mid-year conditions in many regions means reduced agricultural productivity, less replenishment of aquifers and increased probability of forest fires;

Change in recurrence of 100-year droughts, 2020-70, compared to 1961-90, business as usual model.



IPCC Precipitation Projections 2090-2099 enlarged



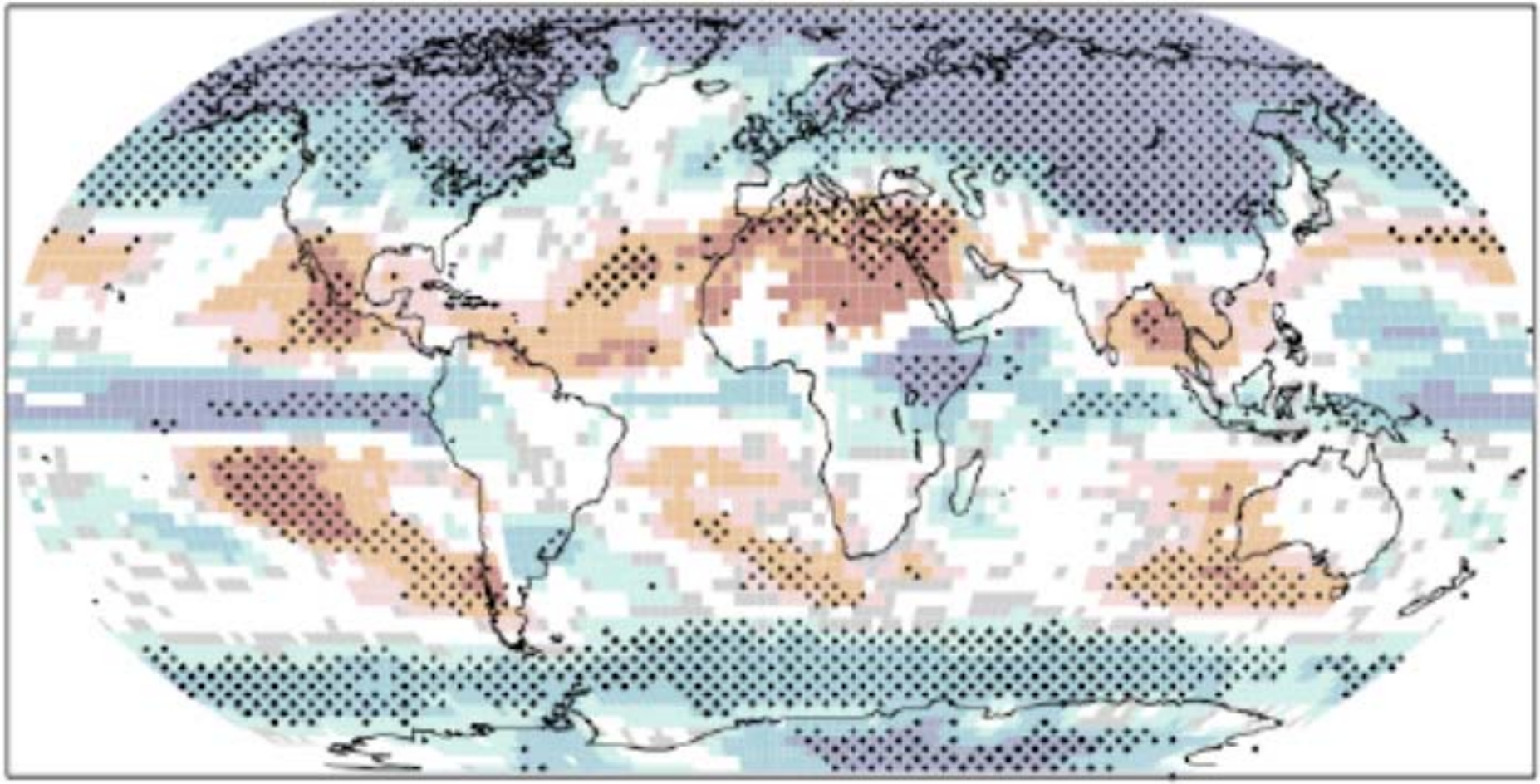
Those who need more will have even less…

June-August

Climate Change 2007:
The Physical Science Basis

Working Group I Contribution to the IPCC Fourth Assessment Report

IPCC Precipitation Projections 2090-2099 enlarged



And those who have lots will get much more…

December-February

Climate Change 2007:
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Working Group I Contribution to the IPCC Fourth Assessment Report

Precipitation: feast or famine

Flooding in UK, 2007

Credit: The First Post, 16/09/07

Precipitation: feast or famine

Australia's blistering summer has only just begun but reservoir levels are dropping fast, crop forecasts have been slashed, and great swaths of the continent are entering what scientists yesterday called a "one in a thousand years drought". The Guardian, 08/11/06

With many regions in their fifth year of drought, the government yesterday called an emergency water summit

In September 2007, temporary water conservation measures in Australia were made permanent.

Atlanta, Georgia, had less than 90 days water supply remaining in Oct.08;

California will implement water rationing in 2009

Credit: J. Wood/ Getty

We have seen some of the impacts of climate change on the building sector.

But there will also be other issues facing us.

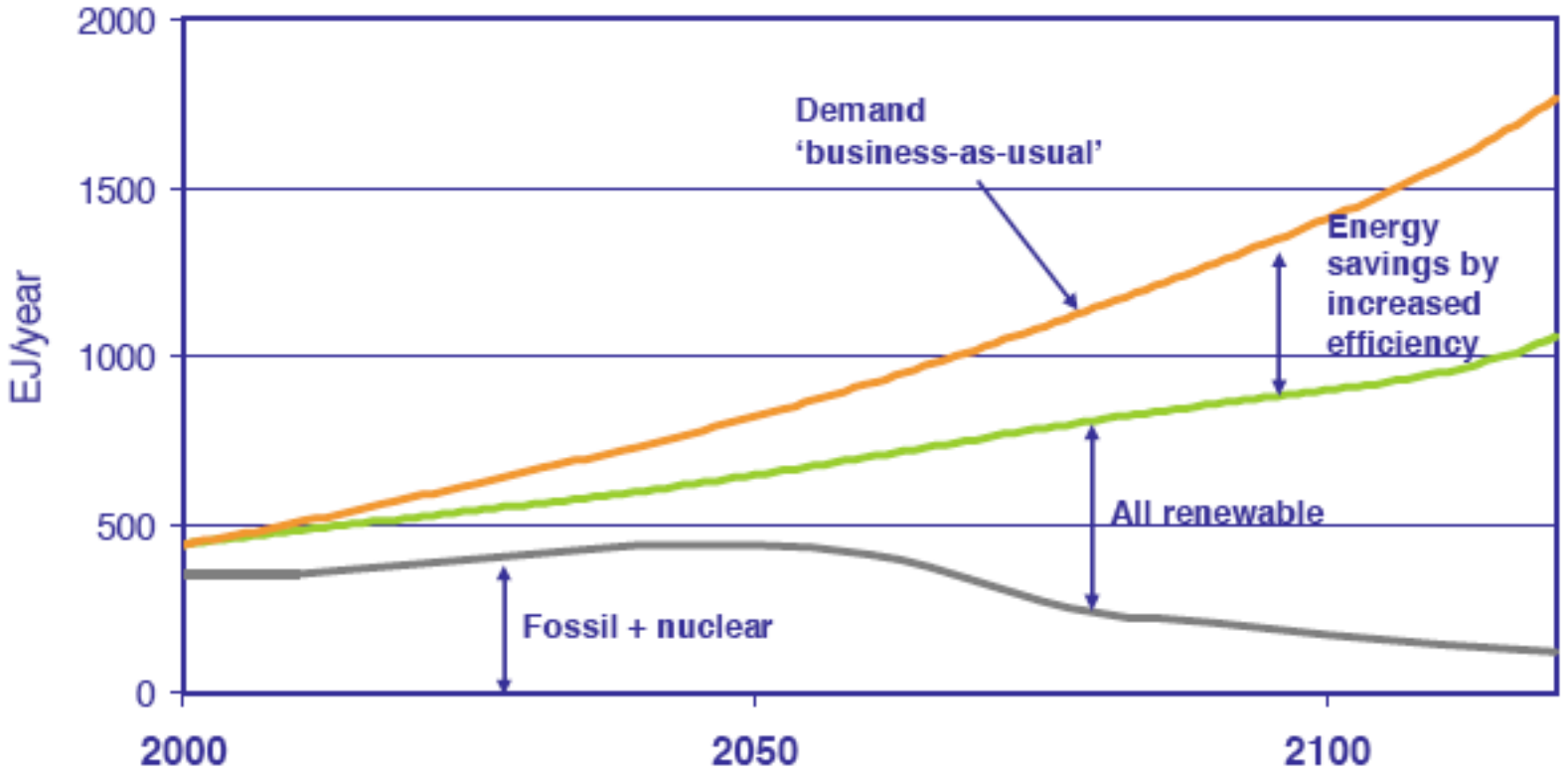
Possible context during the next century

- There may be a scarcity of affordable natural gas in some areas due to declining production from easily accessible fields;
- The global production of oil may be close to peak or already past it;
- Energy prices will probably be very high, although predicting the range is unwise;
- This diminution of affordable fossil fuel supplies will have immense effects, only some of which can be foreseen clearly;
- Certainly, fuel-dependent transportation will become very expensive, and so will the construction and operation of buildings;
- Fuel poverty is inevitable.

Unless…

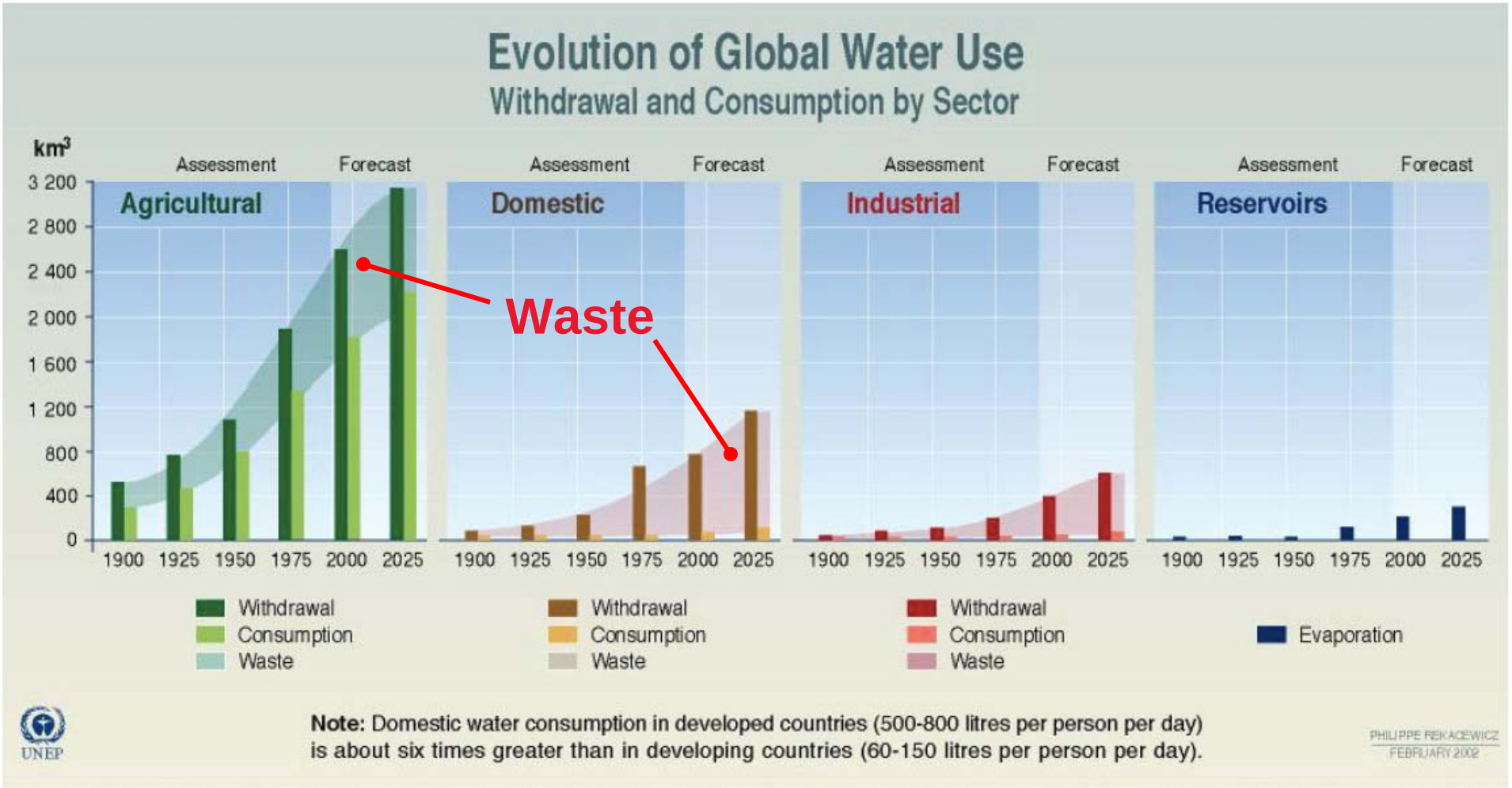
www.mallorcawindmills.com

IEA has an optimistic scenario for the growth of renewables and gains in efficiency



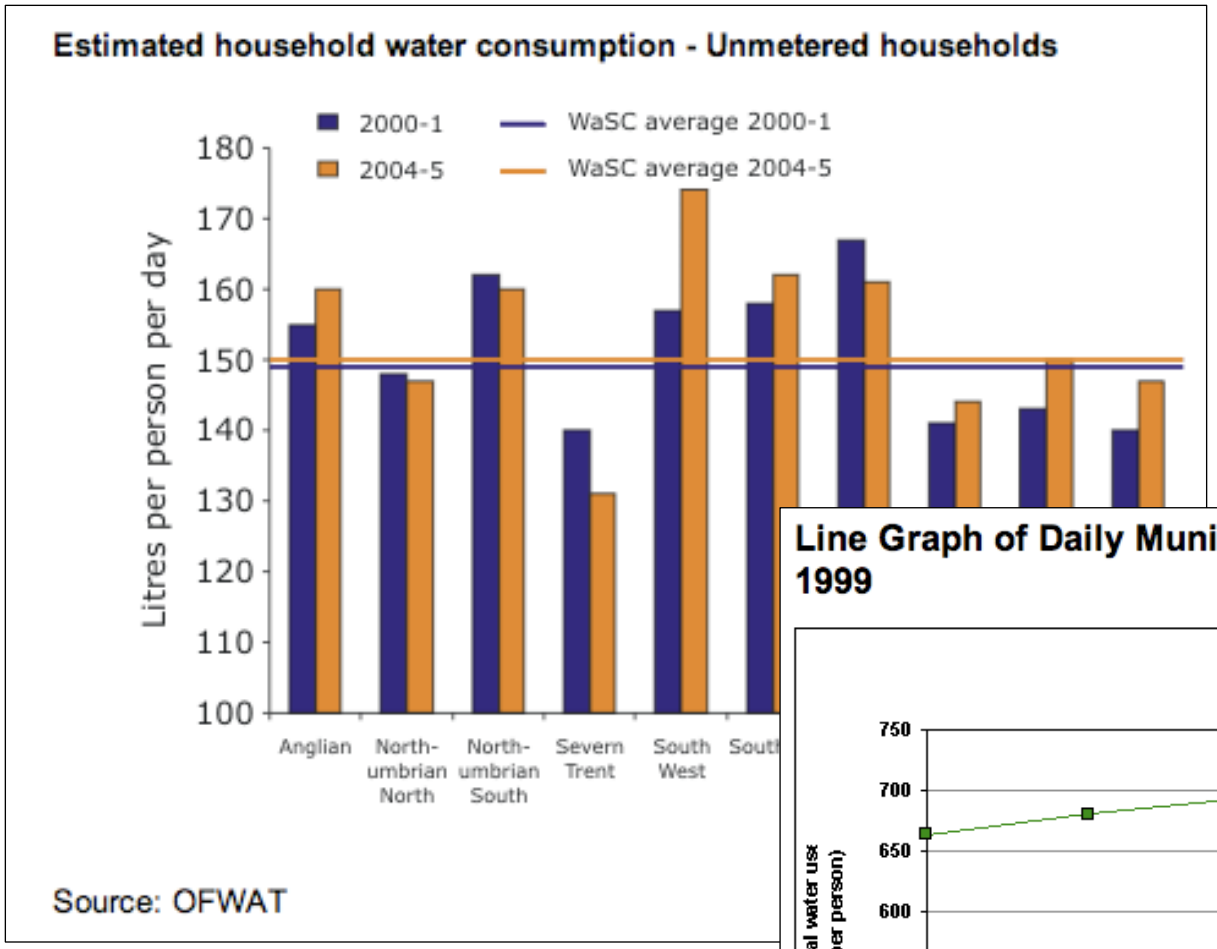
Water Resources

- Water resources are unequally distributed to begin with;
- Shortages result from temperature and precipitation changes caused by climate change and also from the depletion of rivers and aquifers;
- Depletion of aquifers can also cause serious ground settlement, as in Shanghai or Mexico City.
- If water availability is reduced below critical levels, new development has to be discouraged or banned, e.g. in Spain;
- Potable water requires infrastructure and energy to purify and to pump, and the resulting waste water requires further treatment. Both these factors indicate that water efficiency is an imperative;
- In this context, the massive amount of water waste in some regions needs to be addressed on an urgent basis.

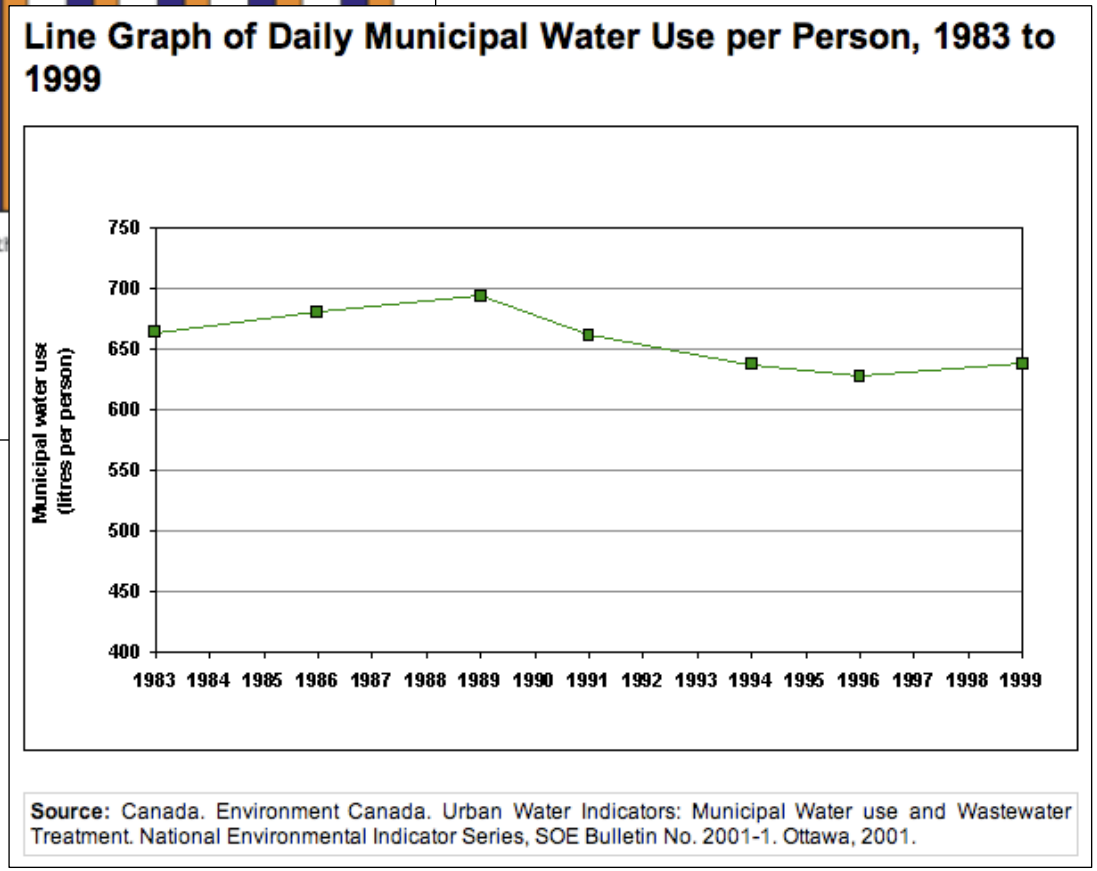


Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational,Scientific and Cultural Organisation (UNESCO, Paris), 1999.

Global water consumption -- note the large proportion of waste



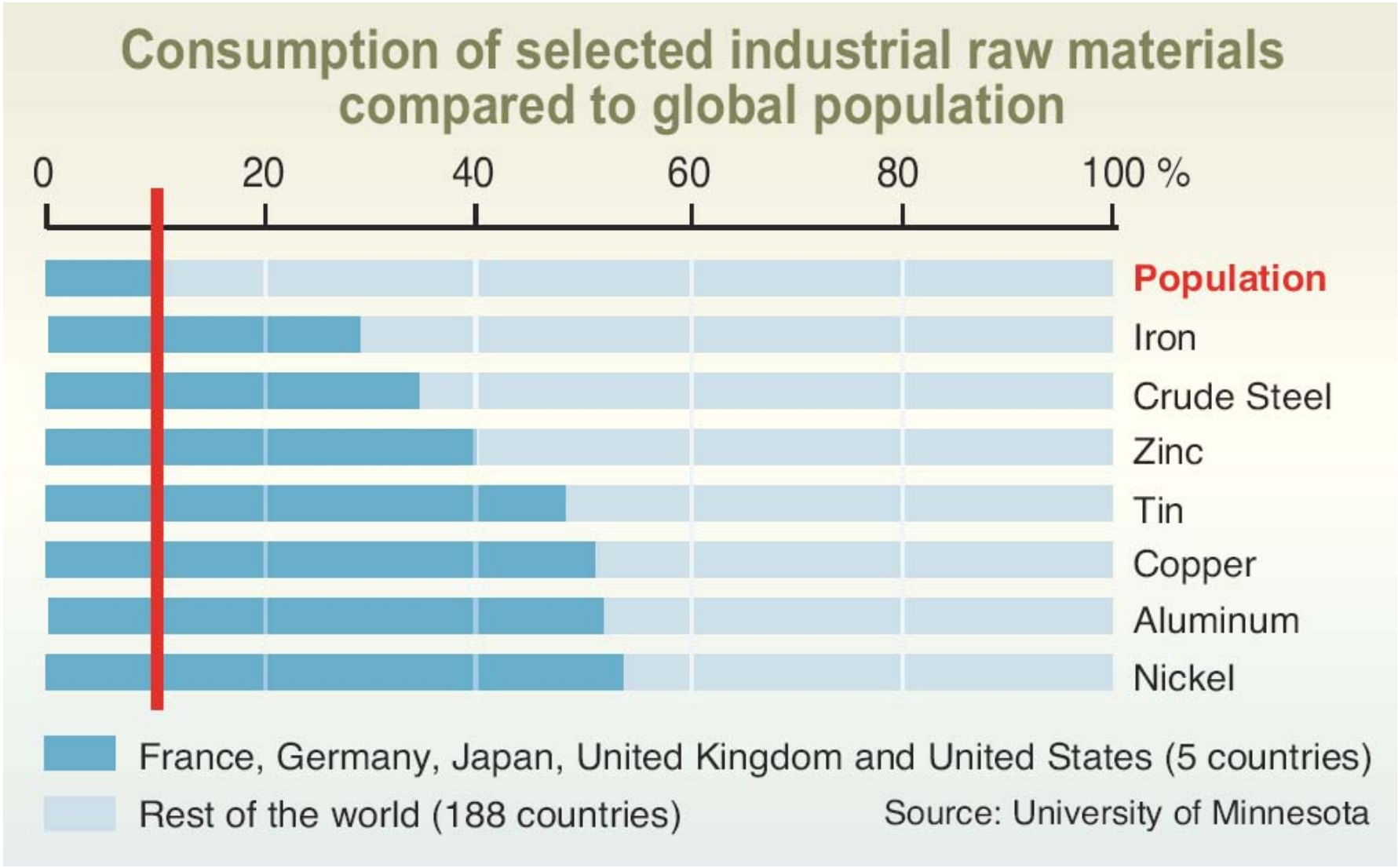
UK residential water use - about **150 Lpp/day**



In Canada, total municipal water use is about 650 Lpp. Residential water use increased from 327 Lpp in 1996 to **343 Lpp/day** in 1999

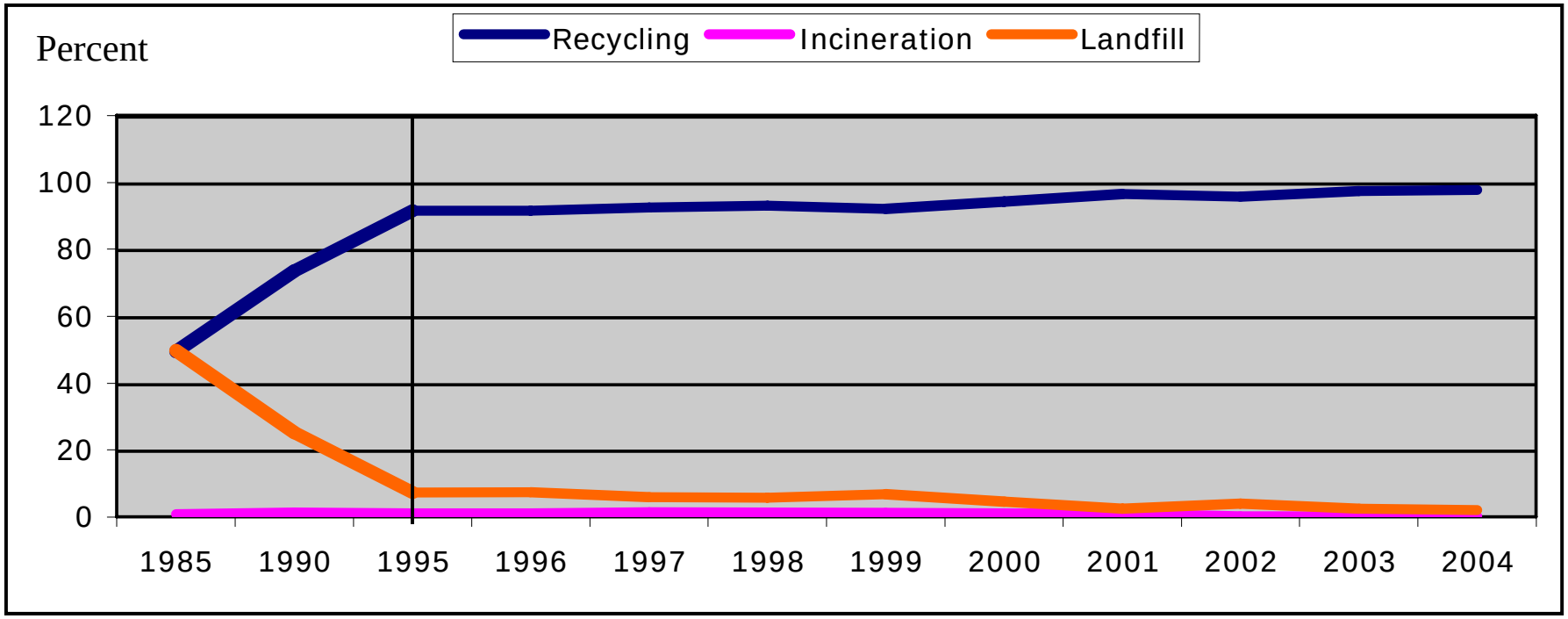
Commodities

- The construction sector is a major user of commodities and basic products, including steel, aluminum, copper, wood, plastics, cement, masonry etc….
- The production process for building materials require large amounts of energy and water, which feeds back into the central problem;
- There are clear signs that the increasing scarcity of resources and the greater difficulty of extracting them is having a long-term impact on prices and availability;
- This is amplified by the rate of growth in China, India and Brazil;
- Despite the current slump in prices, higher resource and material prices are here to stay in the long term.



Consumption of a range of industrial materials in Western Europe and USA is much more than in the rest of the world: what happens when India and China join the party?

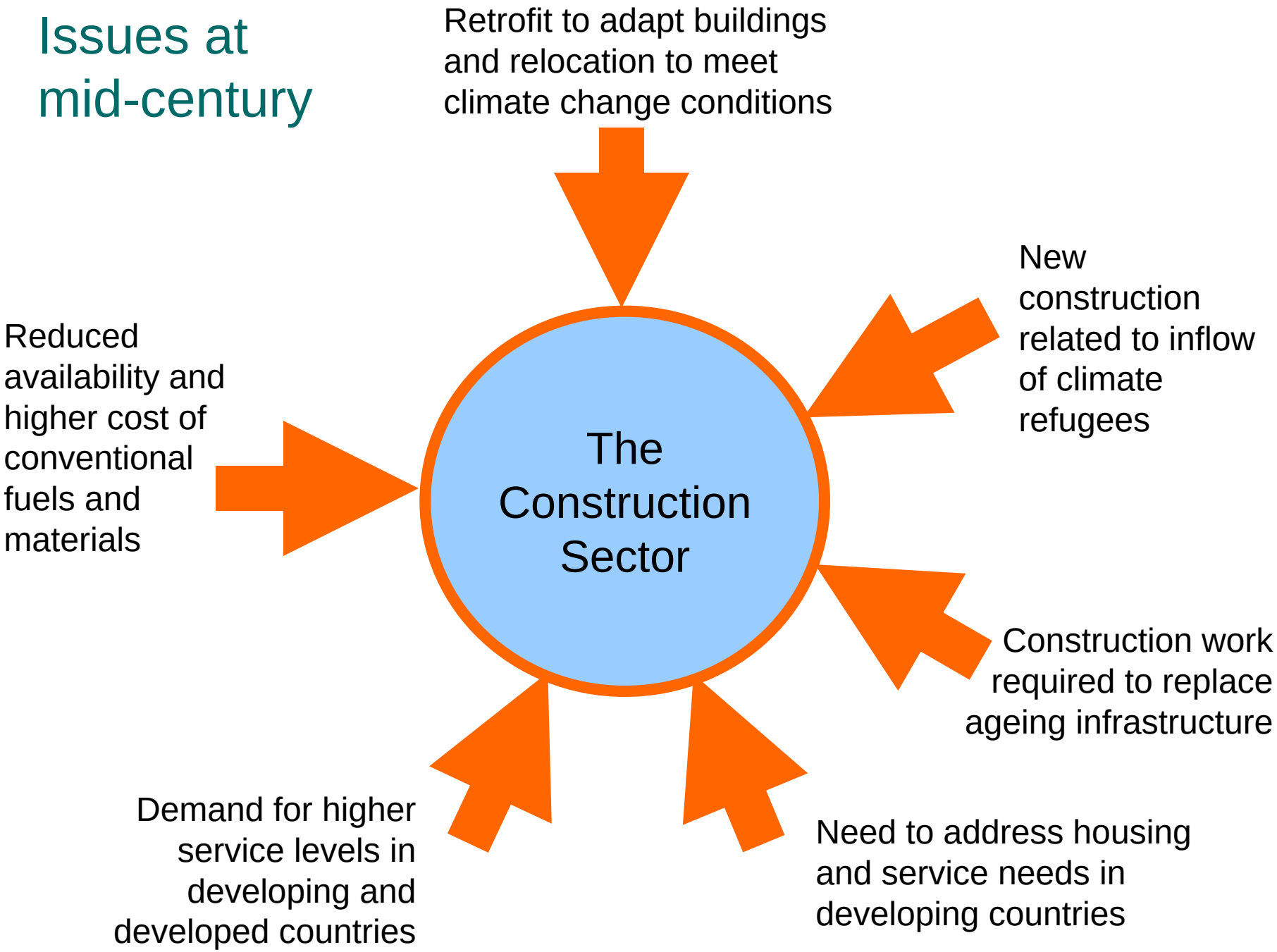
Reduction of C &D wastes in the Netherlands: it can be done



Info courtesy of Ronald Rovers

What would the combination of climate and resource issues look like?

Issues at mid-century



Social issues

- The combination of climate change effects and resource issues will also have major socio-economic effects;
- But the ageing population will also add to the mix of issues, with reduced incomes and decreased adaptability to extreme climate conditions;
- All the work that needs to be done to cope, such as relocation, massive performance upgrade programs, etc., will all require major public investments;
- And there will be a smaller number of taxpayers…

What we need to do

Energy efficiency v. demand and service levels

- Energy efficiency in operations is clearly a top priority in view of its central role in reducing GHGs;
- However, consider the impacts of the following:
  - Construction undertaken for new airports and roads, future Olympics and World Expo events;
  - Buildings that are fully air-conditioned in even moderate climates;
  - Second and third homes;
  - Single family houses that are efficient but have areas of 500 m2 or more;
  - The proliferation of types and numbers of household appliances in even middle-class homes;
- No matter how efficient any of these area, they still add to the total climate burden.

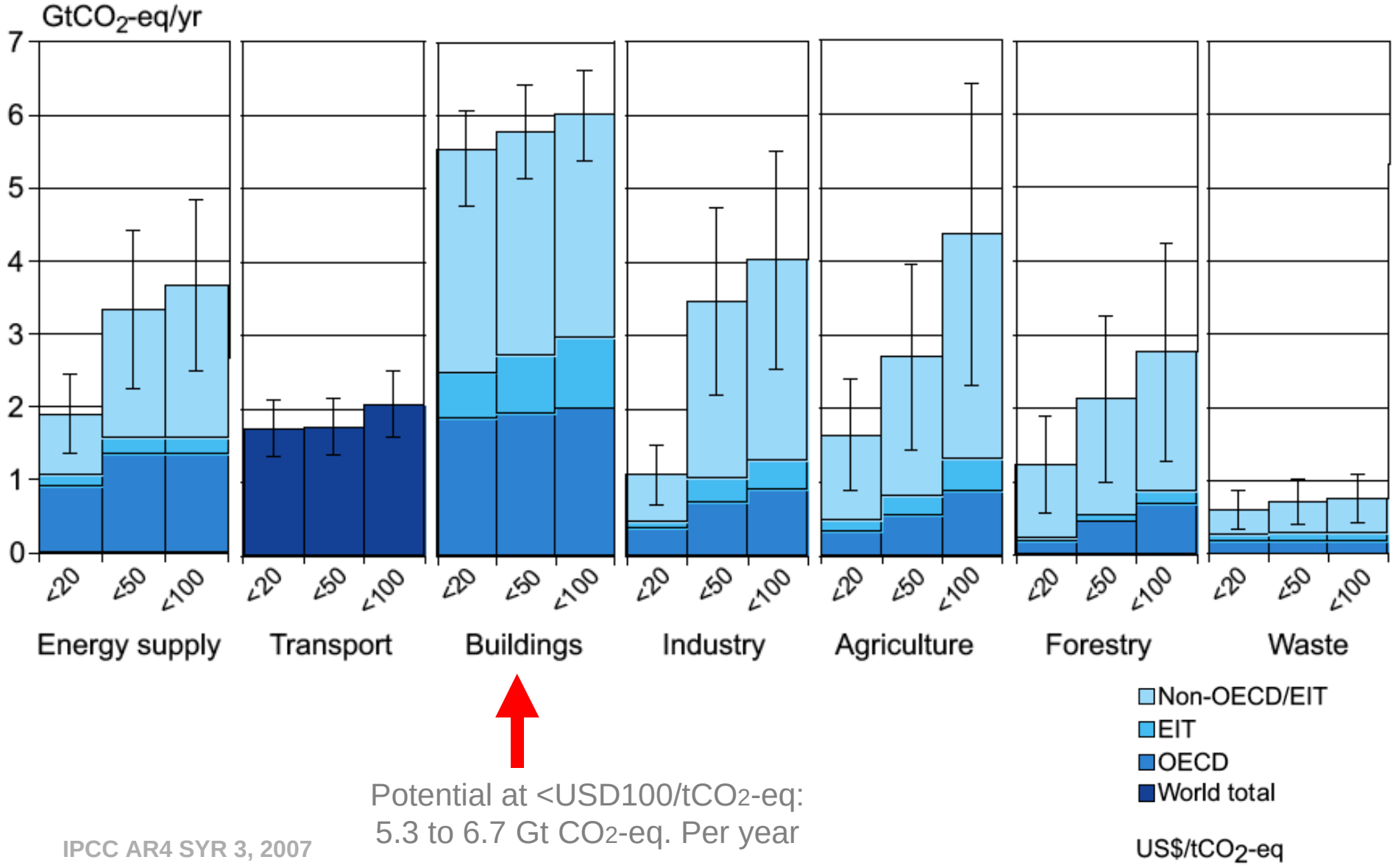
Above: the Canadian Dream of 15 years ago; now the house is much larger and the garage has room for several cars;

All are influenced by such images

Energy efficiency v. demand and service levels

- We can conclude that energy efficiency is not enough, and we must reduce the level of demand and expectations of service levels;
- But a reduction in demand or service levels is much harder to achieve than efficiency improvements, since it requires changes in values and lifestyles;
- We need social housing occupants to adopt this approach, but they will not be anxious to cooperate if they see continuing examples of waste by higher-income groups;
- So *everyone* must participate in reducing their material requirements that are carbon-based or use non-renewable fuels or materials;
- This also implies making better use of existing neighbourhoods through selective infill and upgrading of infrastructure and local public transportation systems, and better use of existing buildings through renovation and performance upgrading;
- These will be the main issues to address during the next decades.

Some good news: Economic mitigation potentials by sector, as a function of carbon price in 2030 estimated from bottom-up studies



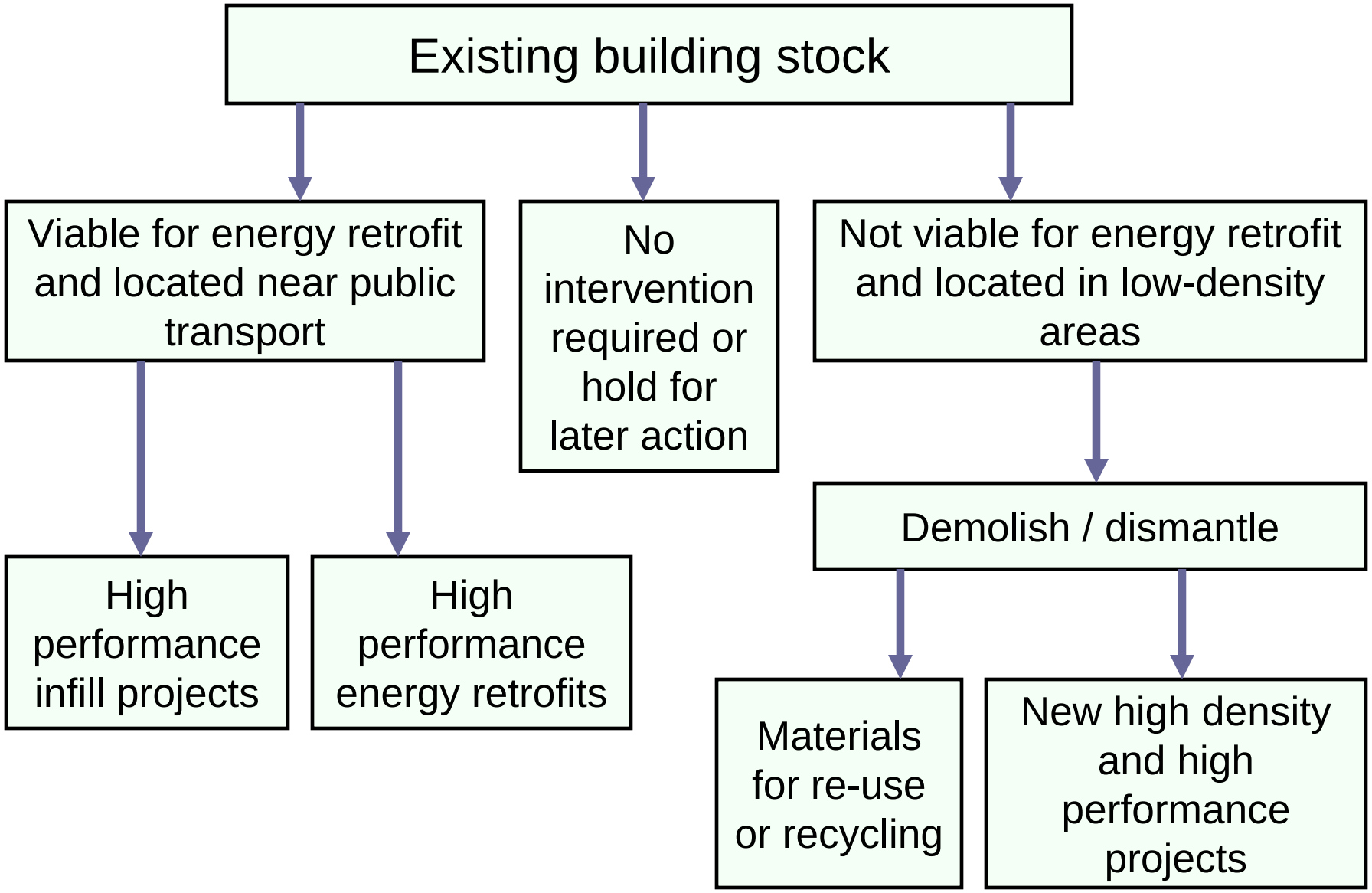
Potential at <USD100/tCO2-eq:
5.3 to 6.7 Gt CO2-eq. Per year

IPCC AR4 SYR 3, 2007

Things governments should do….

- Establish challenging performance regulatory requirements for urban areas and for existing and new buildings;
- Establish carbon taxes and minimize taxes on renovation work, except for second homes;
- Ensure that planning regulations move the industry towards high-density and mixed-use development in areas served by public transport;
- Undertake demonstrations programs to make high-density areas attractive to families;
- Provide support to R&D to ensure that high-performance technologies make their way to the market quickly;
- Require labelling to show core performance indicators, such as energy;
- Undertake re-development triage programs in existing urban areas.

Triage of existing building stock



Things investors and owners should do….

- How can we make better use of empty dwelling units?
- Can an existing building be renovated instead of building new?
- Select development sites that are environmentally preferable;
- Make data on key performance parameters publicly available.

From the *Housing Europe Manifesto*: we need future MEPs to push for…

2. Initiatives that will promote the spread within the housing sector of new technologies and building materials which use less energy (aiming at creating energy-positive homes), strengthen research programmes to increase energy efficiency, including in existing housing, provide effective follow-up to pilot projects in the social housing sector; (perhaps energy-positive at the neighbourhood level?)
3. Initiatives for training workforce in new housing refurbishment/construction techniques;

….

6. A 0% VAT rate for investments in existing residential dwellings to improve their energy efficiency; (but excluding second homes?)

….

8. The revenues of the EU Emission Trading Scheme to be used to promote energy efficiency and renewable energy in existing housing stock. (are buildings accepted in emissions trading?)

From the Housing Europe Manifesto

- To correct this, we need future MEPs to push for…
  - A cohesion policy to develop a “neighbourhood fund, merging the different Structural Funds, with the aim of developing economically, socially and environmentally deprived areas; (there is some interesting historical experience with block funding schemes in old residential neighbourhoods in Canada in the 1970’s, using citizen participation to allocate final use of funds)

Conclusions

- Energy efficiency and Greenhouse gas emissions are core factors, but more than operating energy is involved;
- Other key issues include water and resource scarcity;
- Success will require action on a broad front, taking into account varying regional needs and preferences;
- Great advances in environmental efficiency can be expected, but it is not so clear that we will see the changes of lifestyles and values required to reduce the production volume of buildings and equipment or to reduce service quality expectations;
- In doing this, we must ensure that the poor, old and vulnerable are protected from the worst effects of the new century.

Contacts & Info

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