Climate change and the role of buildings and solar thermal use to minimize its impacts

CENTER FOR CLIMATE CHANGE AND SUSTAINABLE ENERGY POLICY

CENTRAL EUROPEAN UNIVERSITY

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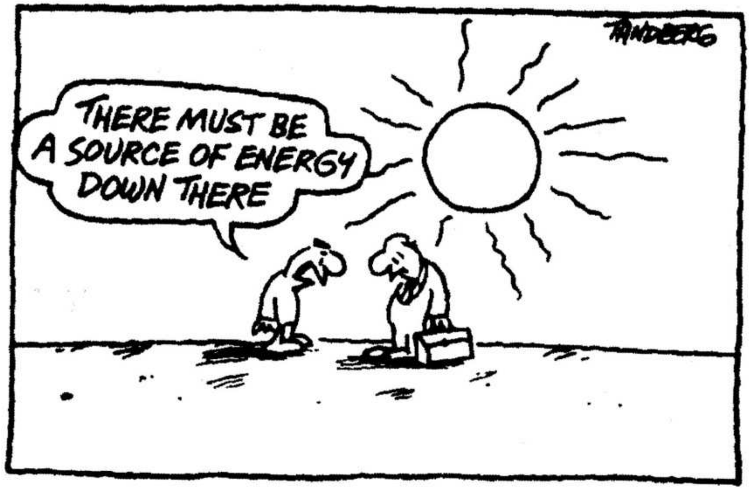

Diana Ürge-Vorsatz

Director, 3CSEP, CEU

and IIASA, Global Energy Assessment

Eurosun 2010

Sep 29, 2010, Graz

Overview

- Introduction: the climate change challenge
- The role of solar thermal energy in fighting CC
- How far can buildings and (solar) thermal energy take us in mitigating CC?
- the risk of the lock-in effect
- Summary

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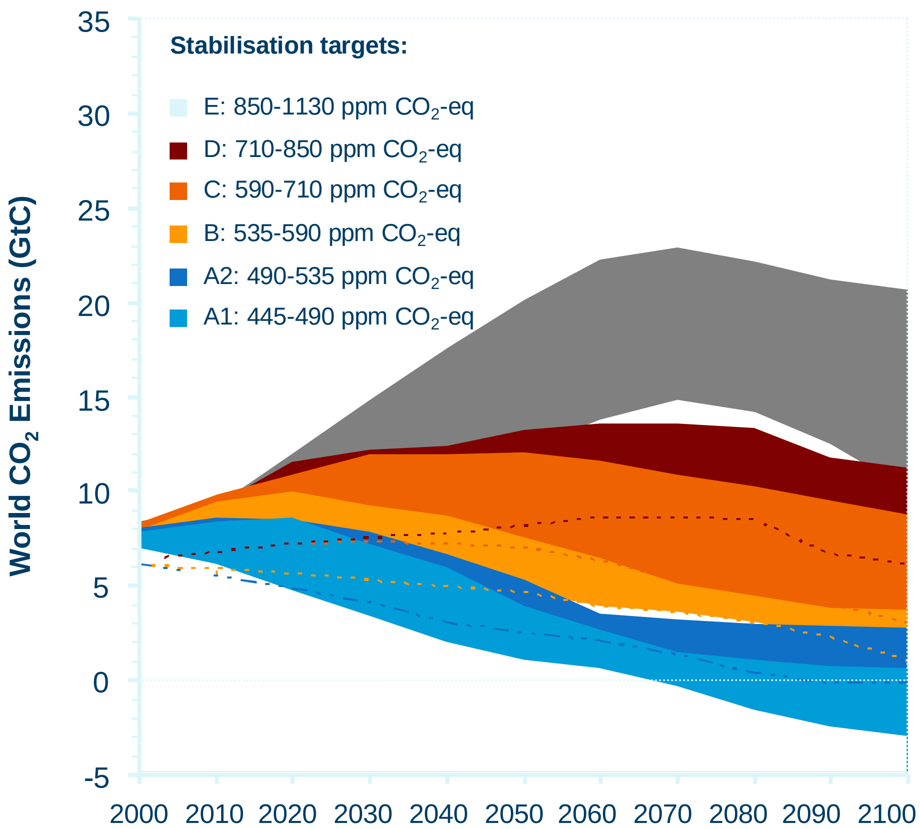
The climate change challenge

"HOW ON EARTH DO WE TURN IT OFF?"

In order to limit the impacts of CC, GHG emissions have to be reduced significantly

- Stabilizing global mean temperature requires a stabilization of GHG concentrations in the atmosphere -> GHG emissions would need to peak and decline thereafter (SPM 18 WG III)
- The lower the target stabilisation level limit, the earlier global emissions have to peak.
- Limiting increase to 3.2 – 4℃ requires emissions to peak within the next 55 years.
- Limiting increase to 2.8 – 3.2℃ requires global emissions to peak within 25 years.
- Limiting global mean temperature increases to 2 – 2.4℃ above pre-industrial levels requires global emissions to peak within 15 years and then fall to about **50 to 85%** of current levels by 2050.

Based on SPM 7, WG III. Emission pathways to mitigation scenarios



Multigas and CO_2 only studies combined

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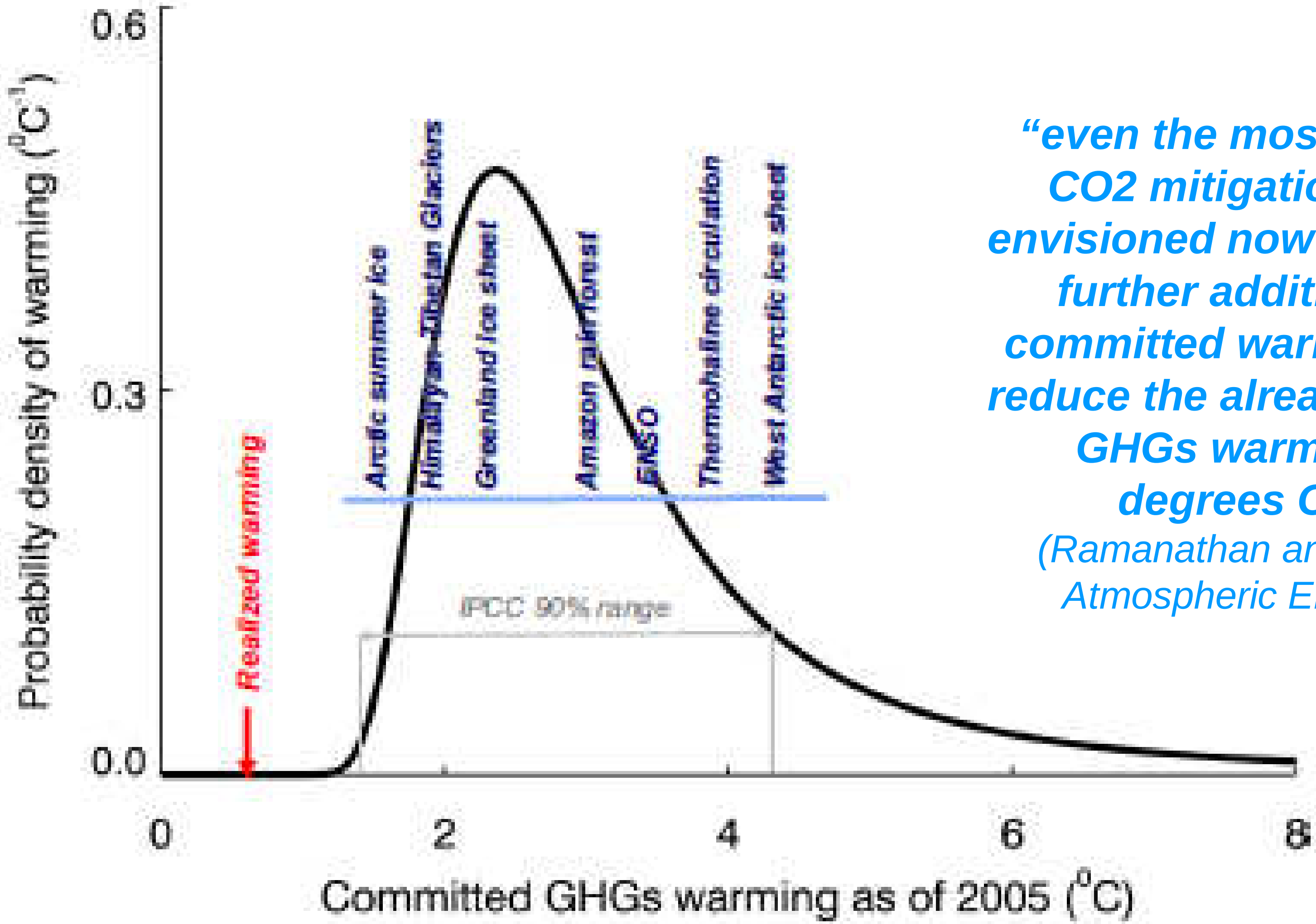
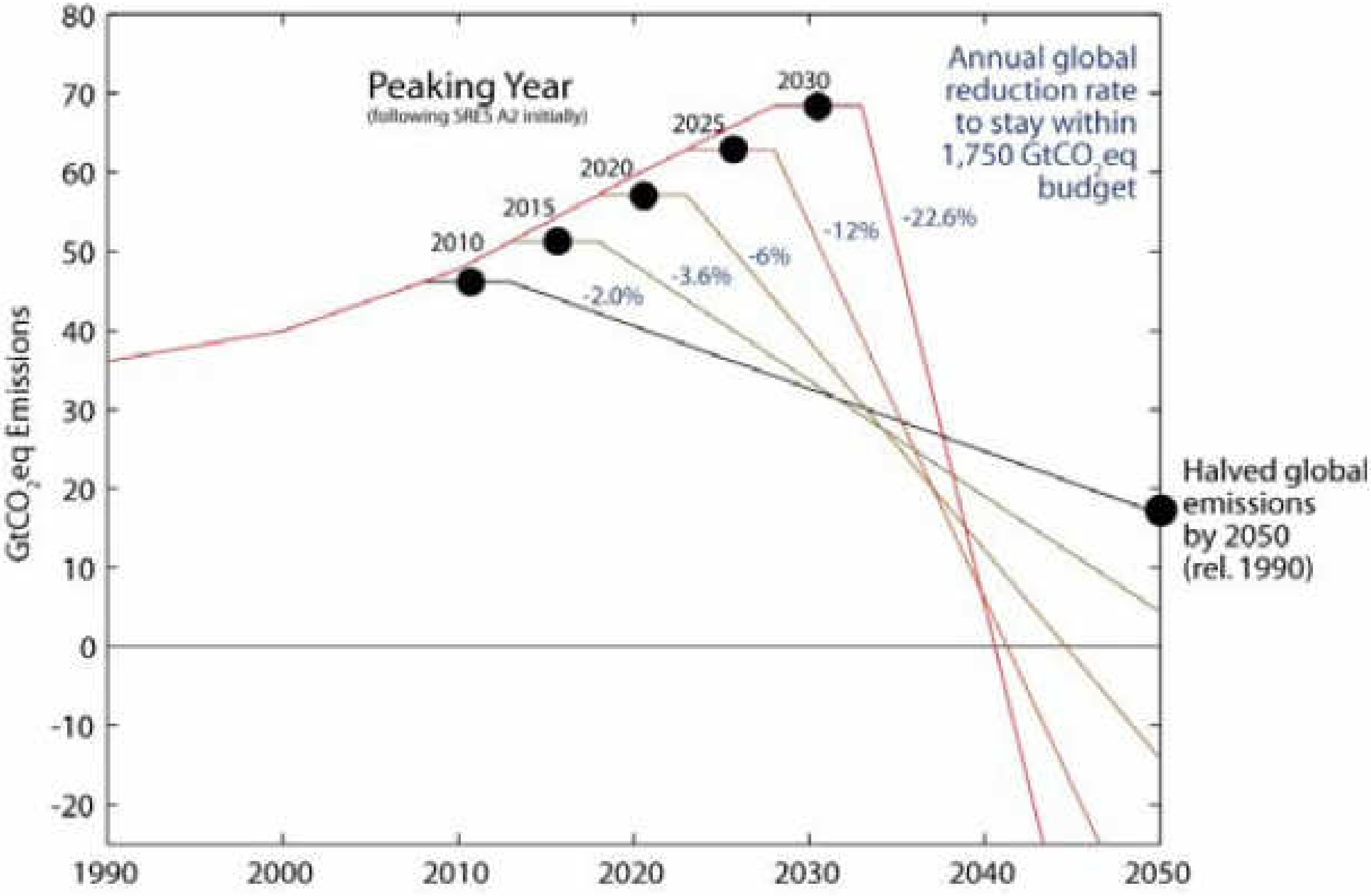
Probability distribution for the committed warming by GHGs between 1750 and 2005.
Shown are climate tipping elements and the temperature threshold range.



"even the most aggressive CO2 mitigation steps as envisioned now can only limit further additions to the committed warming, but not reduce the already committed GHGs warming of 2.4 degrees Celsius"

(Ramanathan and Feng 2008, Atmospheric Environment).

The later emissions peak, the more ambitious reductions needed



***Source**: Meinshausen et al 2009*

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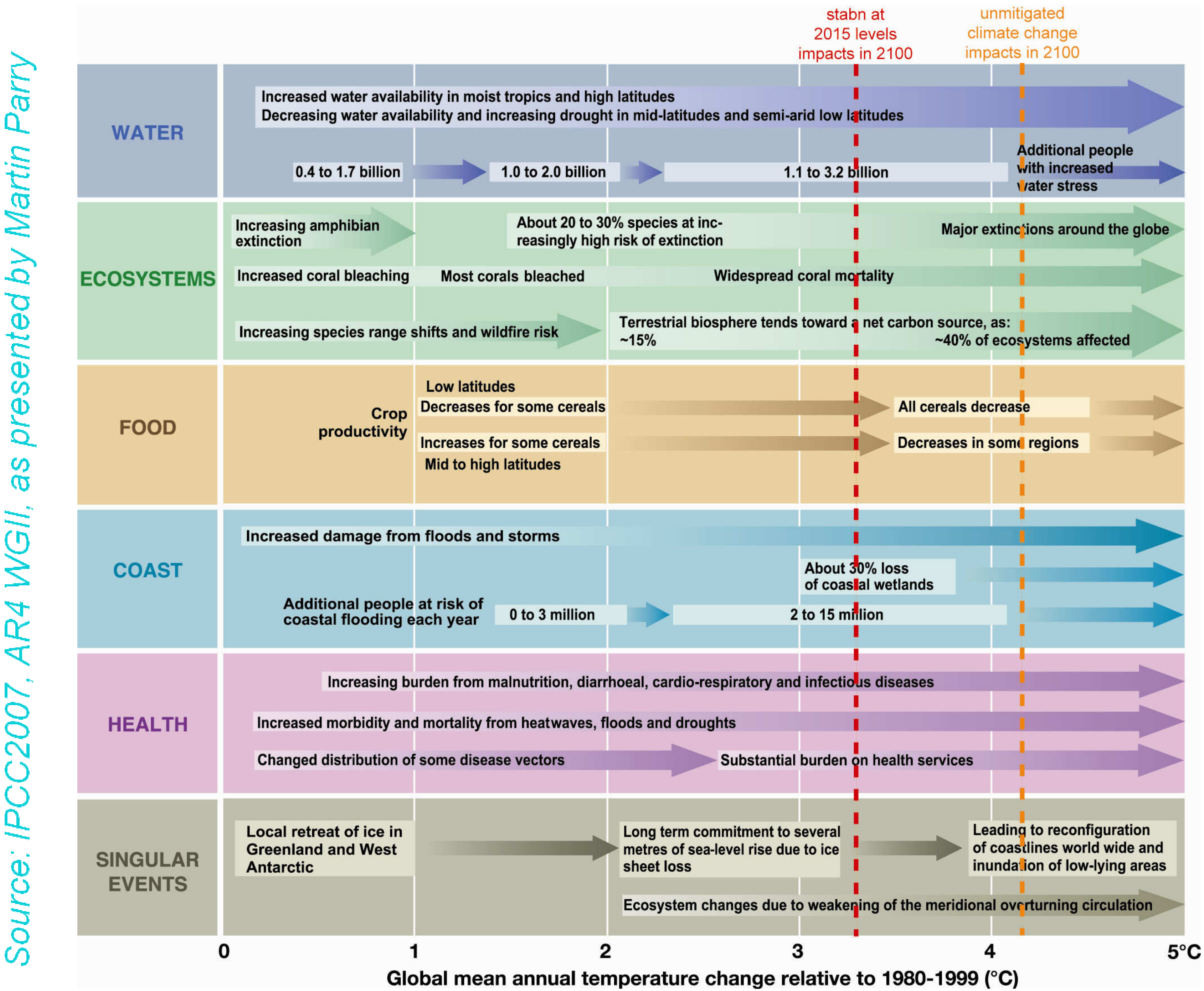
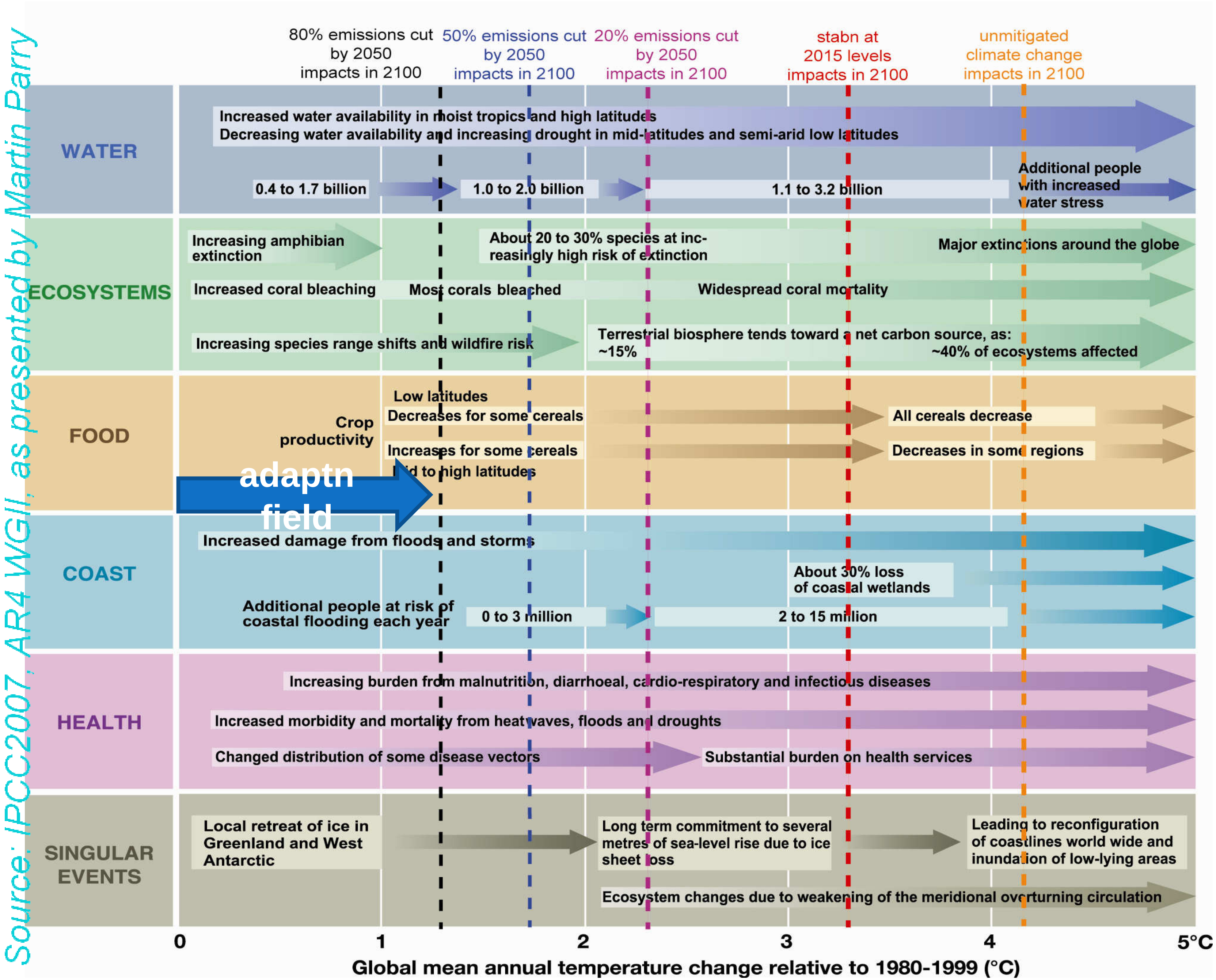


Source: IPCC2007, AR4 WGII, as presented by Martin Parry
stabn at 2015 levels impacts in 2100
unmitigated climate change impacts in 2100
WATER
Increased water availability in moist tropics and high latitudes
Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes
0.4 to 1.7 billion
1.0 to 2.0 billion
1.1 to 3.2 billion
Additional people with increased water stress
ECOSYSTEMS
Increasing amphibian extinction
About 20 to 30% species at increasingly high risk of extinction
Major extinctions around the globe
Increased coral bleaching
Most corals bleached
Widespread coral mortality
Increasing species range shifts and wildfire risk
Terrestrial biosphere tends toward a net carbon source, as:
~15%
~40% of ecosystems affected
FOOD
Crop productivity
Low latitudes
Decreases for some cereals
All cereals decrease
Increases for some cereals
Decreases in some regions
Mid to high latitudes
COAST
Increased damage from floods and storms
About 30% loss of coastal wetlands
Additional people at risk of coastal flooding each year
0 to 3 million
2 to 15 million
HEALTH
Increasing burden from malnutrition, diarrhoeal, cardio-respiratory and infectious diseases
Increased morbidity and mortality from heatwaves, floods and droughts
Changed distribution of some disease vectors
Substantial burden on health services
SINGULAR EVENTS
Local retreat of ice in Greenland and West Antarctic
Long term commitment to several metres of sea-level rise due to ice sheet loss
Leading to reconfiguration of coastlines world wide and inundation of low-lying areas
Ecosystem changes due to weakening of the meridional overturning circulation
0
1
2
3
4
5°C
Global mean annual temperature change relative to 1980-1999 (°C)



80% emissions cut by 2050 impacts in 2100
50% emissions cut by 2050 impacts in 2100
20% emissions cut by 2050 impacts in 2100
stabn at 2015 levels impacts in 2100
unmitigated climate change impacts in 2100
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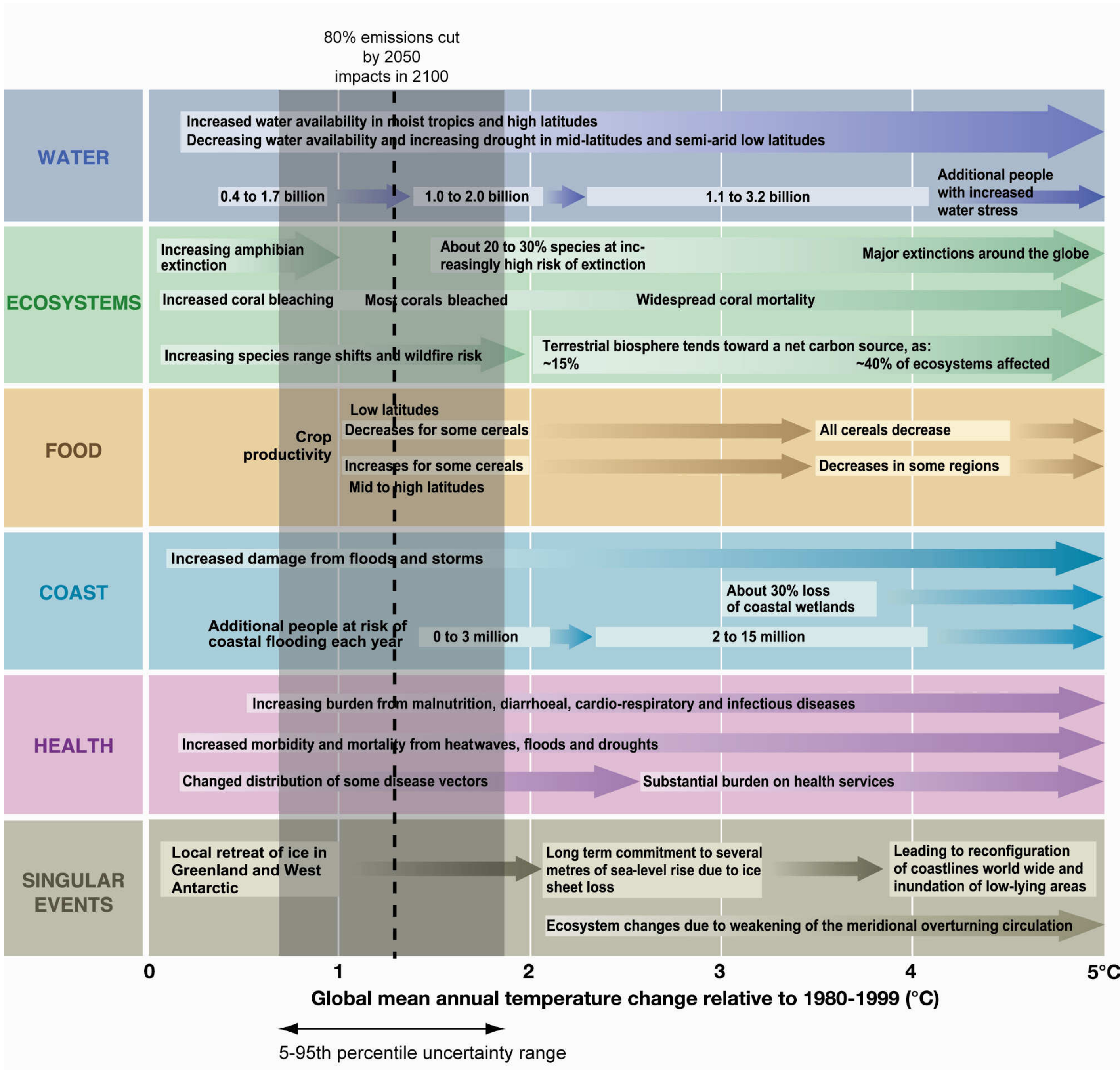

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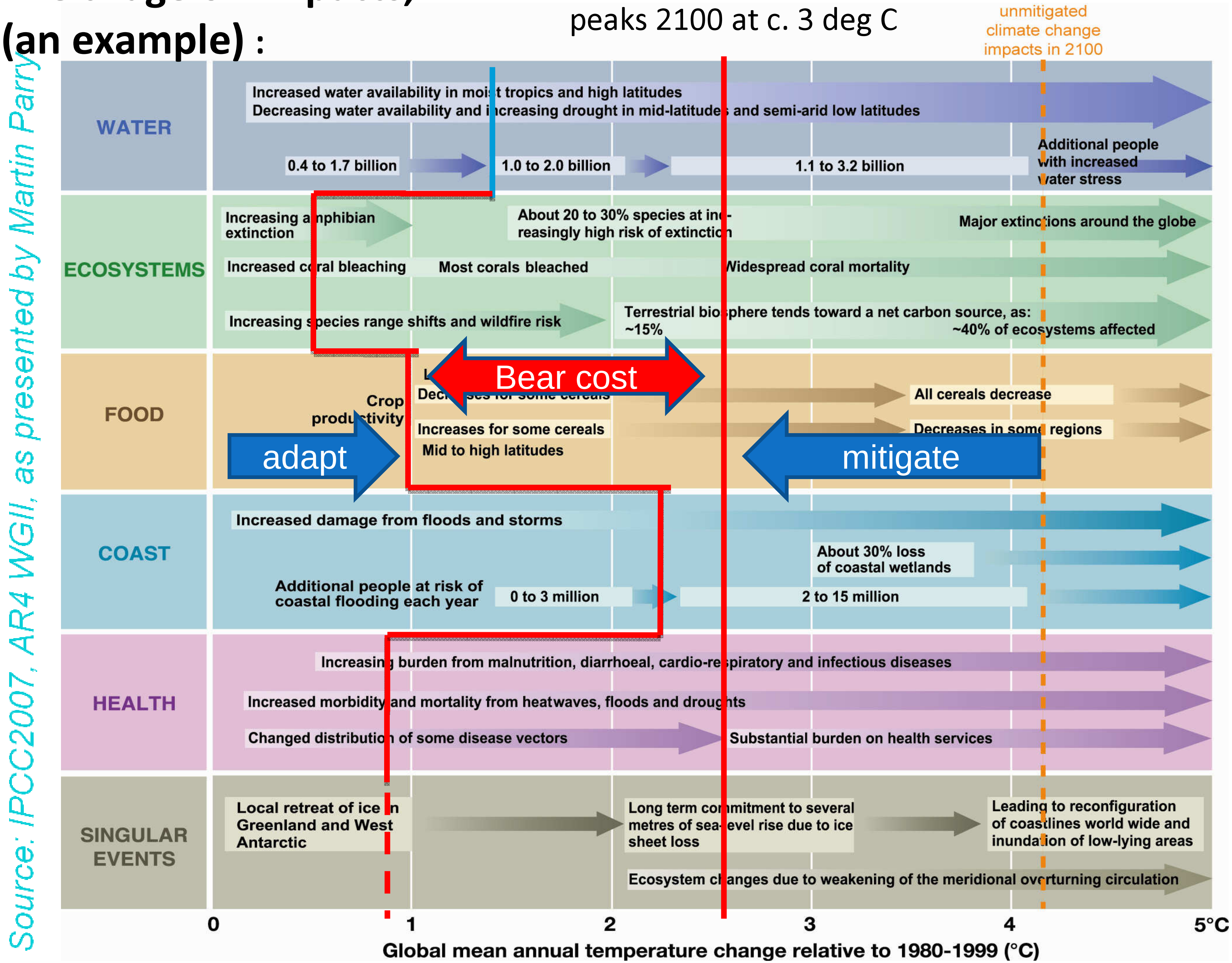
The triage on impacts, (an example) :

Emission peak 2035; T peaks 2100 at c. 3 deg C



The role of solar thermal and the buildings sector in reducing CC impacts

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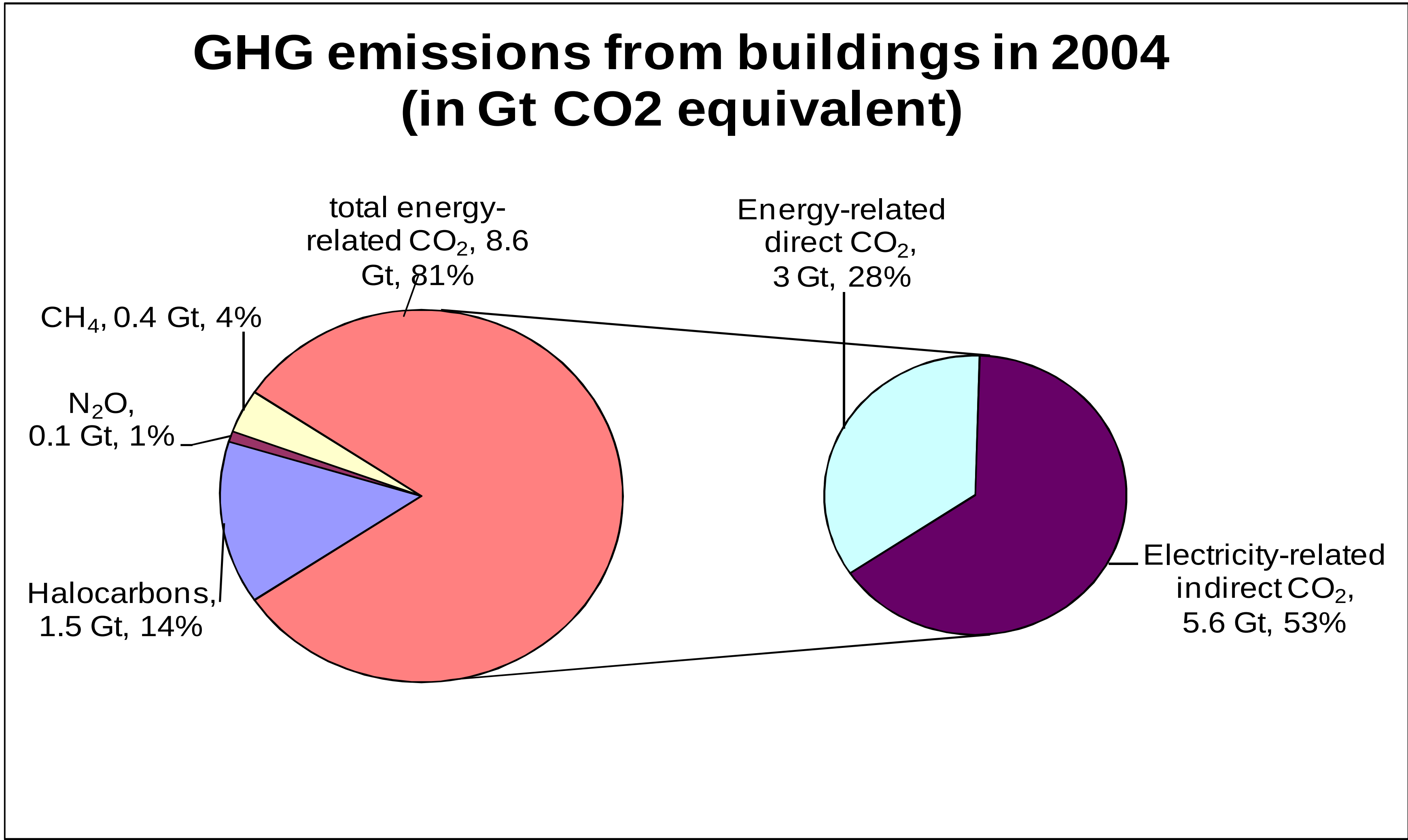
The Role of Solar Energy in our global fight against climate change

- **Mitigation**:
  - Solar technology's fuel source is unlimited and can provide energy at a significant scale
  - Thermal energy needs are often the "Cinderella" of mitigation – focus is mainly on electricity, while its potential maybe multiple of RES power
- **Adaptation**: solar cooling; avoiding/managing solar gains; in urban areas: replacing the need for energy "imports" therefore reducing *local warming*
- **Technology Transfer**: Solar provides the opportunity for developing countries to leapfrog traditional energy dependence on fossil fuels to producing clean energy
- **Finance**: Solar technology is becoming more affordable in every nation; it creates jobs, reduces fuel and energy poverty

***Adapted from**: Solar Trade Associations.2009. SEIZING THE SOLAR SOLUTION : Combating Climate Change through Accelerated Deployment*

Building sector: global importance

In 2004, in buildings were responsible for app. 1/3 of global energy-related CO_2 (incl. indirect) and 2/3 of halocarbon emissions



Source: IPCC 2007, AR4, Chapter 6 (Buildings)

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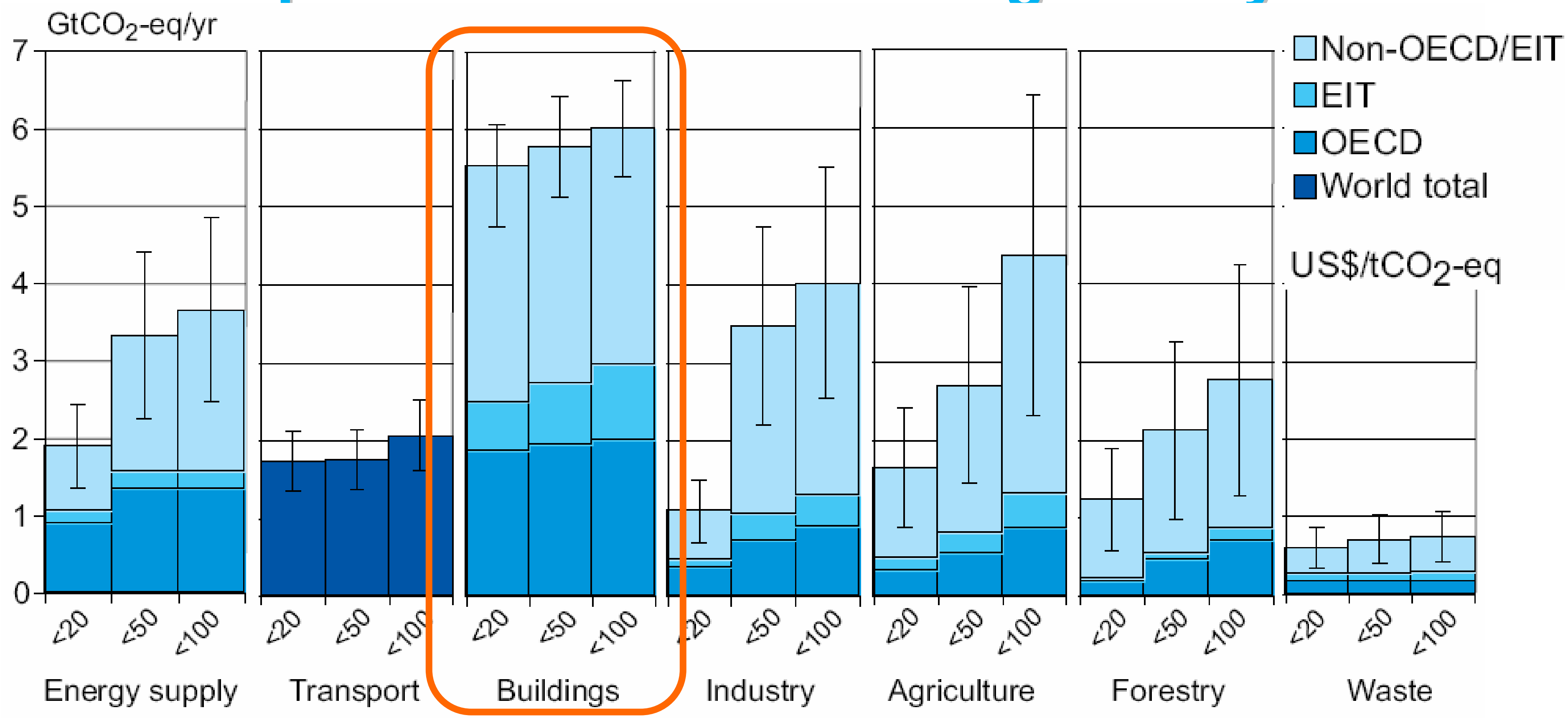
The buildings sector offers the largest low-cost potential in all world regions by 2030



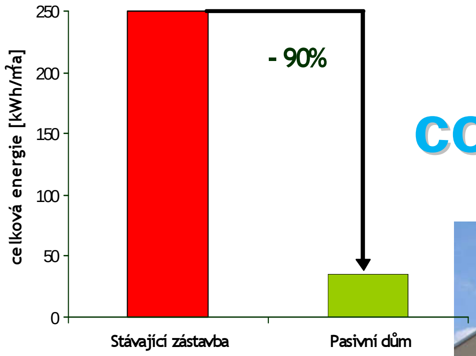
(potential at <US$100/ tCO_2-eq: 2.4 - 4.7 Gt CO_2-eq/yr)	*(potential at <US$100/ tCO_2-eq: 1.6 - 2.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 5.3 -6.7 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.5 - 5.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.3 -6.4 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 1.3 - 4.2 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 0.4 - 1 Gt CO_2-eq/yr)*

Source: IPCC 2007, AR4, Chapter 10

Few sectors can deliver the magnitude of emission reduction needed

- know-how has recently developed that we can build and retrofit buildings to achieve 60 – 90% thermal energy savings as compared to standard practice in all climate zones (providing similar or increased service levels)

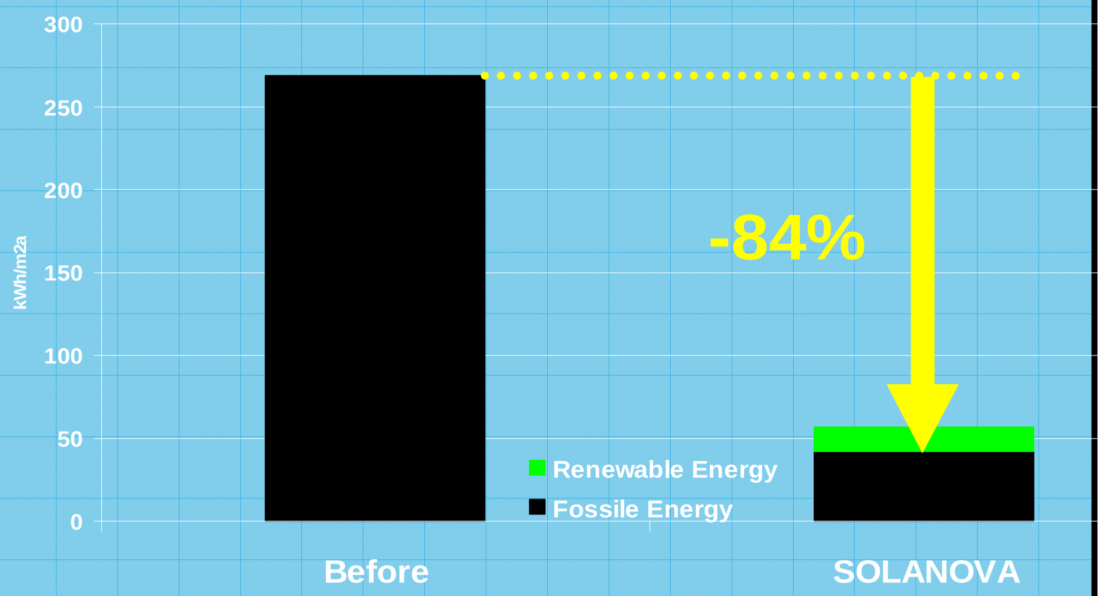
Photos from Gunter Lang



Buildings utilising passive solar construction and solar thermal technologies

Source: Jan Barta, Center for Passive Buildings, www.pasivnidomy.cz

“EU buildings – a goldmine
for CO2 reductions, energy security, job creation and addressing low income population problems”



Source: Claude Turmes (MEP), Amsterdam Forum, 2006

More on Solanova: www.solanova.eu

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State-of-the-Art Scenario Results for the World

Thermal Comfort Final Energy

Floor Area

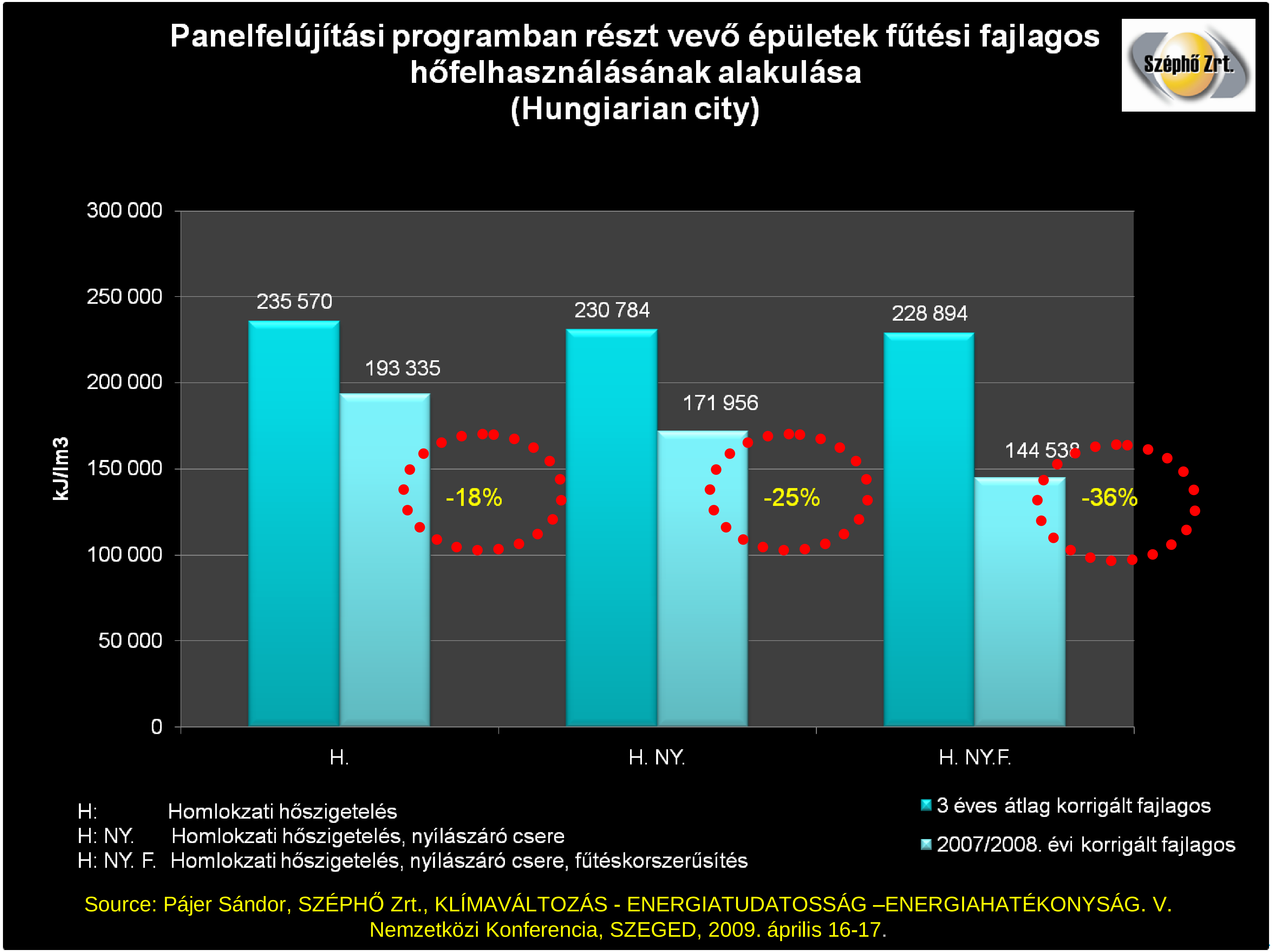
Work in progress

Exact numbers still changing

Source: www.globalenergyassessment.org (to come)

Opportunity or risk?

The size of the potential lock-in effect


Panelfelújítási programban részt vevő épületek fűtési fajlagos hőfelhasználásának alakulása
(Hungiarian city)
Széphő Zrt.
300 000
250 000
200 000
150 000
100 000
50 000
0
kJ/lm3
235 570
193 335
230 784
171 956
228 894
144 538
-18%
-25%
-36%
H.
H. NY.
H. NY.F.
H: Homlokzati hőszigetelés
H: NY. Homlokzati hőszigetelés, nyílászáró csere
H: NY. F. Homlokzati hőszigetelés, nyílászáró csere, fűtéskorszerűsítés
3 éves átlag korrigált fajlagos
2007/2008. évi korrigált fajlagos
Source: Pájer Sándor, SZÉPHŐ Zrt., KLÍMAVÁLTOZÁS - ENERGIATUDATOSSÁG –ENERGIAHATÉKONYSÁG. V. Nemzetközi Konferencia, SZEGED, 2009. április 16-17.

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Sustainable Buildings
& Climate Initiative

The risk of the lock-in effect

Final thermal energy consumption Worldwide

State-of-the-art vs. suboptimal renovation scenarios

Source: www.globalenergyassessment.org (to come)

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The risk of the lock-in effect

Final thermal energy consumption in Western Europe

State-of-the-art vs. suboptimal renovation scenarios

Work in progress
Exact numbers still changing

Source: www.globalenergyassessment.org (to come)

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The lock-in effect in detail for Western Europe

Thermal Comfort Final Energy, state-of-the-art scenario

Thermal Comfort Final Energy, suboptimal scenario

Work in progress

Exact numbers still changing

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The risk of the lock-in effect

Final thermal energy consumption in Eastern Europe

State-of-the-art vs. suboptimal renovation scenarios

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Conclusions

- The challenge of fighting climate change is Herculean – but it is possible to solve.
- Mitigation needs to go hand-in-hand with adaptation: synergies!
  - Solar thermal has important role in both areas
- Buildings are key to climate change mitigation in each world region
- Substantial opportunities exist; as much as 42% of 2005 final thermal energy consumption can be eliminated by 2050 by state-of-the-art architecture and solar thermal technologies, while living standards increase and energy poverty eliminated
- However, major lock-in risks exist
  - Suboptimal retrofit and cherry-picking represents major climate lock-in risk
  - Present policies can **lock in** **43% – 78% of all 2005 building thermal energy-related emissions** in Europe for many decades
  - We need to stop cherry-picking and focus on strategic, holistic solutions
- We need to make solar thermal solutions more "sexy" and the benefits more quantifiable

Thank you for your attention

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