Buildings:
how far can they take us in mitigating climate change?

CENTER FOR CLIMATE CHANGE
AND SUSTAINABLE ENERGY POLICY

CENTRAL EUROPEAN UNIVERSITY

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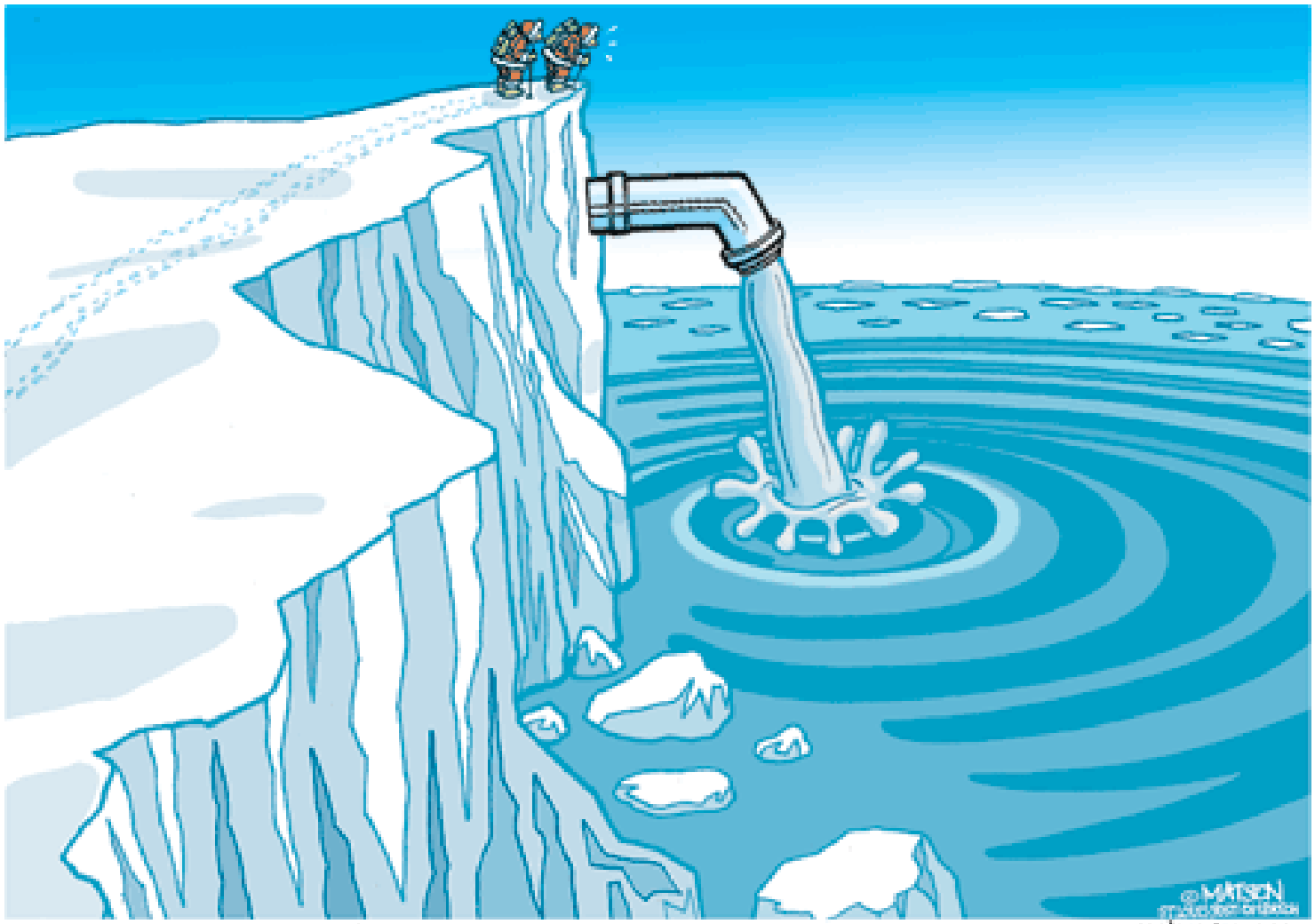
Key messages

- Buildings are (the?) key to reaching ambitious mitigation targets…
- …but they can also lock us into high(er) GHG concentration levels for many decades
  - more focus on retrofit is needed
  - Suboptimal retrofits and new construction are a major climate risk
- High performance buildings may also have the largest co-benefits among mitigation options

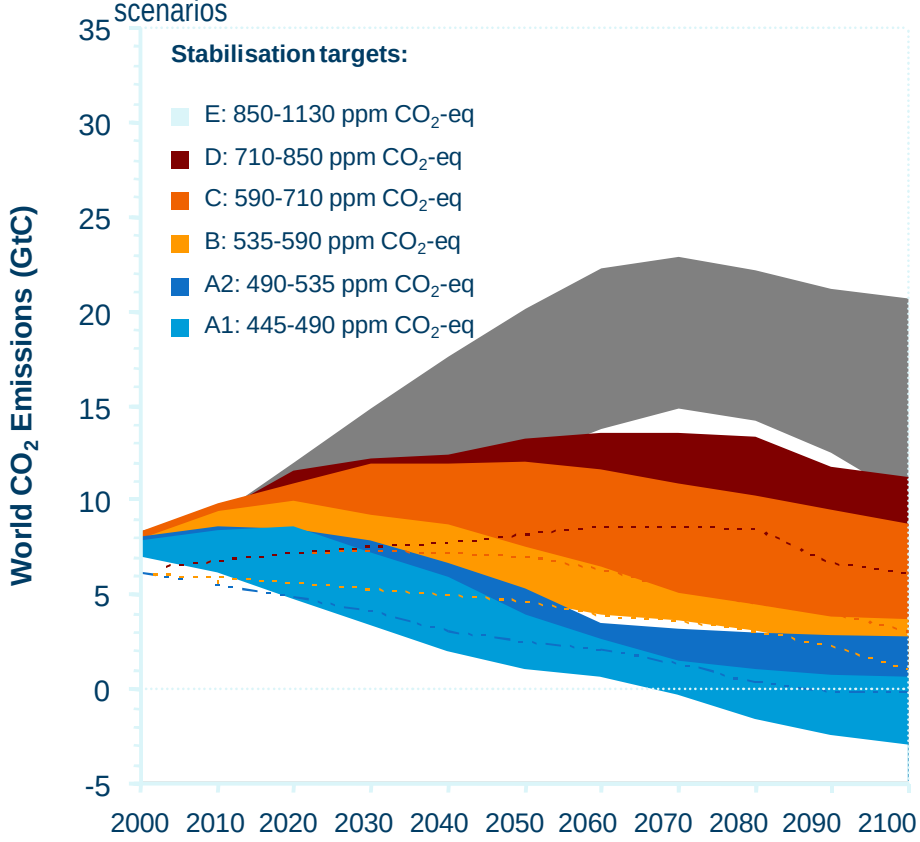
The climate change mitigation challenge



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°C requires emissions to peak within the next 55 years.
- Limiting increase to 2.8 – 3.2°C requires global emissions to peak within 25 years.
- Limiting global mean temperature increases to 2 – 2.4°C 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 IPCC SPM 7, WG III. Emission pathways to mitigation scenarios



Multigas and CO_2 only studies combined

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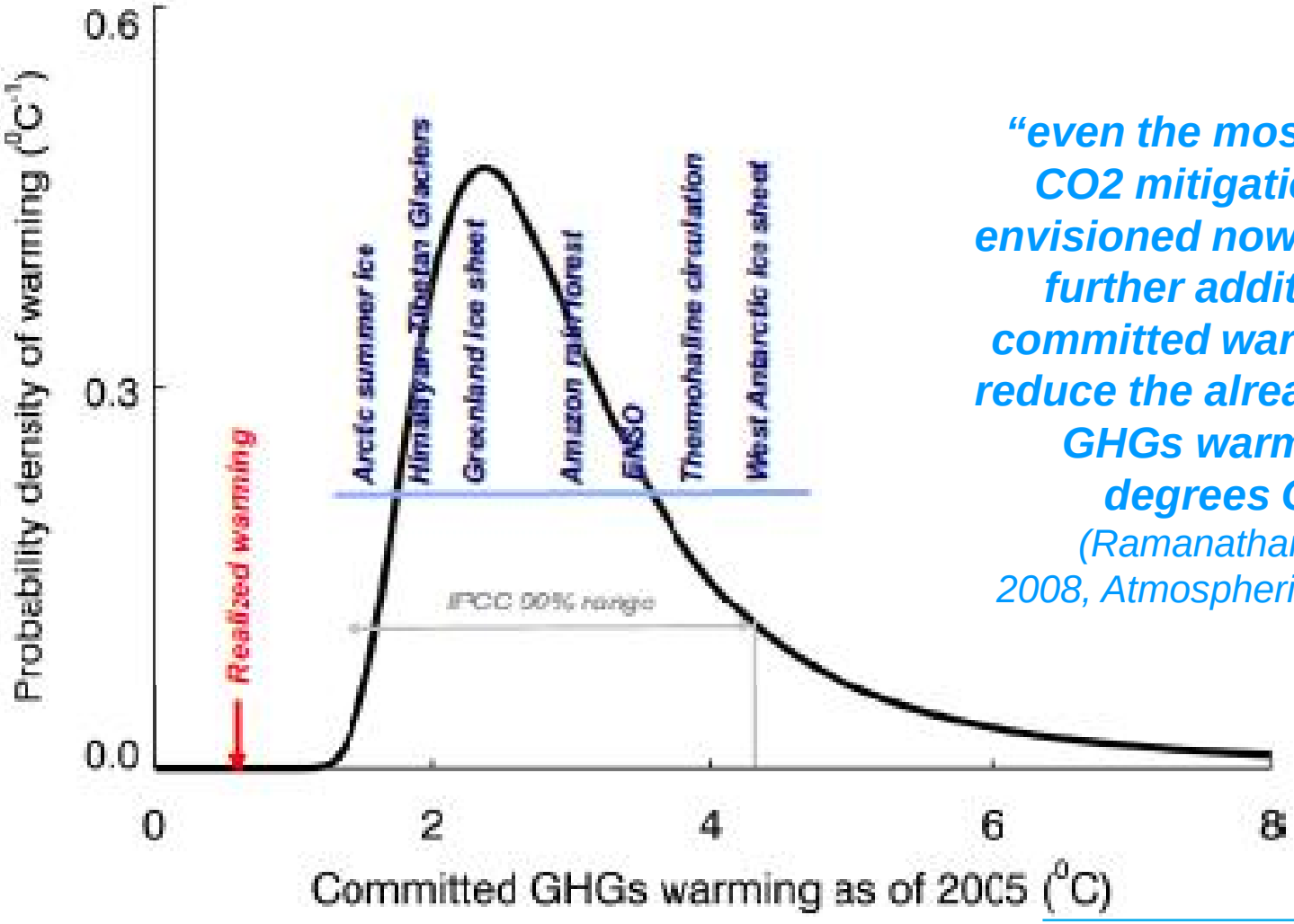
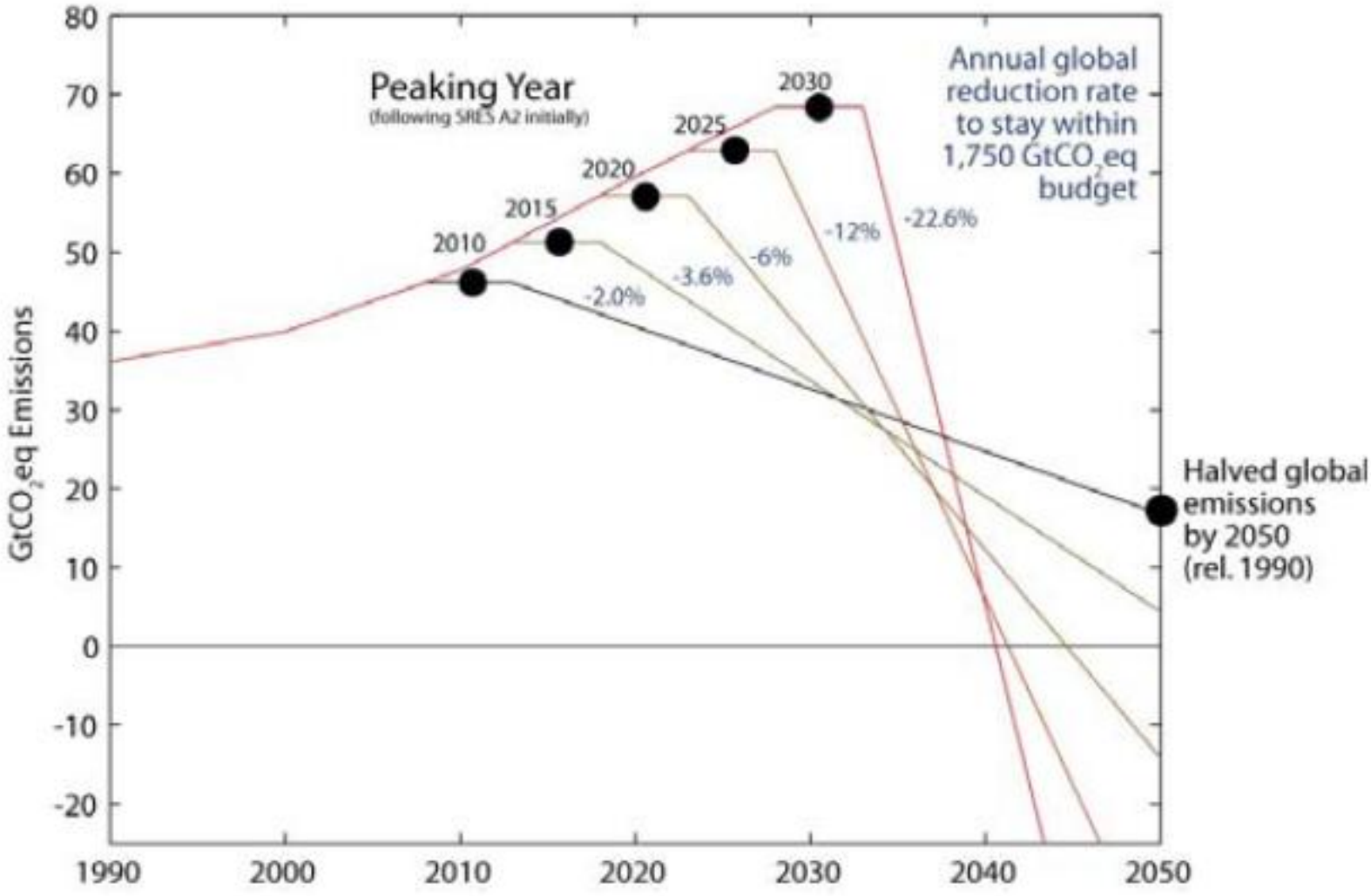
Probability distribution for the committed warming by GHGs between 1750 and 2005. Shown are climate tipping elements and the temperature threshold range.



"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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Buildings are key in climate change mitigation

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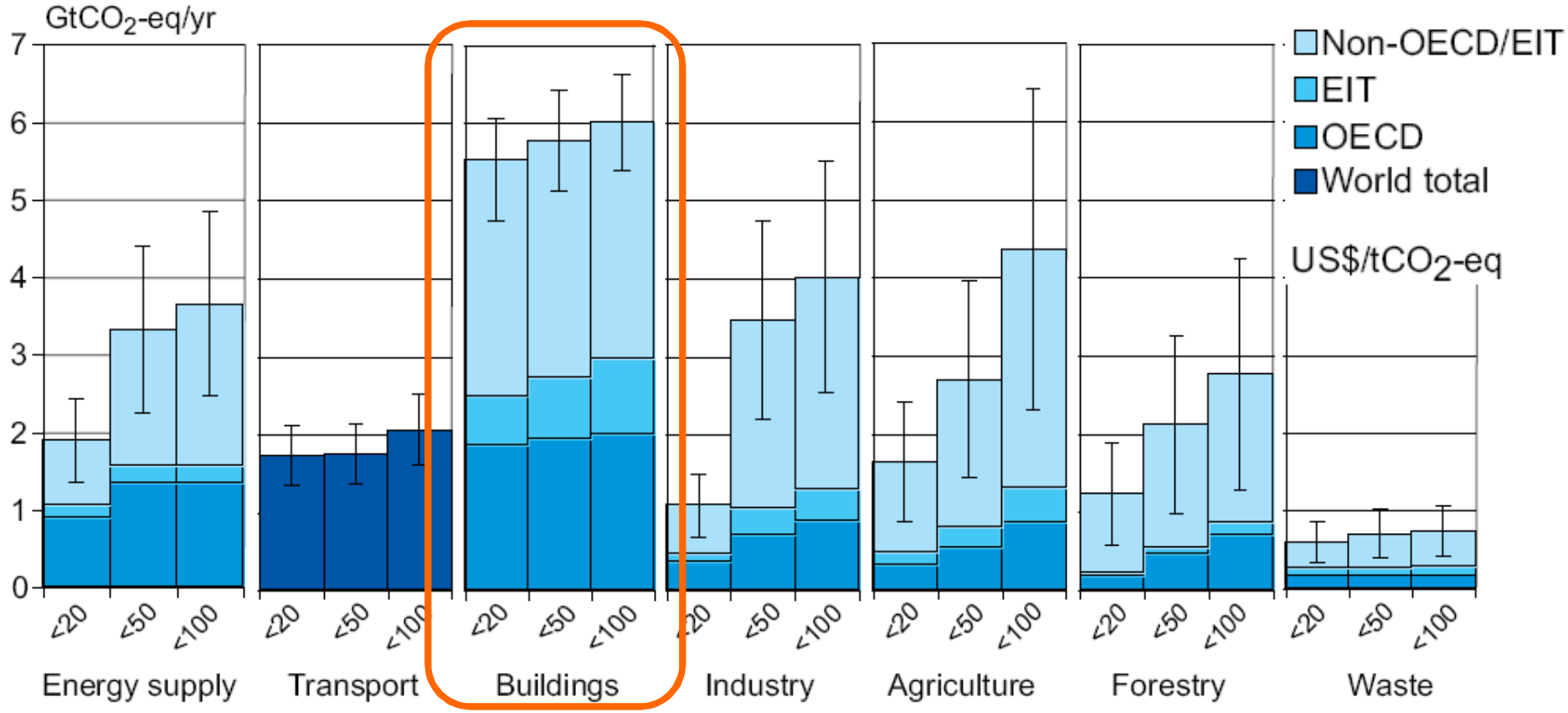
The buildings sector offers the largest low-cost potential in all world regions by 2030

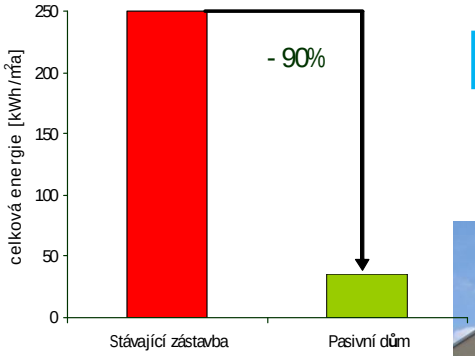


(potential at <US$100/ tCO_2-eq: 2.4 - 4.7 Gt CO_2-eq/yr)	*(potential at <US$100/ tCO_2-eq: 1.6 - 2.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 5.3 -6.7 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.5 - 5.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.3 -6.4 Gt CO_2-eq/yr)*	*(potential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

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% savings as compared to standard practice in all climate zones (providing similar or increased service levels)

Buildings utilising passive solar construction (“PassivHaus”)



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

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% savings as compared to standard practice in all climate zones (providing similar or increased service levels)
- Novel methods developed for mitigation potential assessment that considers buildings as complex systems rather than independent sums of components
- New scenarios are constructed under the Global Energy Assessment, with co-funding from UNEP SBCI, that reflect this new approach

Final thermal energy consumption in the world's buildings, 2005-2050

Using state-of-the-art and cost-effective construction know-how

Work in progress – not yet publishable

Watch out for the Global Energy Assessment release in 2011…

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Opportunity or risk?

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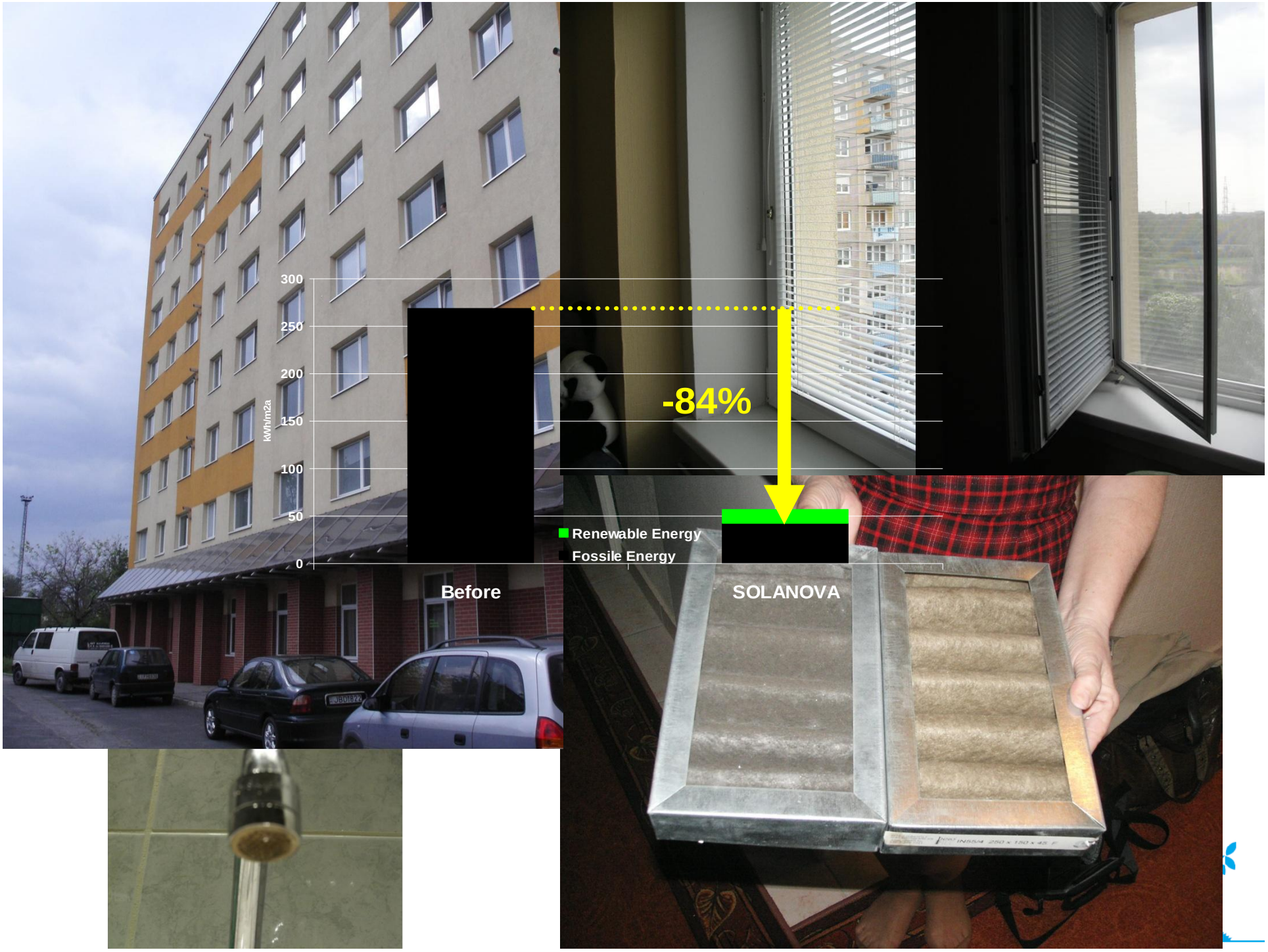
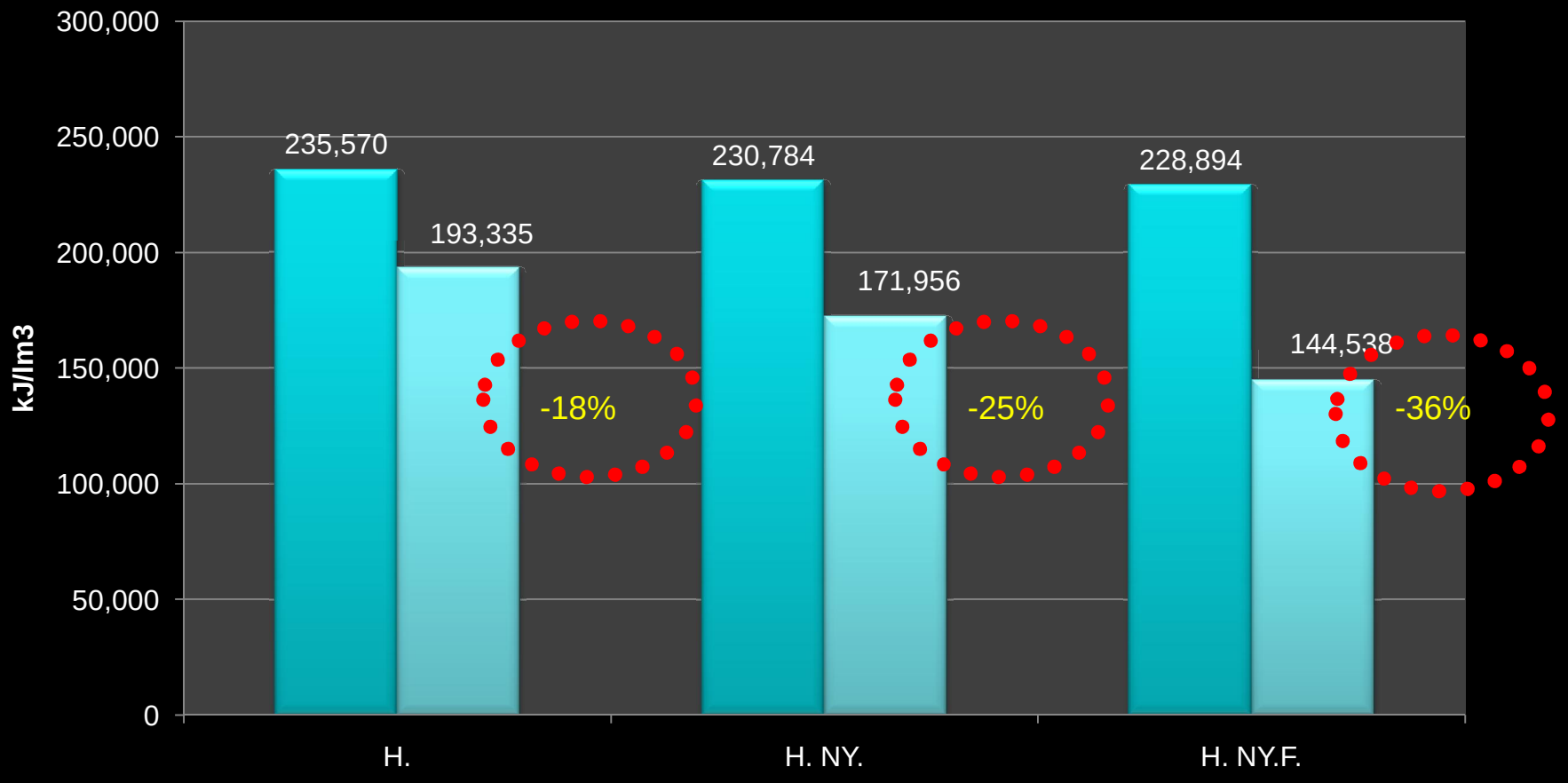
The size of the potential lock-in effect


300
250
200
150
100
50
0
kWh/m2a
-84%
Renewable Energy
Fossile Energy
Before
SOLANOVA

Panelfelújítási programban részt vevő épületek fűtési fajlagos hőfelhasználásának alakulása (city of Sz in Hungary)



H: Homlokzati hőszigetelés
H: NY. Homlokzati hőszigetelés, nyílászáró csere
H: NY. F. Homlokzati hőszigetelés, nyílászáró csere, fűtéskorszerűsítés

Source: Pájer Sándor, SZÉPHŐ Zrt., KLÍMAVÁLTOZÁS - ENERGIATUDATOSSÁG –ENERGIAHATÉKONYSÁG. V. Nemzetközi Konferencia, SZEGED, 2009. április 16-17.

The lock-in effect

Final world thermal energy consumption
State-of-the-art vs. suboptimal retrofits

Work in progress – not yet publishable

Watch out for the Global Energy Assessment release in 2011…

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Sub-optimal scenario for the five regions: heating and cooling final energy use development for scenarios using sub-standard renovation and construction energy performance levels

Work in progress – not yet publishable

Watch out for the Global Energy Assessment release in 2011…

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Final heating and cooling energy consumption 2005 – 2050, Western Europe

State-of-the-Art Scenario **Sub-Optimal Scenario**

Work in progress – not yet publishable

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Final heating and cooling energy consumption 2005 – 2050, Centrally Planned Asia

State-of-the-Art Scenario **Sub-Optimal Scenario**

Work in progress – not yet publishable

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Co-benefits - the free lunch we are paid to eat…

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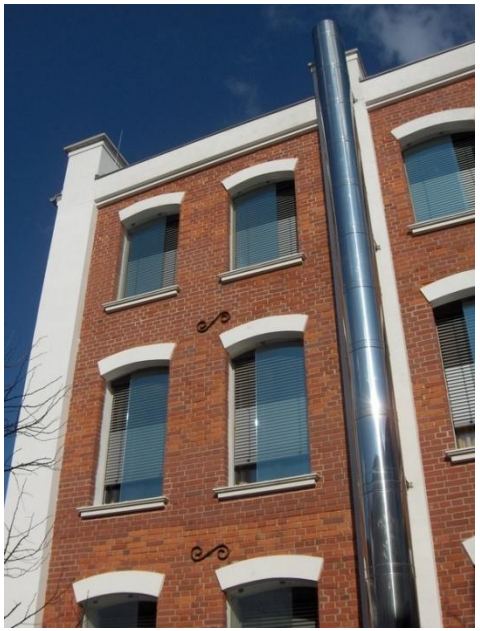

Co-benefits of energy-efficient buildings

Investment needs vs. energy cost savings, Hungarian tertiary sector

	Energy saving potential			CO_2 reduction potential			Investment vs. savings	
	Business-as-usual in year 2030	Energy saving potential in year 2030	Energy saving potential in year 2030 (% of BAU)	Business-as-usual 2030	CO_2 mitigation potential 2030	CO_2 mitigation potential 2030 (% of BAU)	Total cumulative investment (2011-2030)	Cumulative energy cost savings (2011-2030)
	GWh	GWh	GWh	kt CO_2	kt CO_2	kt CO_2	Billion Euro	Billion Euro
Suboptimal accelerated	7 633	1 667	22%	1 518	331	22%	1.82	0.97
Passive 1%	7 633	1 518	20%	1 518	302	20%	0.84	0.88
Passive accelerated	7 633	5 572	73%	1 518	1 108	73%	2.62	3.24

Source: Katarina Korytarova, dissertation draft

In many countries, high-performance buildings are not primarily a green, but a **social** and **economic** agenda

- Fuel poverty is widespread in Europe
- According to a new study, app. 2500 lives are lost in Hungary alone each year
- By the UK definition, the average Hungarian household is fuel poor (has spent 10.4% of its disposable income on energy in 2007, it probably worsened since then)
- A widespread deep (!) building energy retrofit program can eliminate fuel poverty

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EE as an economic/social agenda: employment and other economic benefits

- In energy-efficient buildings:
  - labor **productivity** rises by app. 6–16%;
  - students' test scores shows ~20–26% faster learning
  - Influenza and cold rates can decrease by as much as 20%, resulting in a USD10 bln/yr savings in US alone
    - better indoor environments related with building EE save annually in the US $6 -14 bill.(reduced respiratory disease); $1 - 4 bill. (reduced allergies and asthma); $10 - 30 bill. (reduced sick building syndrome); and $20 - 160 bill. (direct improvements in worker performance unrelated to health)
- Employment: (local) job creation: Danish trade union study finds twice higher employment intensity than for other mitigation options
- a wide-scale renovation program can create app. 250,000 net jobs in Hu alone (vs. the "1 million" estimated for the whole EU for the 20/20/20 target)
- …and save 40% of Hungary's natural gas import needs

European Climate Foundation

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Recommendations for SBCI to consider focusing on

- avoiding the lock-in: recommended specific regional performance levels for state-of-the-art new construction and retrofit
- Quantification:
  - More study on the cost-effectiveness of deep renovations (tunneling effect?)
  - Regionally specific quantification of co-benefits (in monetary and other units)

Thank you for your attention

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