The role of the building sector in the climate change mitigation challenge

Center for Climate Change
and Sustainable Energy Policy

Central European University

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Mainstreaming Building Energy Efficiency Codes in Developing Countries
Nov 19, 2009, World Bank, Washington DC

Overview

- Introduction: the CC mitigation challenge
- The global and regional importance of the buildings sector in CC
- How far can buildings take us?
- the risk of the lock-in effect
- Summary – recommendations for codes worldwide

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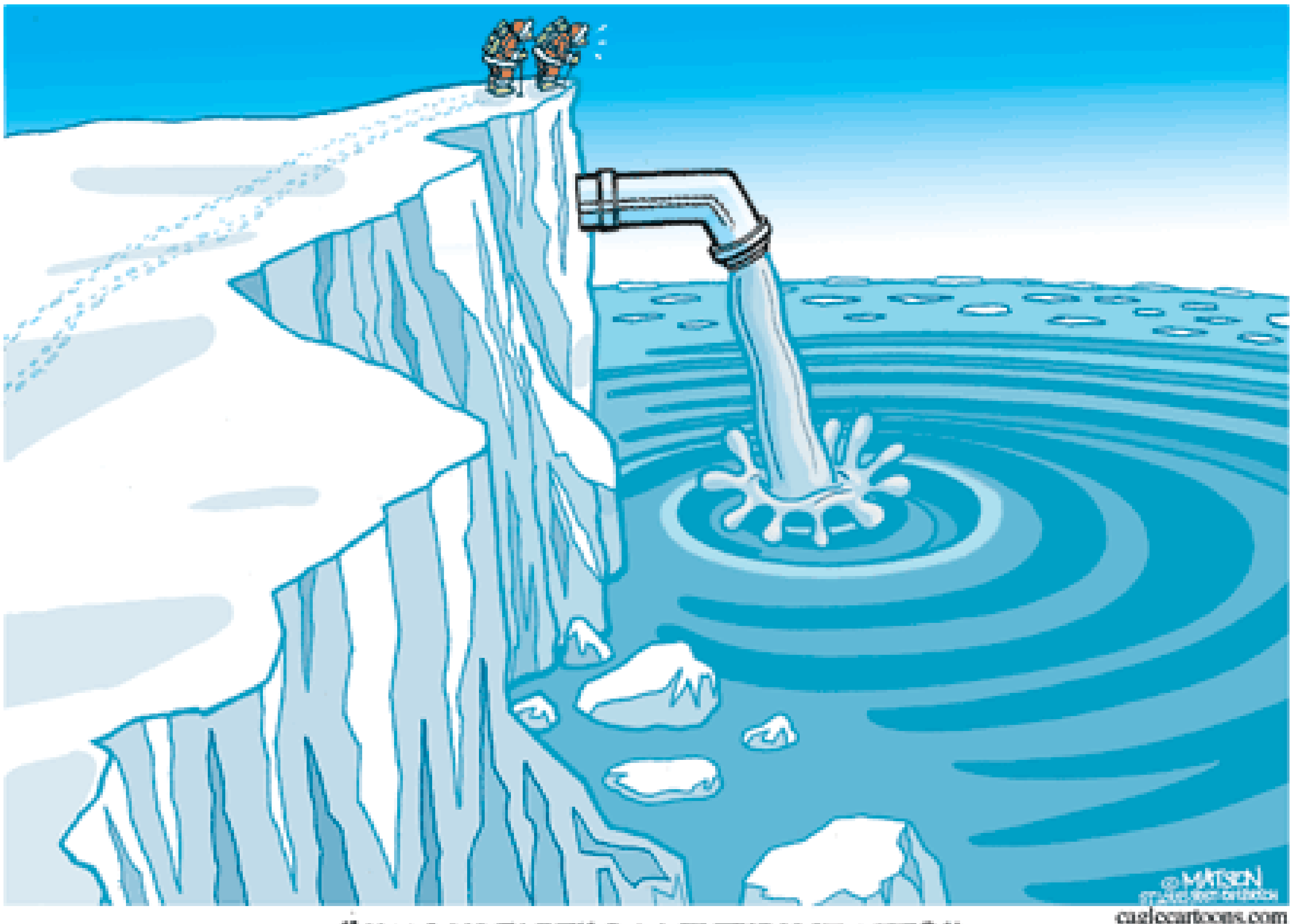
The climate change mitigation challenge

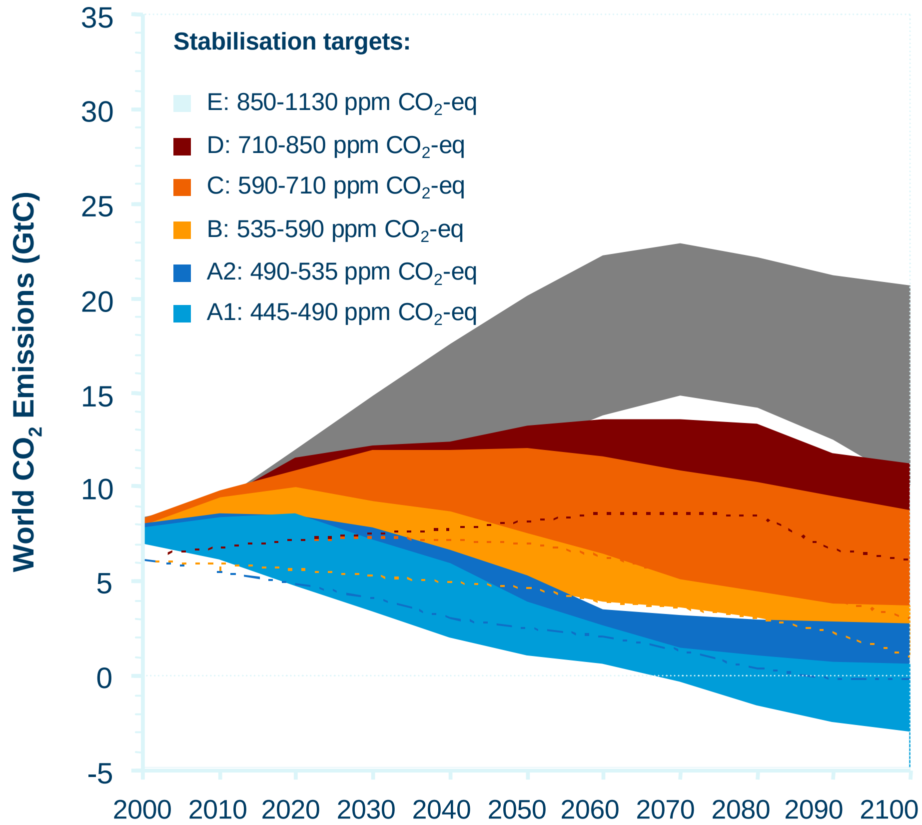


"HOW ON EARTH DO WE TURN IT OFF?"

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°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 SPM 7, WG III. Emission pathways to mitigation scenarios



Multigas and CO_2 only studies combined

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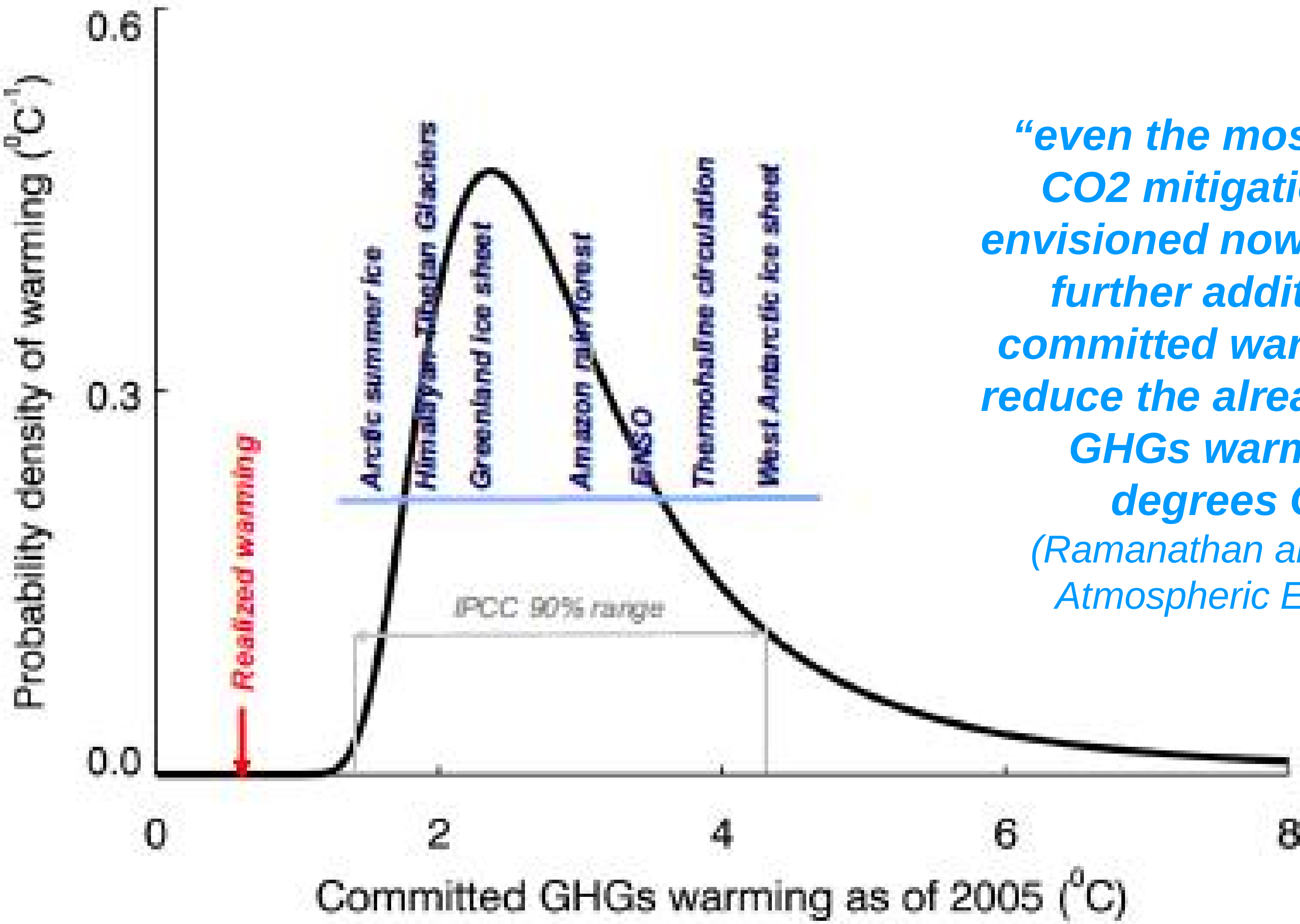
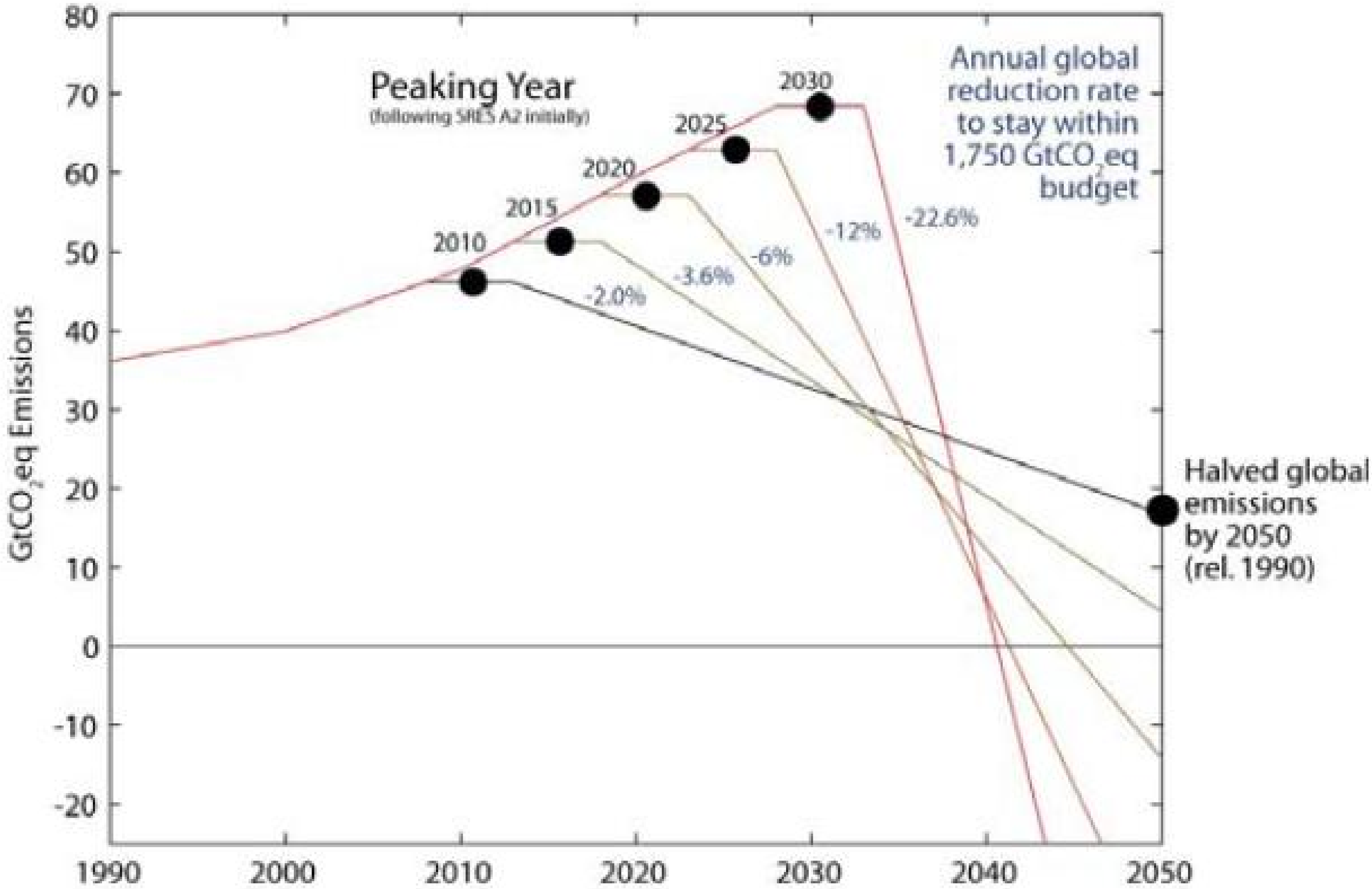
Probability distribution for the committed warming by GHGs between 1750 and 2005.
Shown are climate tipping elements and the temperature threshold range.



"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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The role of the buildings sector in CC mitigation: global and regional importance

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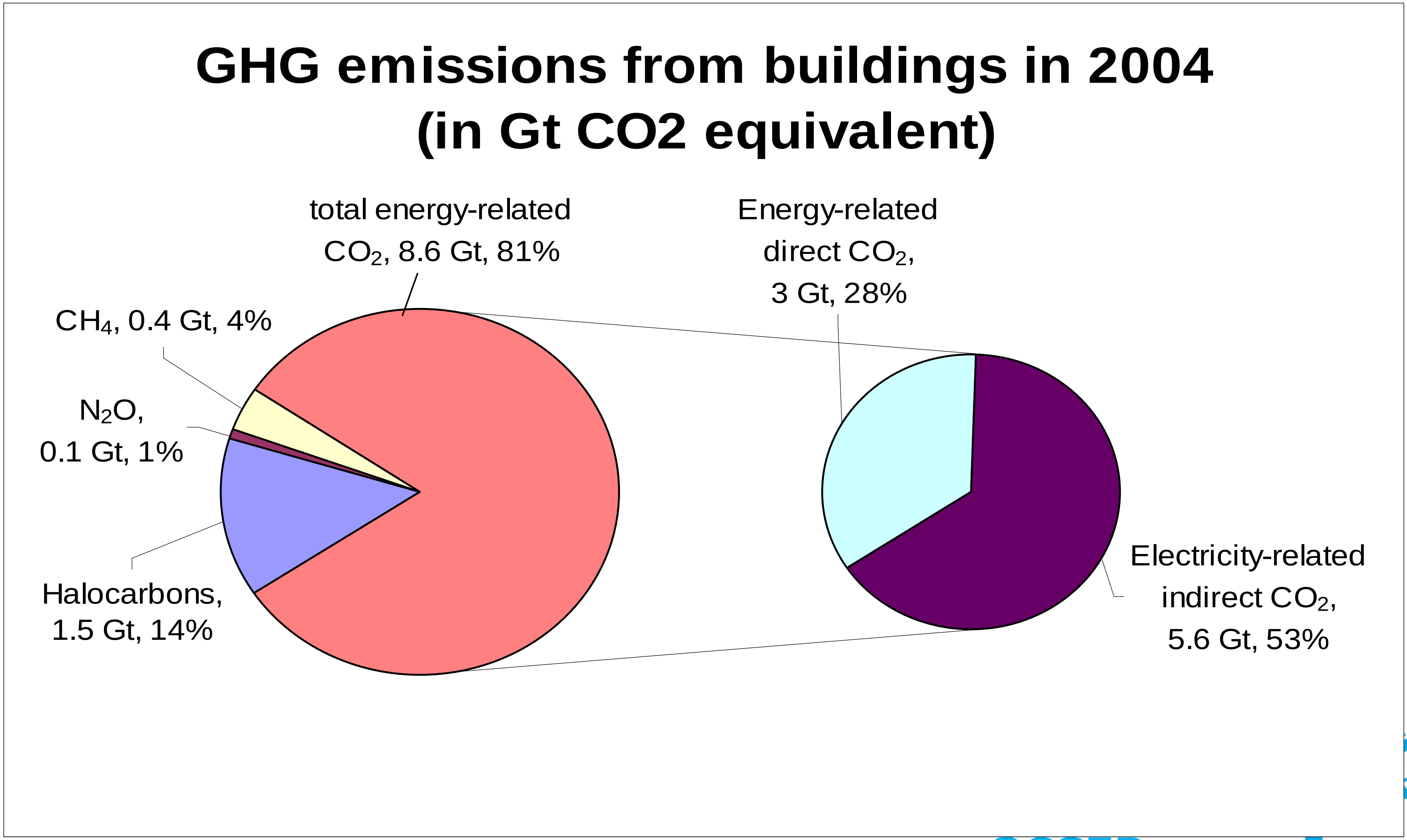
Building sector: global importance

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



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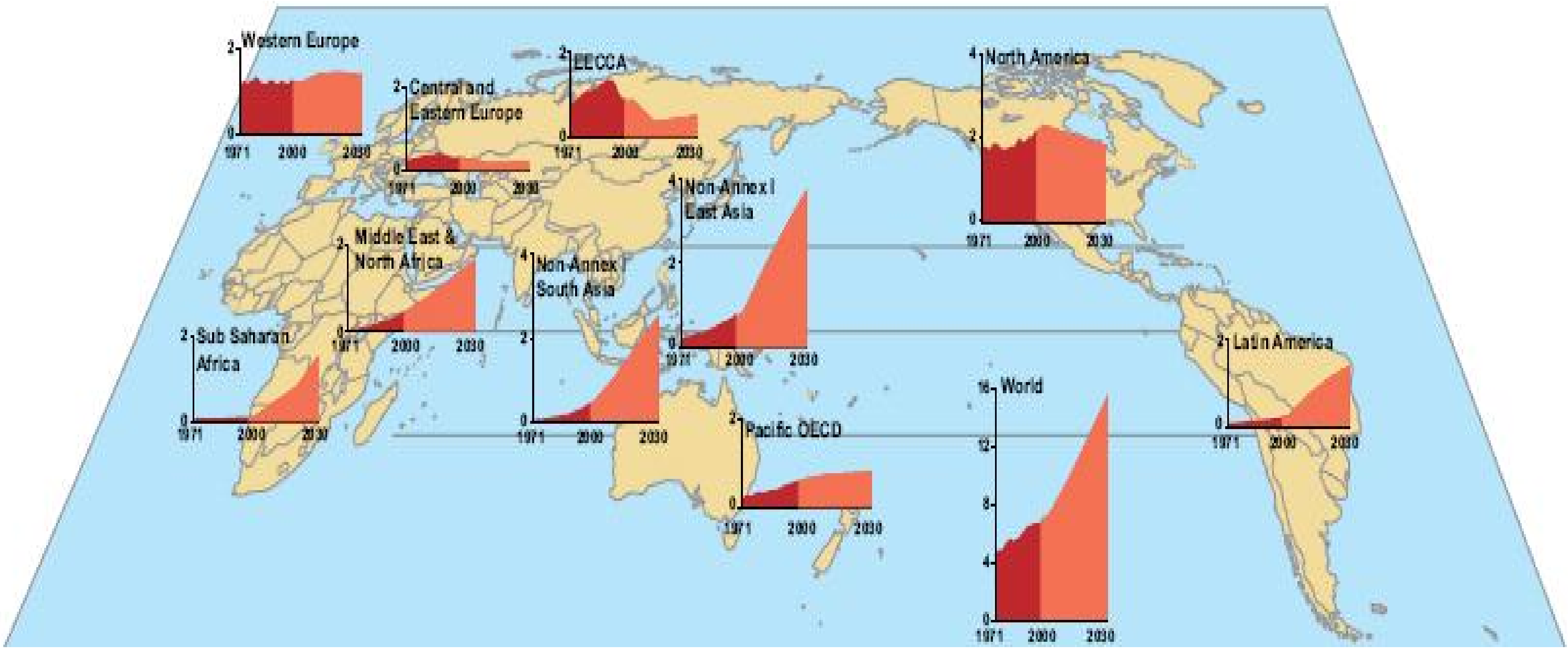
Buildings sector: regional importance

In 2030: the share of building-related emissions in global will stay at approximately 1/3 of energy-related CO2



CO2 emissions including through the use of electricity, A1B scenario

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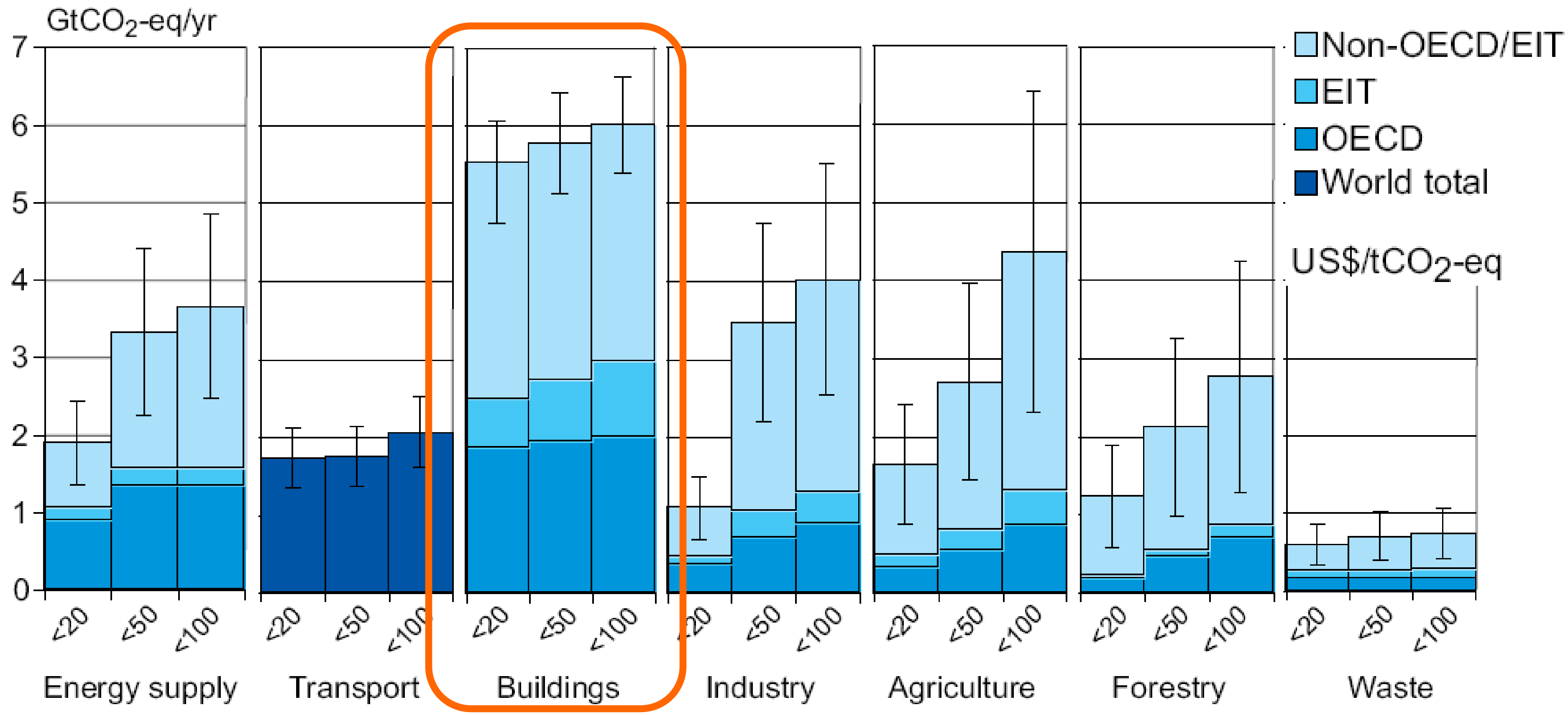
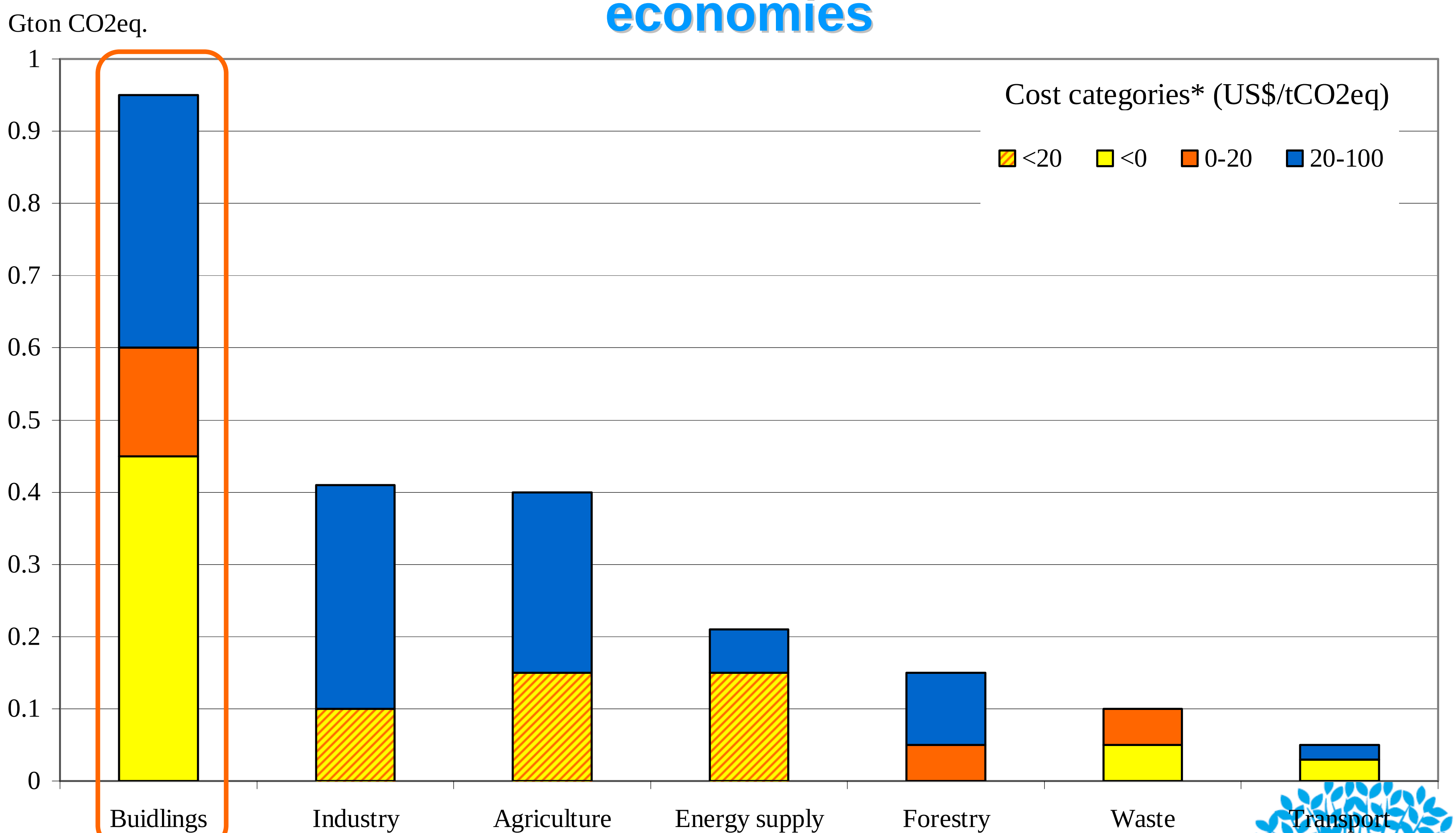
The buildings sector offers the largest low-cost potential in all world regions by 2030



(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)*

Estimated potential for GHG mitigation at a sectoral level in 2030 in different cost categories , transition economies



* For the buildings, forestry, waste and transport sectors, the potential is split into three cost categories: at net negative costs, at 0-20 US$/tCO2, and 20-100 US$/tCO2. For the industrial, forestry, and energy suppy sectors, the potential is split into two categories: at costs below 20 US$/tCO2 and at 20-100 US$/tCO2.

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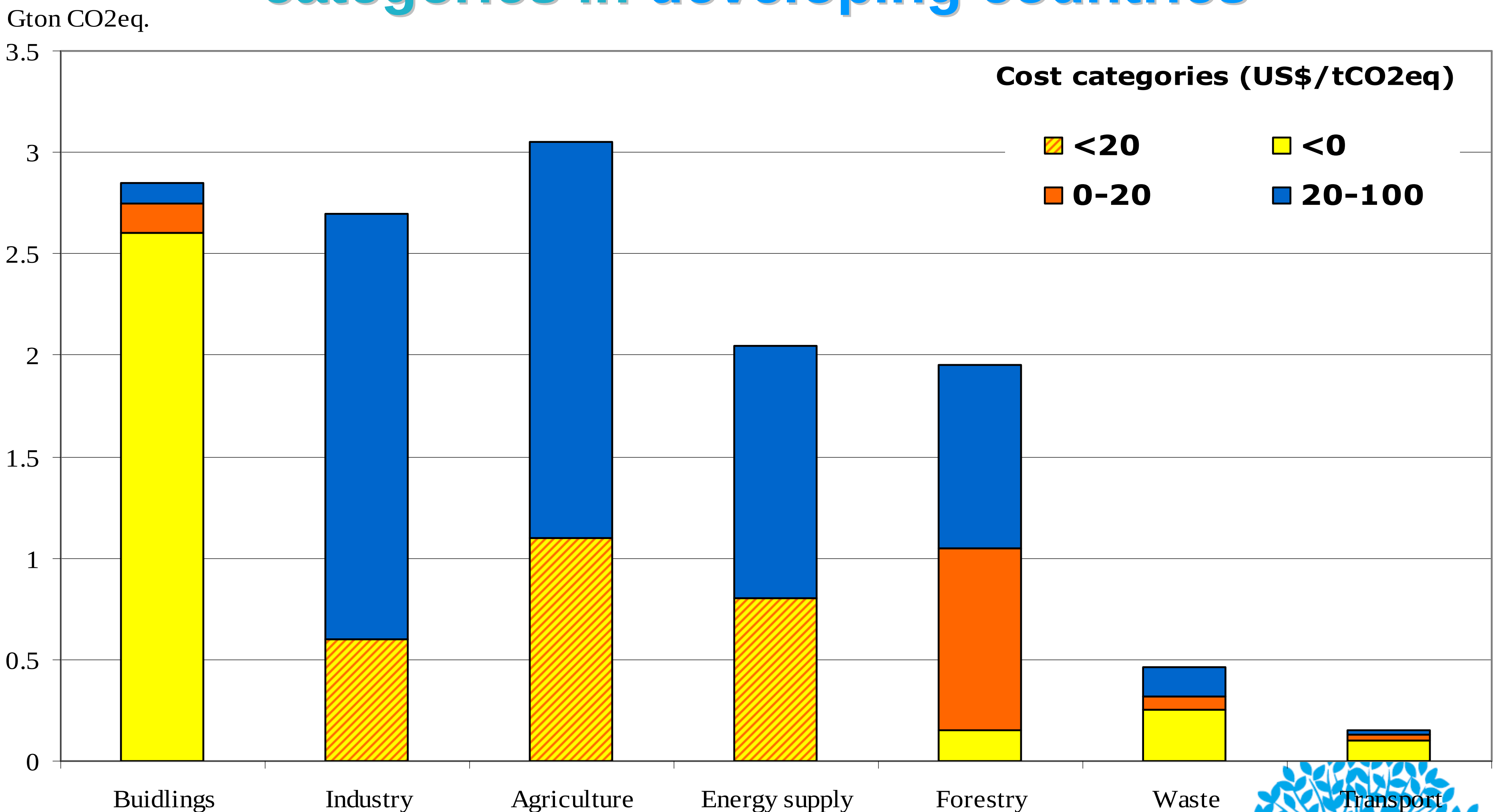
Estimated potential for GHG mitigation at a sectoral level in 2030 in different cost categories in developing countries



Constructed based on Chapter 11 results

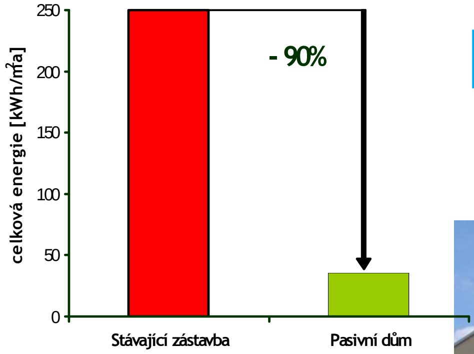
How far can buildings take us?

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)

Photos from Gunter Lang





Buildings utilising passive solar construction ("PassivHaus")



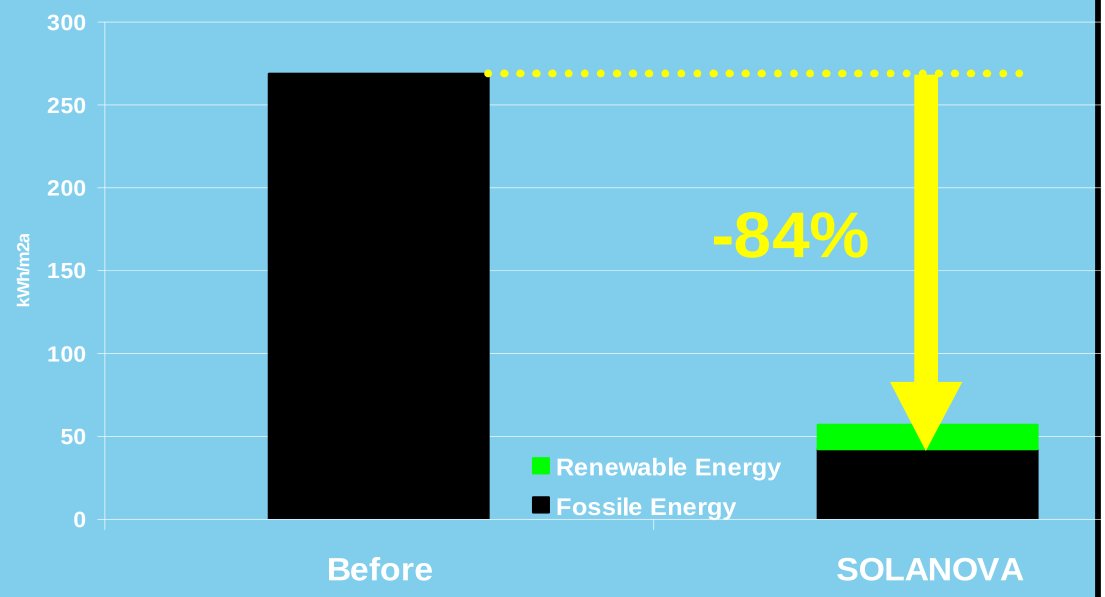






Source: Jan Barta, Center for Passive Buildings, www.pasivnidomy.cz

"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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The Global Energy Assessment: Background and purpose

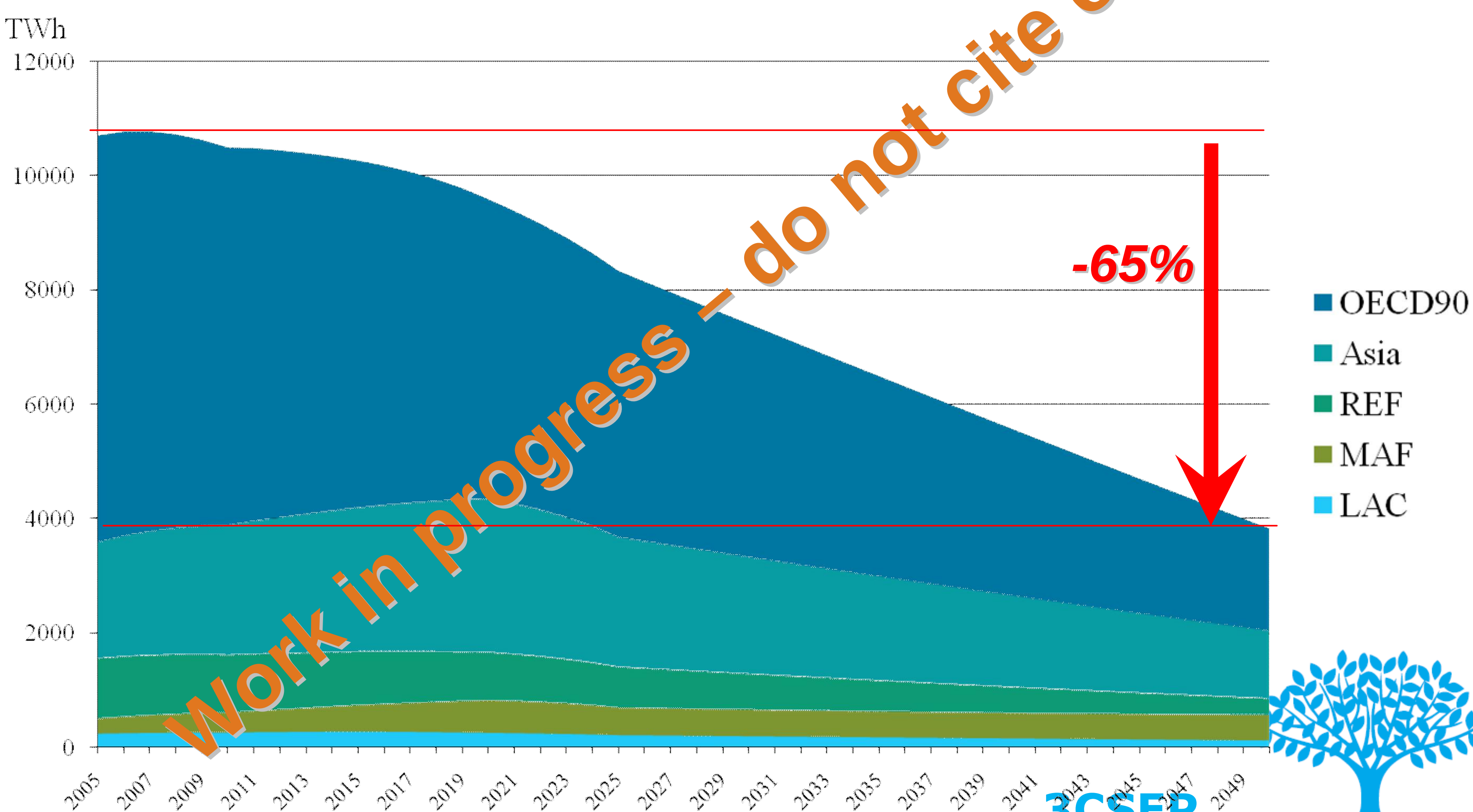
- The Global Energy Assessment aims at providing (a) blueprint(s) for the world how energy-related social, environmental, geopolitical and other challenges can be addressed this century
- We all know that buildings are the key pillar to such a future, but **how much?**
- GEA constructs new scenarios (complementing IPCC-type scenarios) that attempt to take advantage of the really large and novel opportunities in buildings, hard-to-model by existing modeling frameworks
- UNEP SBCI is a partner to further GEA efforts in the buildings scenarios (and WB is partner in GEA)

Main philosophy and assumptions

- Assumes that the world's building stock will transform over to today's known (and built) cutting edge in architecture
  - At the most affordable cost
  - At the natural rate of building construction and retrofit
  - Taking into account capacity and other limitations, but assuming ambitious and supportive (not financially but legally) policy environment.
- The main pillars of the model are existing best practices
  - Best practice from and energy and INVESTMENT COST perspective as well
- The world's building stock is broken down by regions, climate zones and 3 building types
- Model eradicates energy poverty well before 2050, i.e. everyone has appropriate thermal comfort energy services by 2050
- several scenarios planned:
  - Very high efficiency with different modalities; +building-integrated renewables; +behavioural change

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

2%/yr retrofit rate



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Opportunity or risk?

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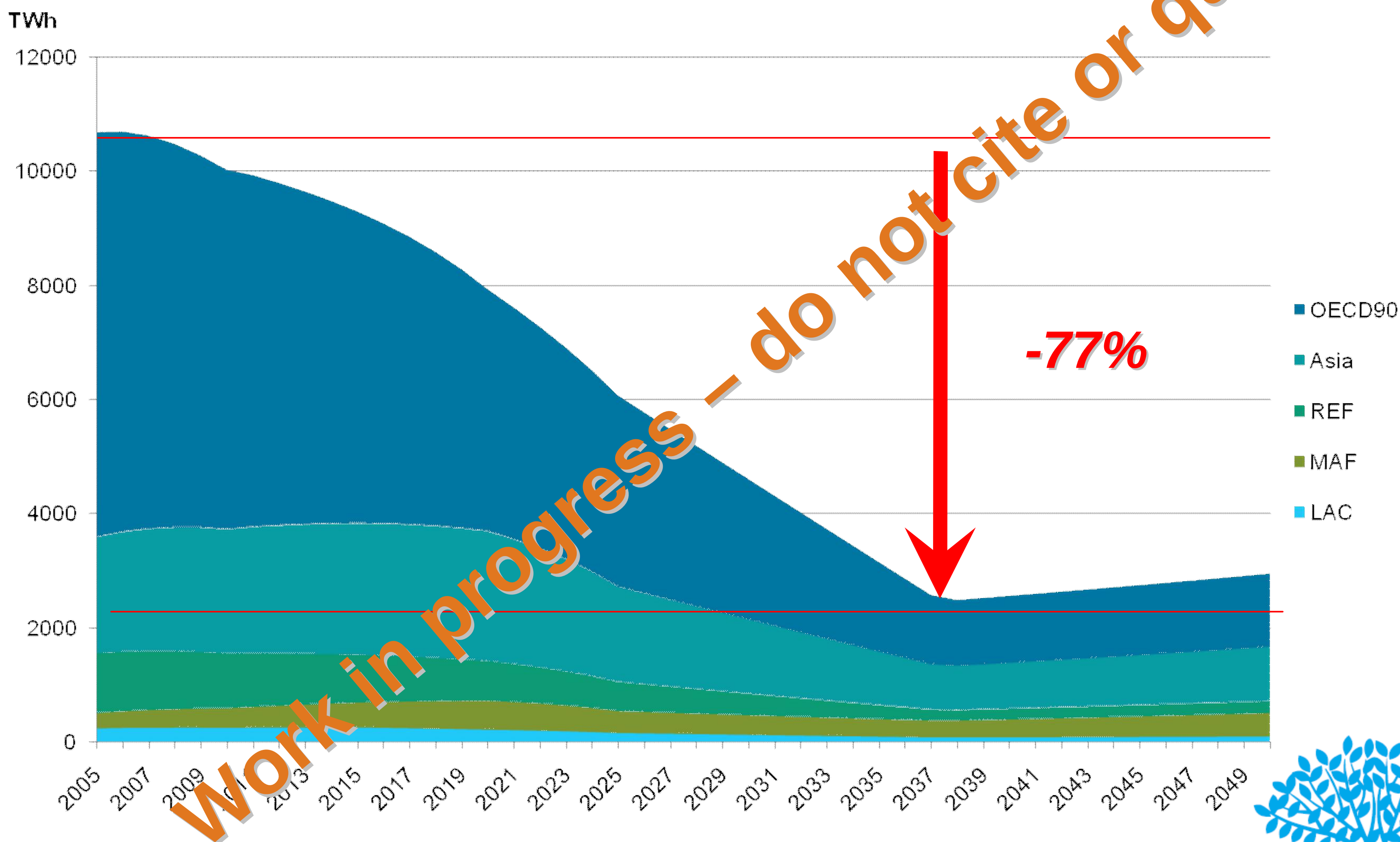
The size of the potential lock-in effect

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

3%/yr retrofit rate



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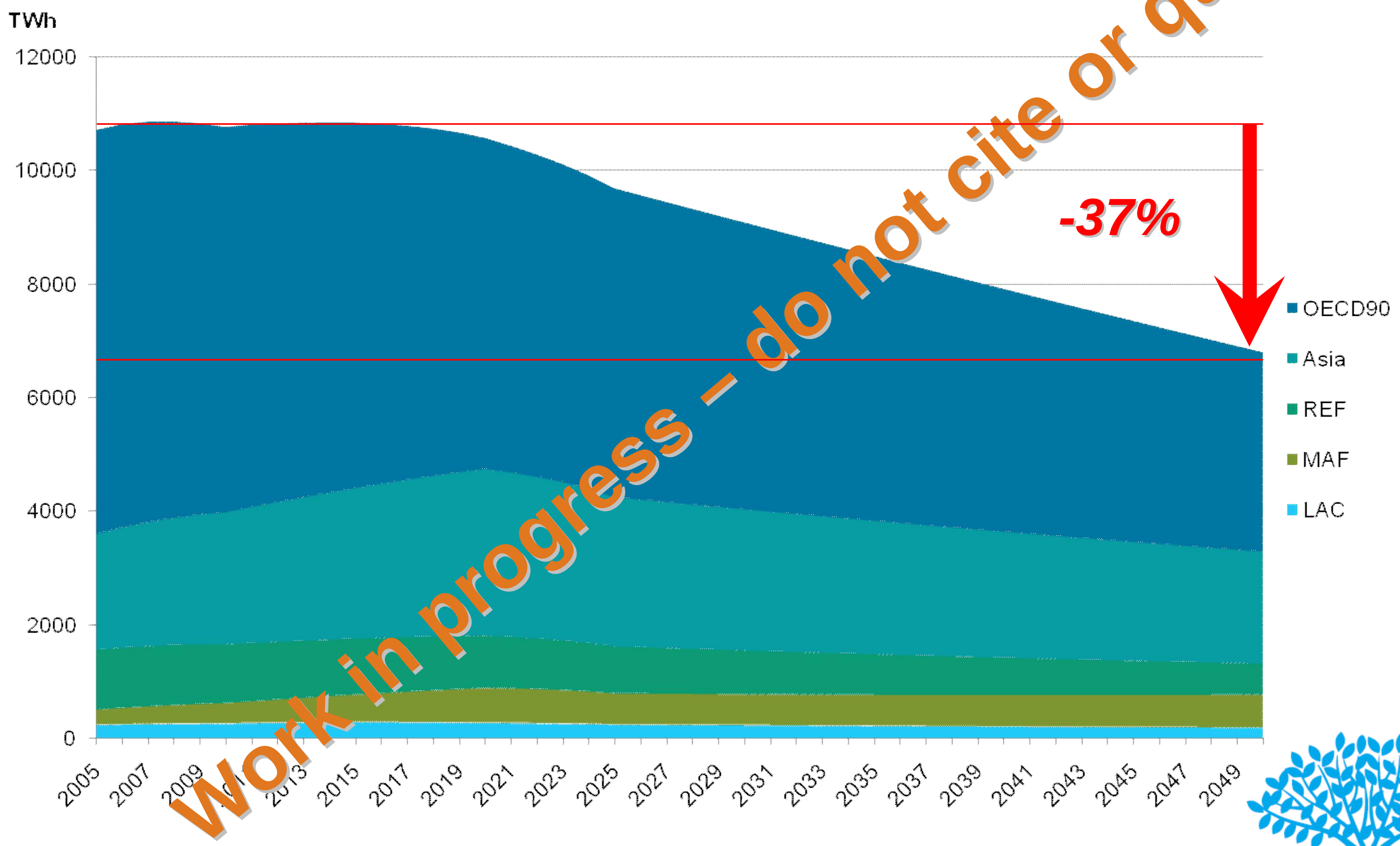
Final thermal energy consumption in the world's buildings by region, 2005-2050

1.4%/yr retrofit rate



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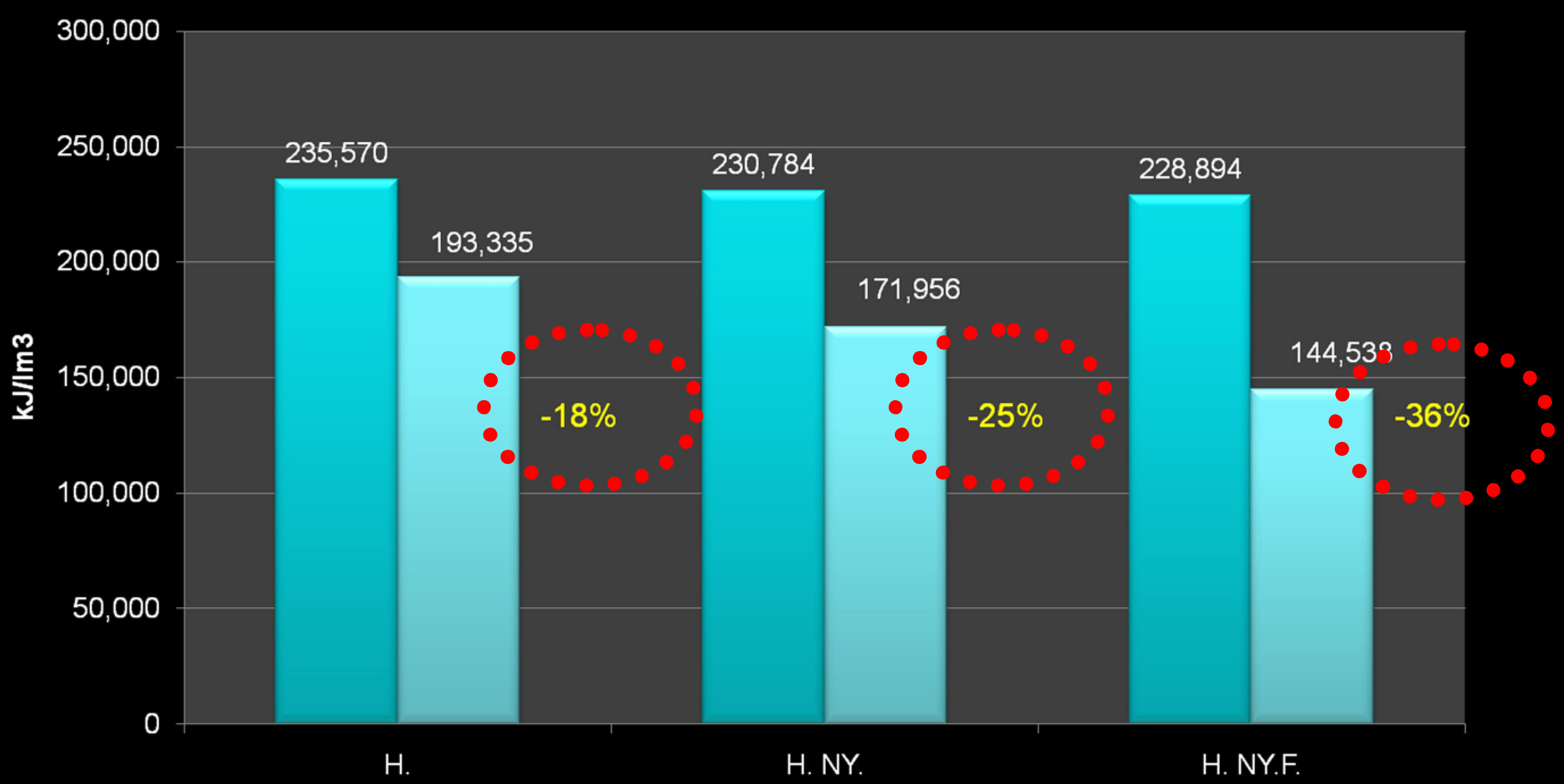
Panelfelújítási programban részt vevő épületek fűtési fajlagos hőfelhasználásának alakulása
Székesfehérvár



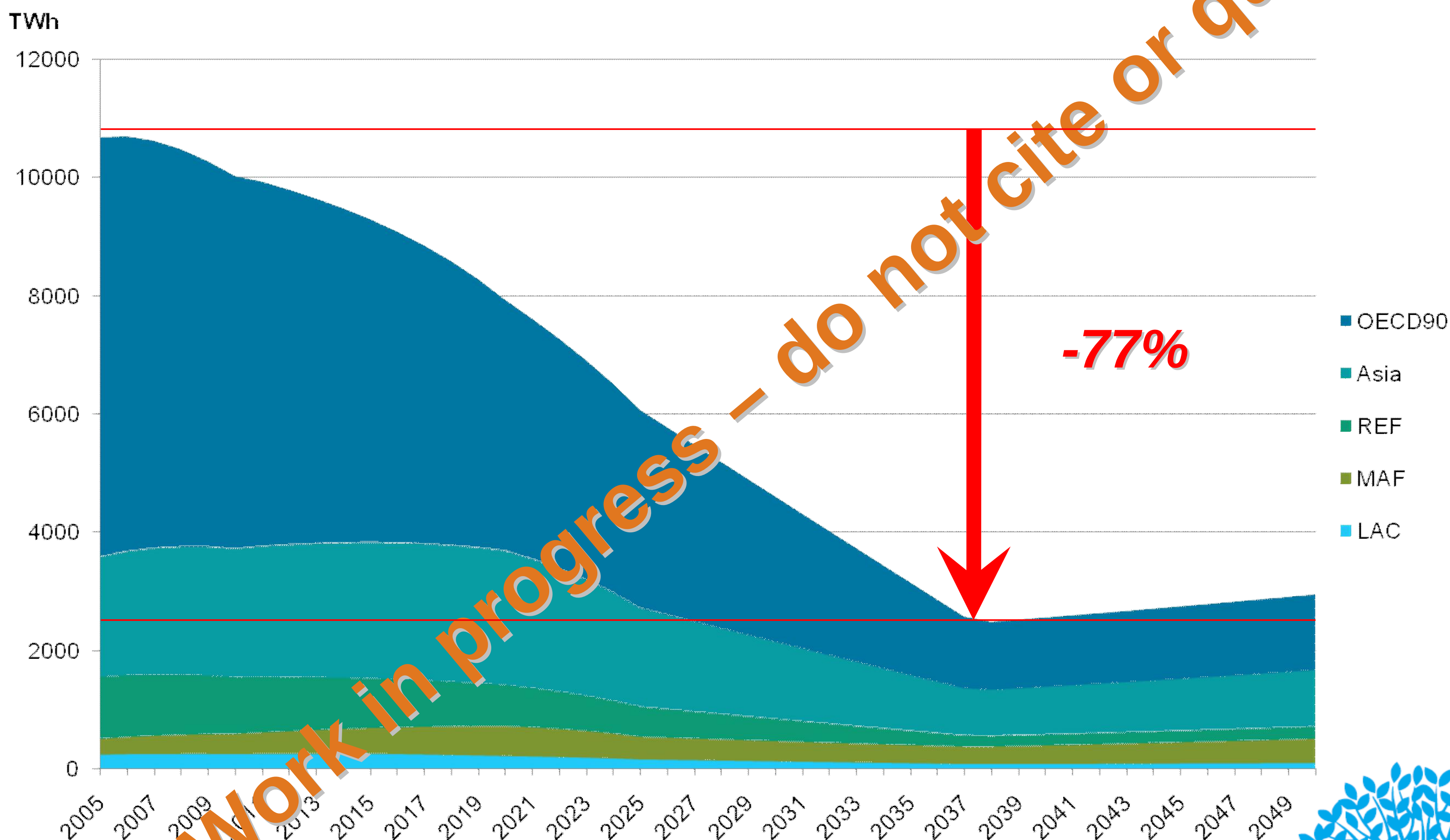
H: Homlokzati hőszigetelés
H: NY. Homlokzati hőszigetelés, nyílászáró csere
H: NY. F. Homlokzati hőszigetelés, nyílászáró csere, fűtéskorszerűsítés

- 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.

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

3%/yr retrofit rate



Work in progress – do not cite or quote

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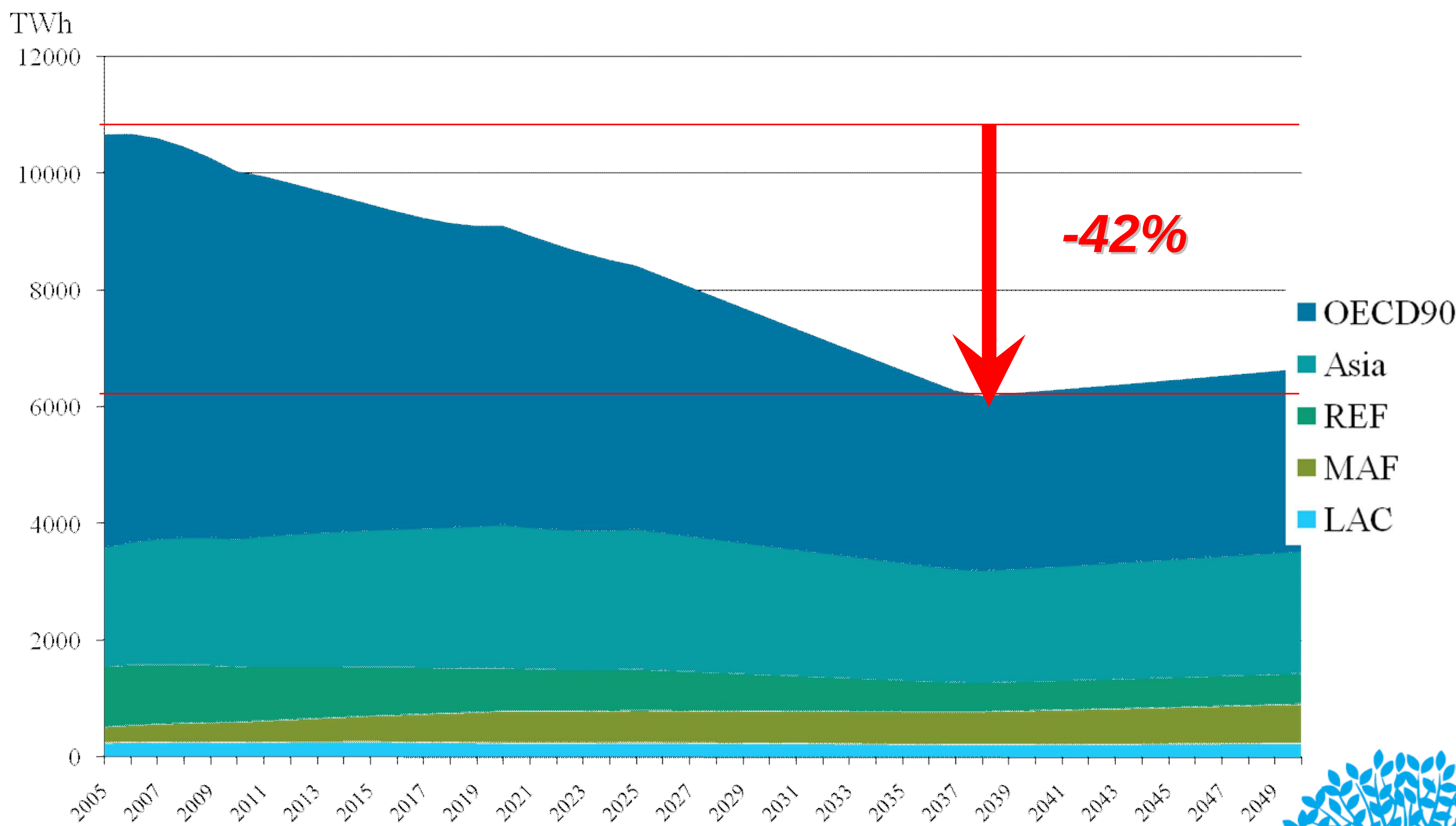
Final thermal energy consumption in the world's buildings by region, 2005-2050

3%/yr retrofit rate, suboptimal retrofit rate



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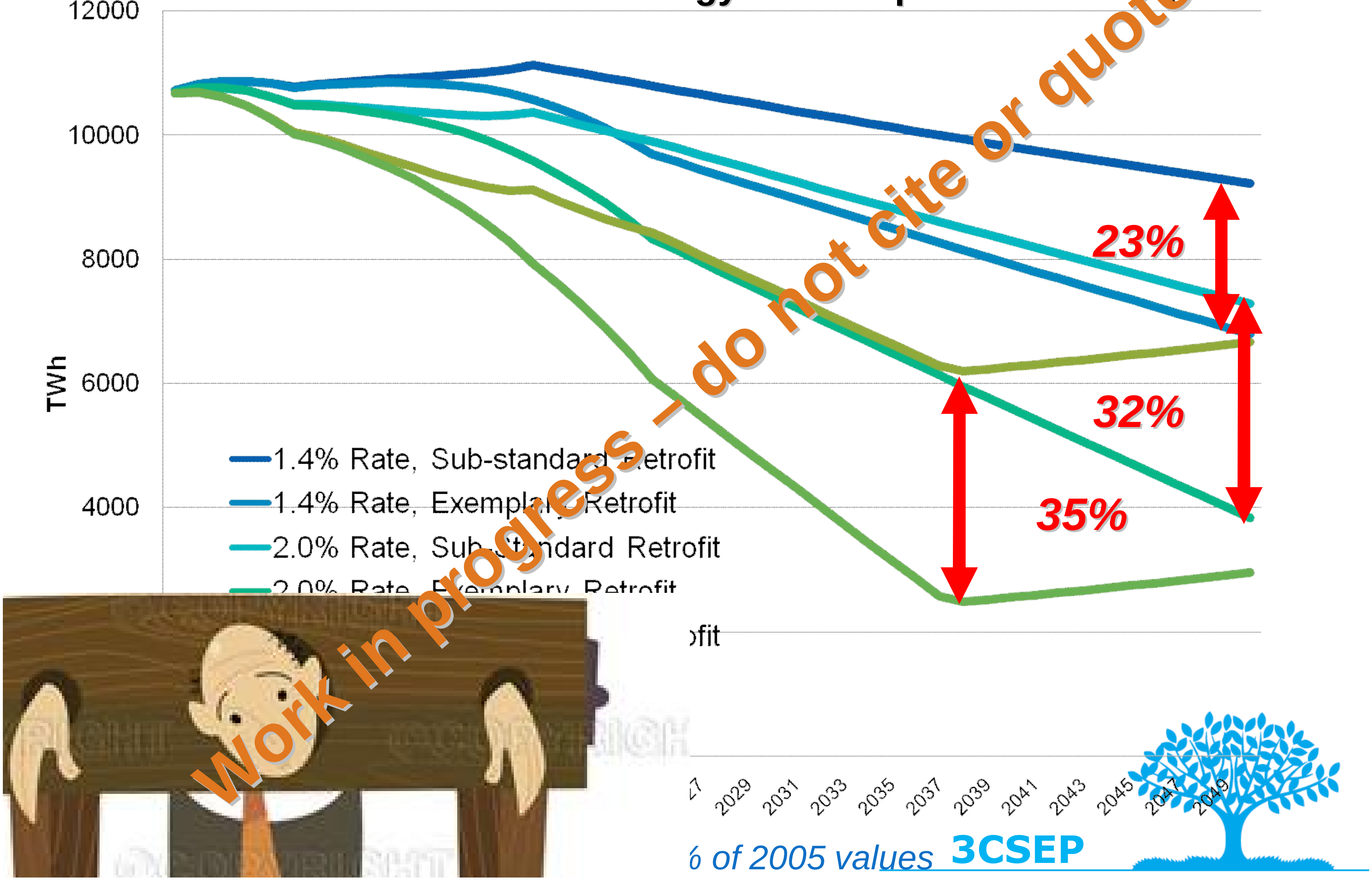
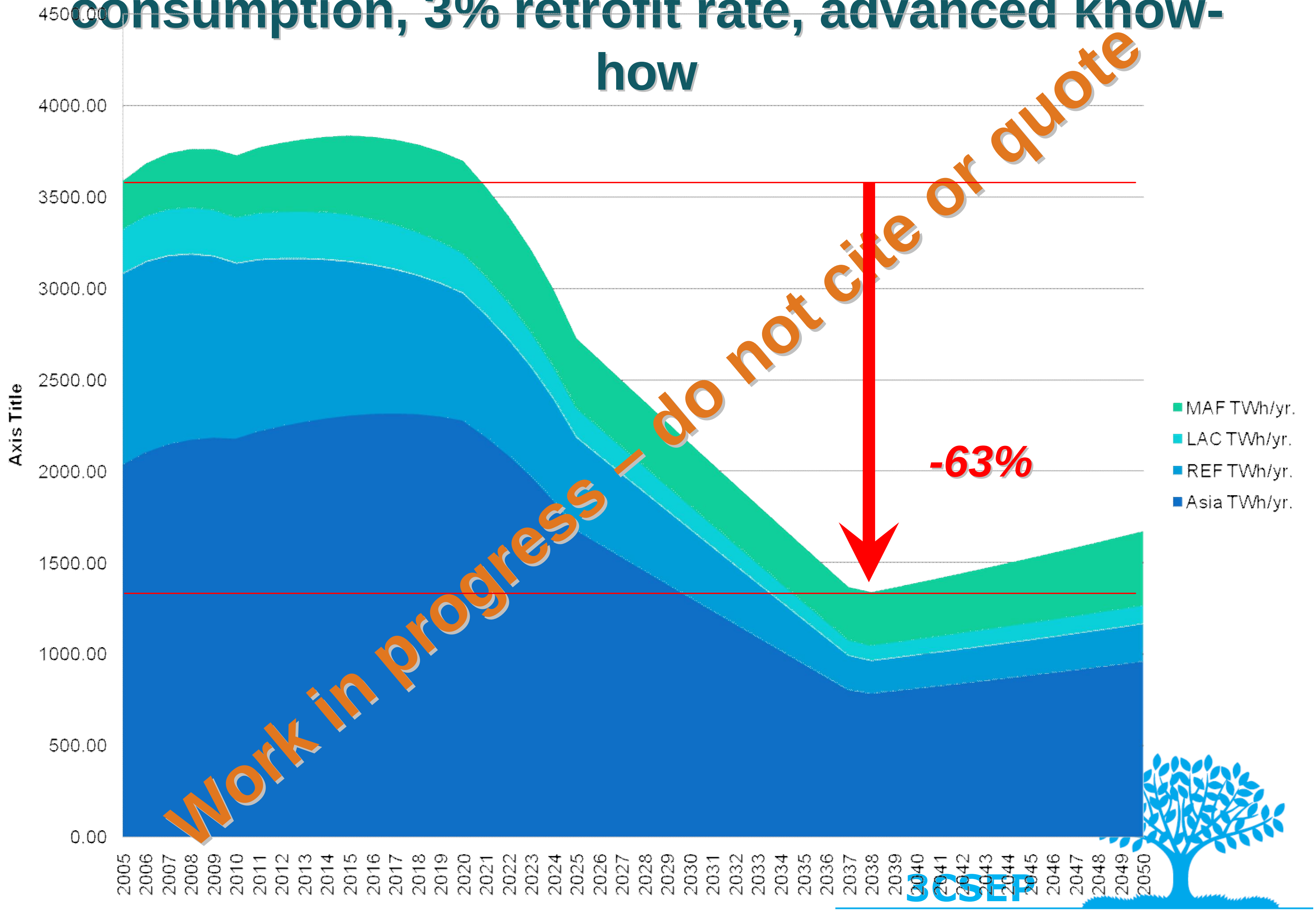
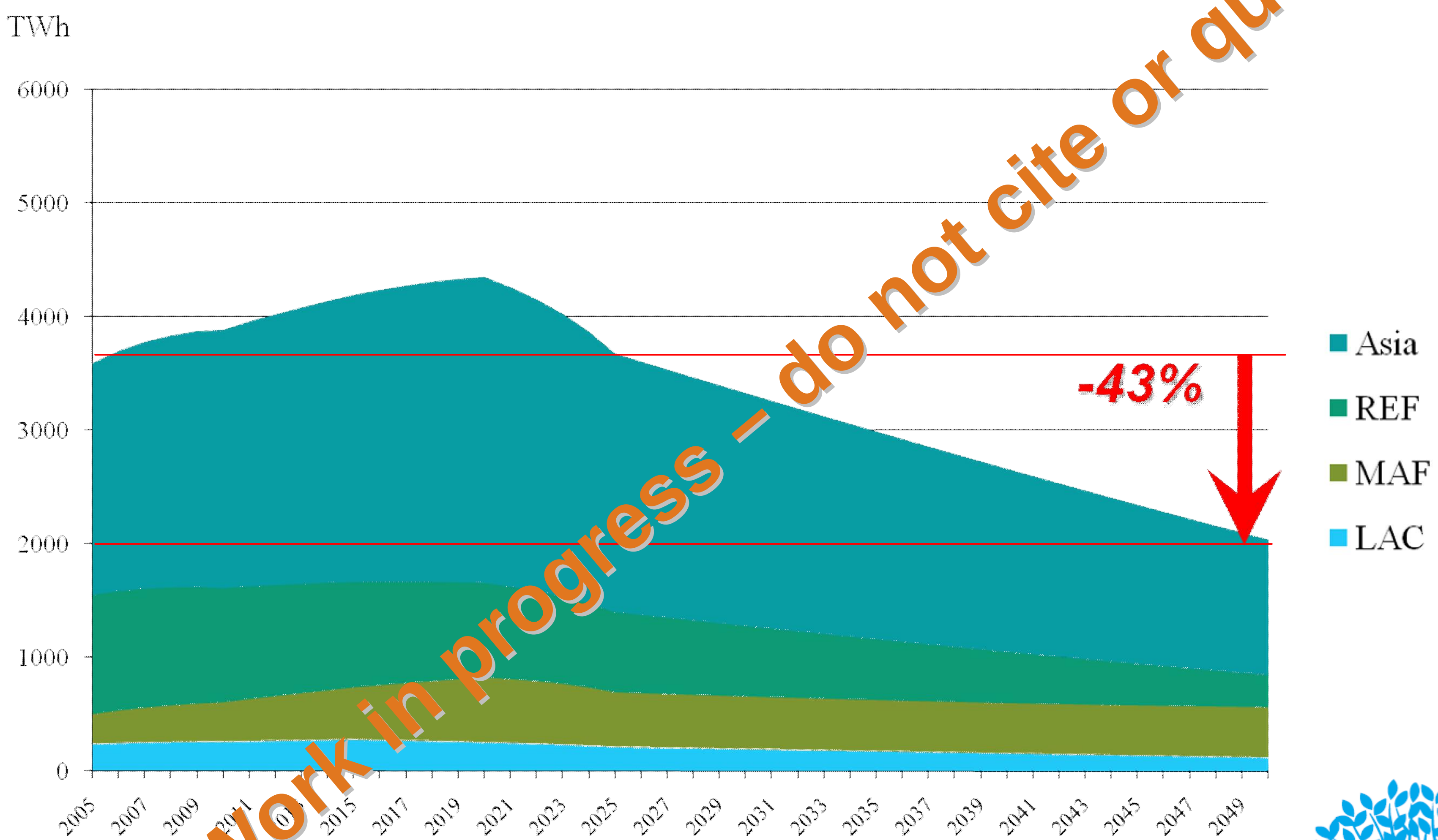
The lock-in effect through substandard retrofit, different retrofit rates
Global total final thermal energy consumption in buildings



Non-OECD building thermal final energy consumption, 3% retrofit rate, advanced know-how



Space heating and cooling final energy consumption
2.0 % retrofit rate, exemplary buildings



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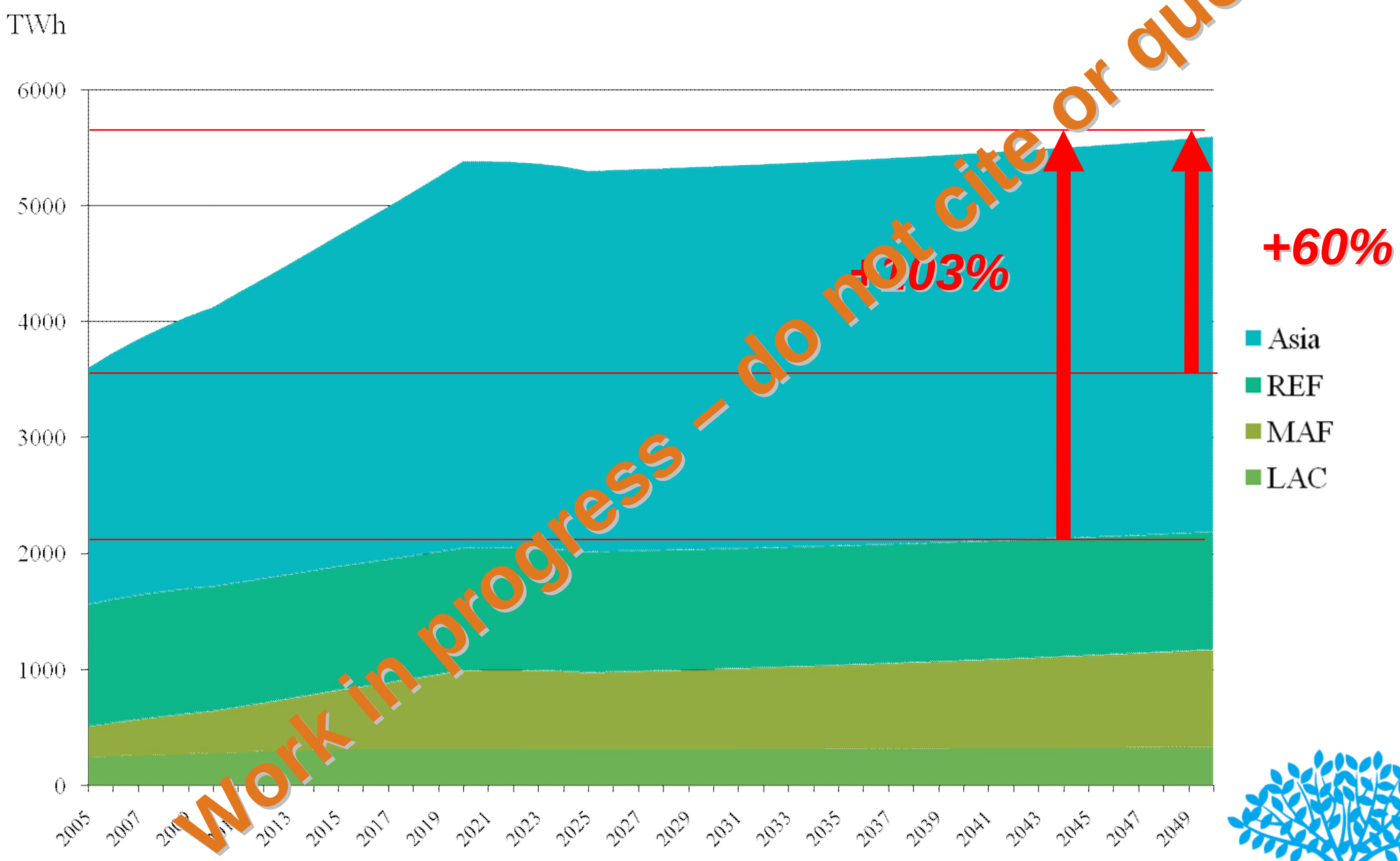
Space heating and cooling final energy consumption
0.5 % retrofit rate, substandard retrofit buildings



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Conclusions

- Buildings are key to climate change mitigation in each world region
- Substantial opportunities exist; as much as 77% of 2005 final thermal energy consumption can be eliminated by 2050 by building codes, while living standards increase as BAU and energy poverty eliminated
- To reach ambitious values:
  - Building codes need to be universal and fully implemented
  - Most advanced (low-cost) know-how needs to be mandated
  - Construction industry needs to gear up soon (in app. a decade)
  - **Codes need to cover major retrofit as well**, not only newbuild
  - 2050 emissions extremely sensitive to retrofit rate: 77% energy savings for 3% retrofit rate drops to 37% for 1.4% rate!!
- Major lock-in risks exist
  - Suboptimal retrofit represents major climate lock-in risk
  - Present trends can **lock in 23% – 35% of all 2005 emissions** (increasing achievable low levels by **37 - 152%!)** for many decades
- Suboptimal retrofits should not be supported; rather wait if complex, deep retrofit is not possible yet

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"From today, each new building constructed in an energy-wasting manner or retrofited to a suboptimal level will lock us into a high climate-footprint future"

Thank you for your attention

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