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Waking up the Giant

The Key Role of Energy Efficiency in Abating Climate Change

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Therm

Joule

BTU

Negajoule

GigaJoule

Kill-a-Watt

kWh

MegaJoule

Introduction

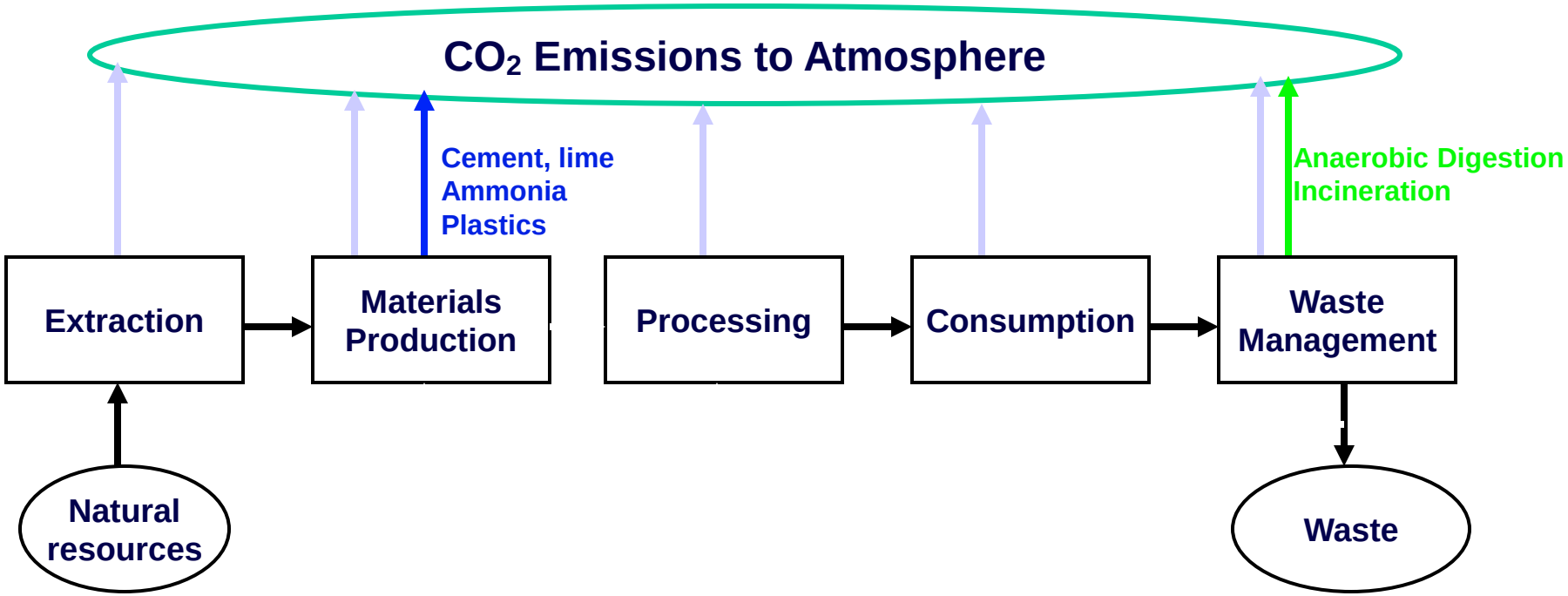
- Climate Change
  - IPCC 4th Assessment Report Results
  - Mitigation: potentials & contributions
- Energy Efficiency & Climate Change
- Key Role of Energy Efficiency
  - Industry
  - Buildings
- Management & Realizing Energy Efficiency
- Conclusions

2007 Nobel Peace Prize
Awarded to IPCC

IPCC Process

- **IPCC charged with assessing existing scientific basis for climate change and response**
- **Fourth Assessment Report completed in 2007**
- **Three Working Groups**
  - WG III – Mitigation – Technology and Economics
- **Summary for Policy Makers**
  - WG III report approved in May 2007
  - Line by line approval by participating governments
  - Four-day approval process – WGIII Bangkok, May 2007
  - Government interventions improve accuracy of reporting with appropriate caveats

CO_2 Emission Sources

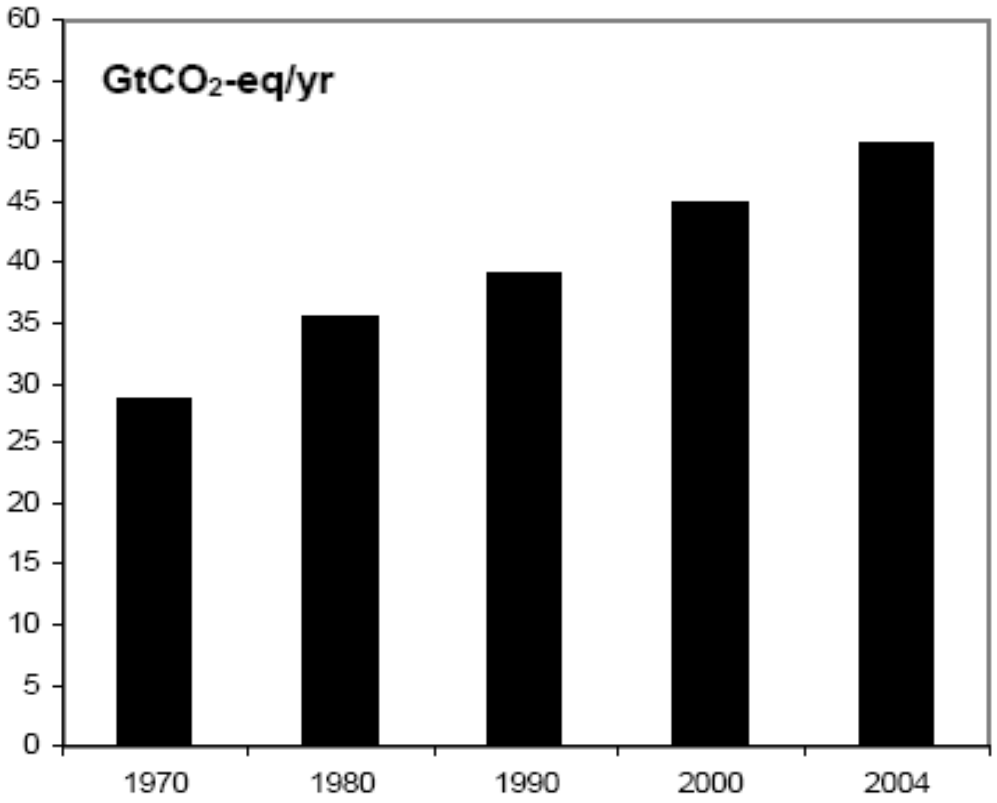


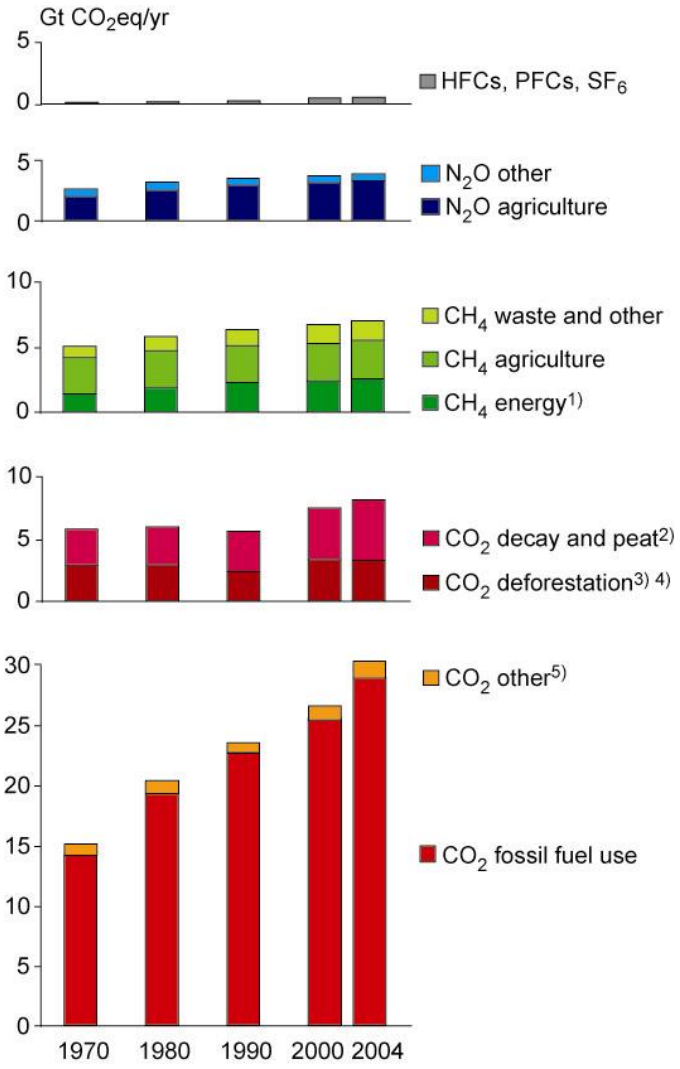
CO_2 from energy

CO_2 from feedstock (fossil fuels, limestone

CO_2 from waste treatment (fossil and biomass)

Between 1970 and 2004 Global Greenhouse Gas Emissions Increased by 70 %

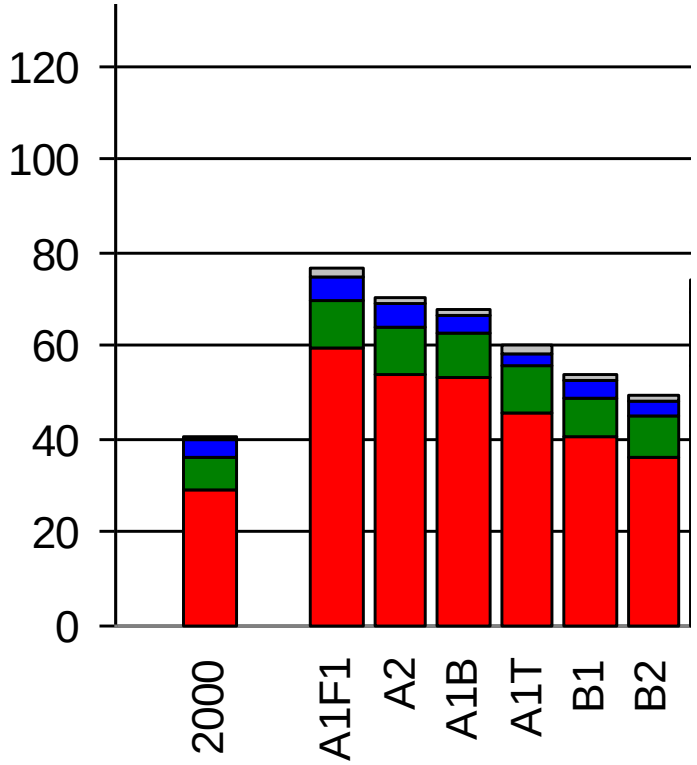




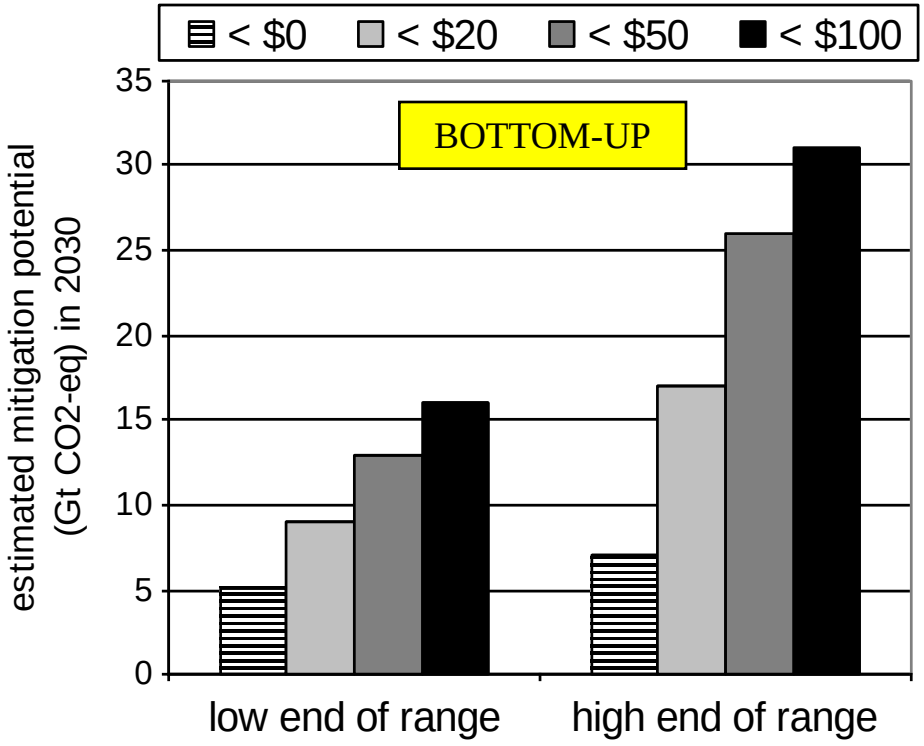
Even With Current Policies Global GHG Emissions Will Continue to Grow

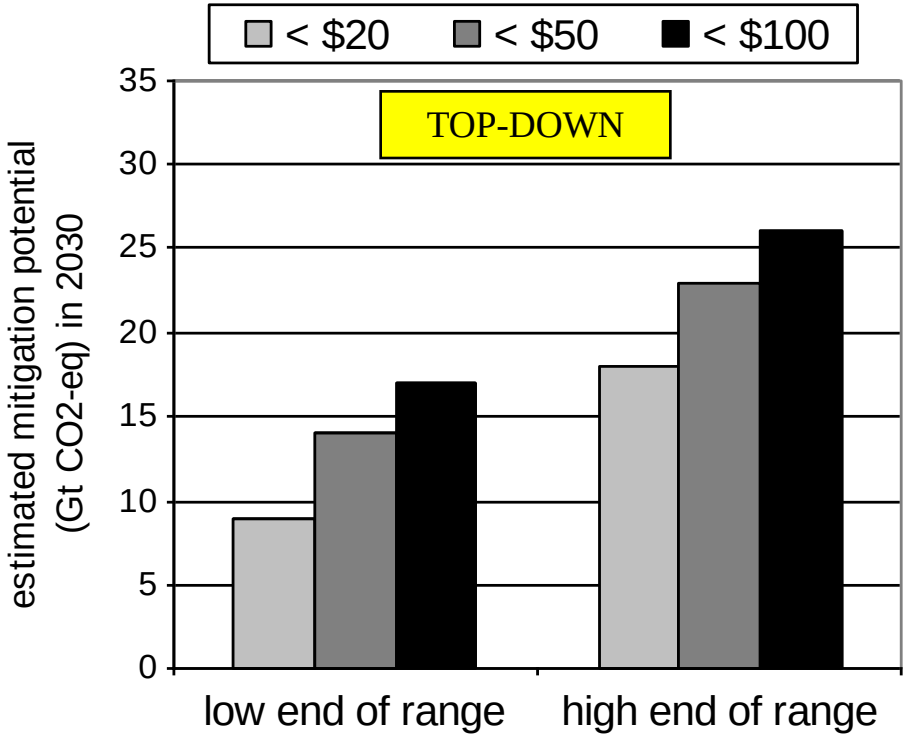
IPCC SRES Scenarios:

- 2030 GHG emissions 50-76 Gt CO_2 or 25-90% higher relative to 2000
- Depending on population and economic growth



Substantial economic potential for GHG Emission mitigation over the coming decades





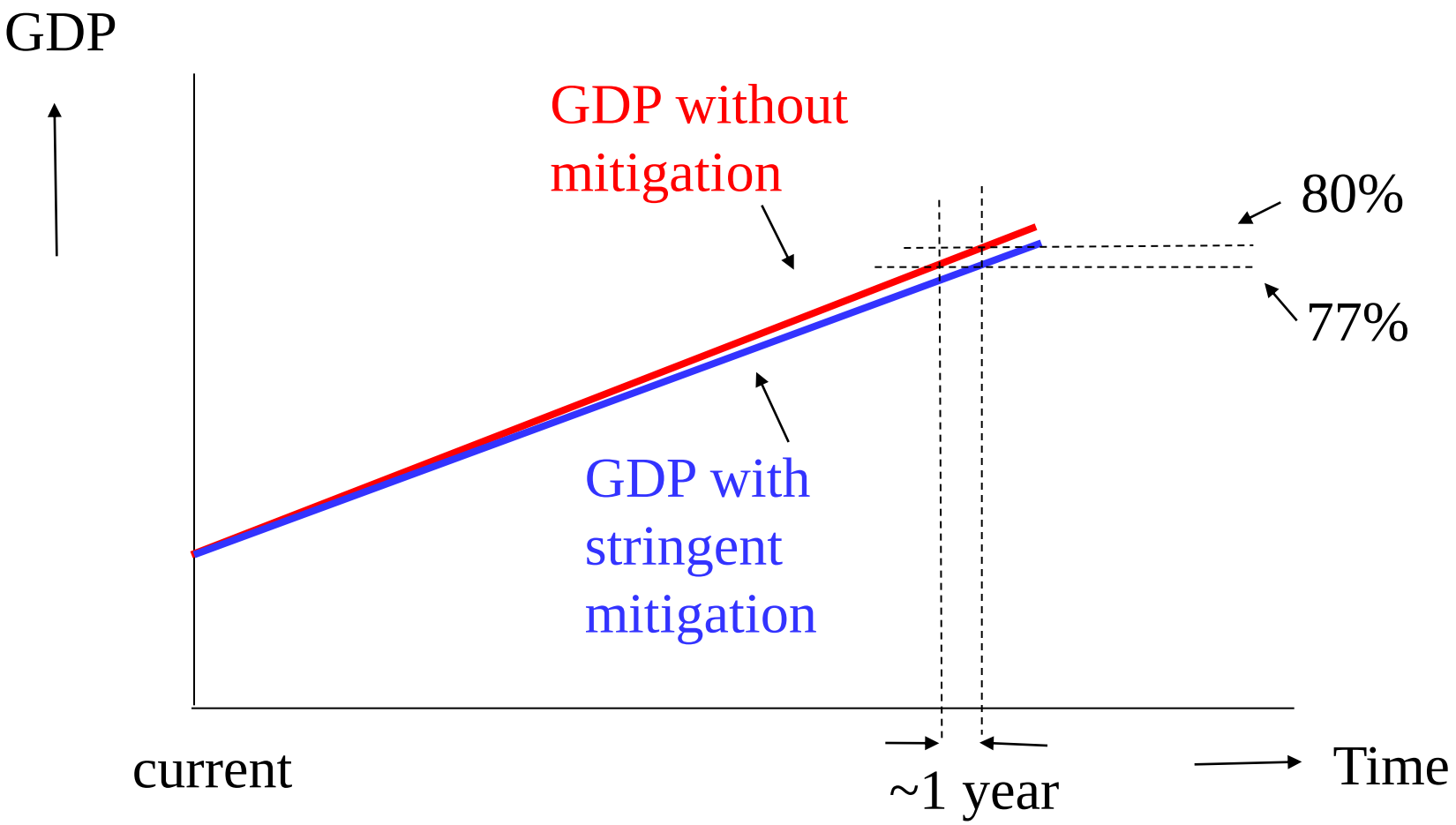
Emissions 2004: 43GtCO2eq: 2030: SRES A1B: 68GtCO2eq ; SRES B2: 49 GtCO2eq

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

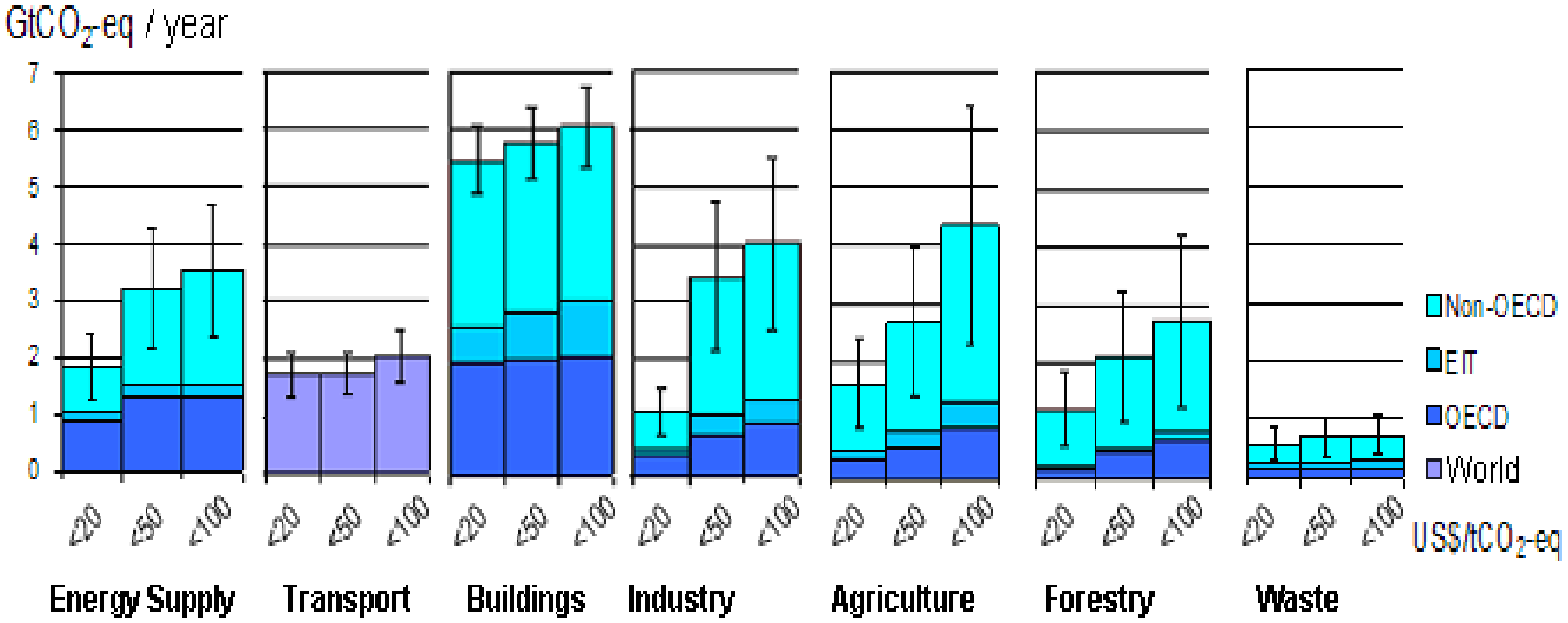
What does US$ 50/ tCO_{2eq} Mean?

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

Mitigation Investments are Limited



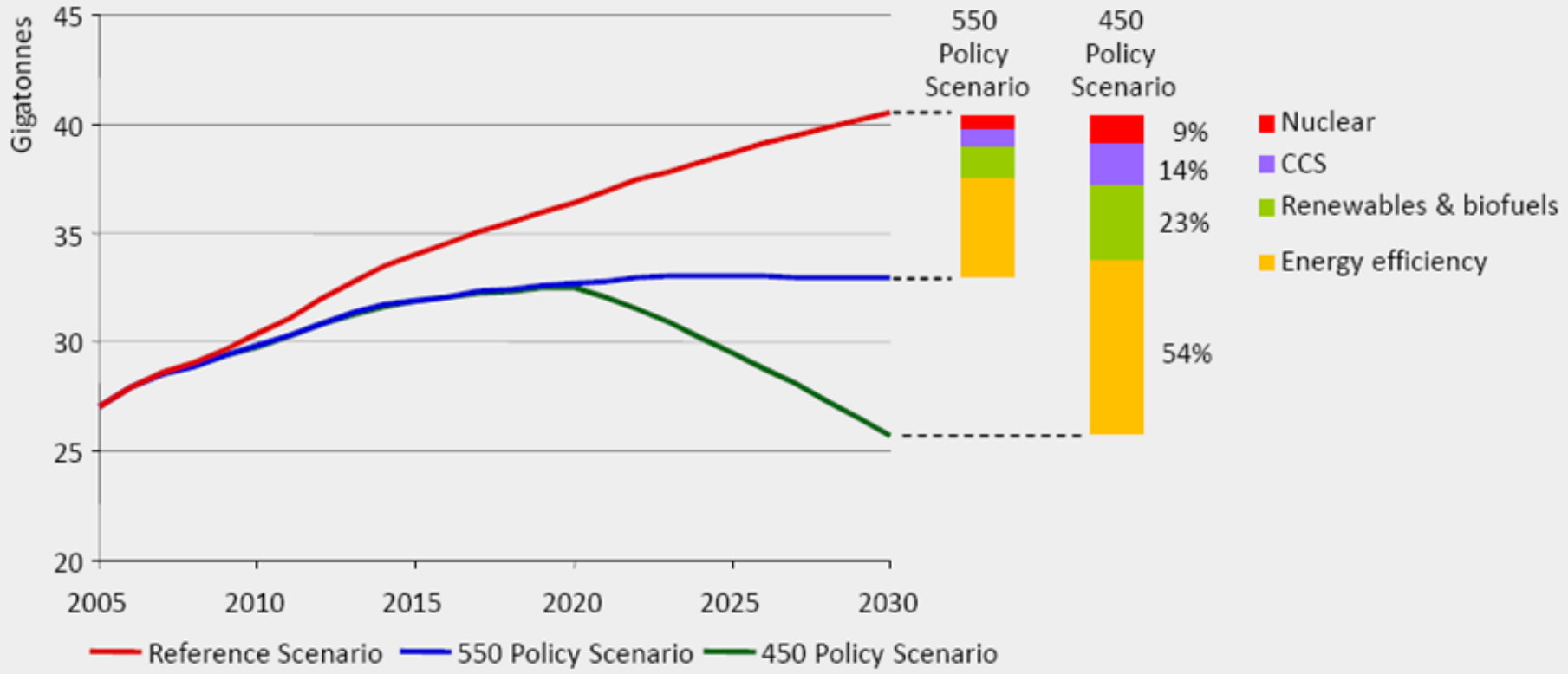
All Sectors and Regions have the Potential to Contribute



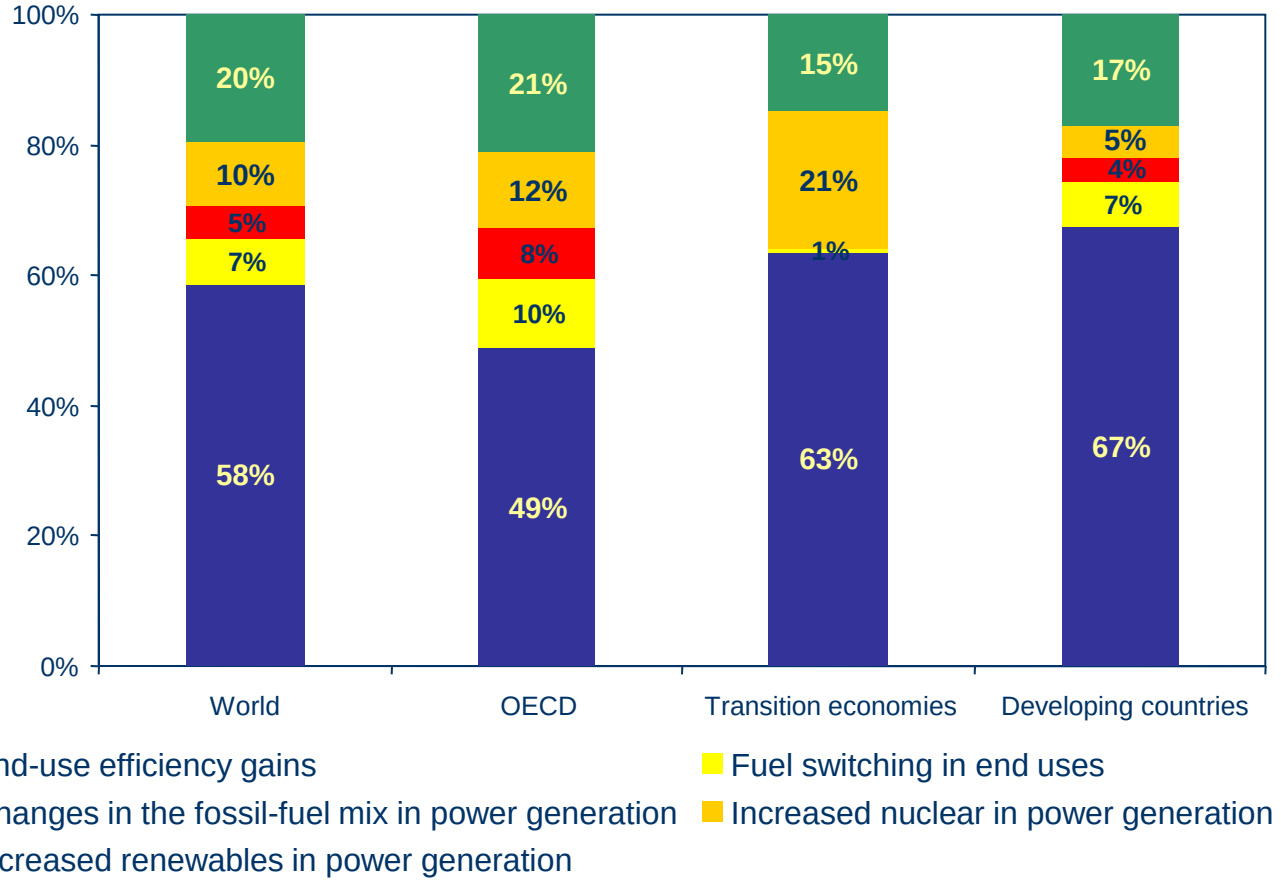
Reducing GHG Emissions

- **The need to stabilize GHG concentrations in the atmosphere at sustainable levels will demand strong reductions in global GHG emissions**
- **Emission reduction in materials production possible by:**
  - improving energy efficiency
  - reducing the emissions of non-CO_2 greenhouse gases
  - capture and sequestration of CO_2 emissions
  - increased use of renewable energy and feedstocks
  - improving the efficiency with which we use materials
- **Focus on integrated energy and material efficiency strategies**
- **In next decades energy efficiency key**

Emission reduction pathways

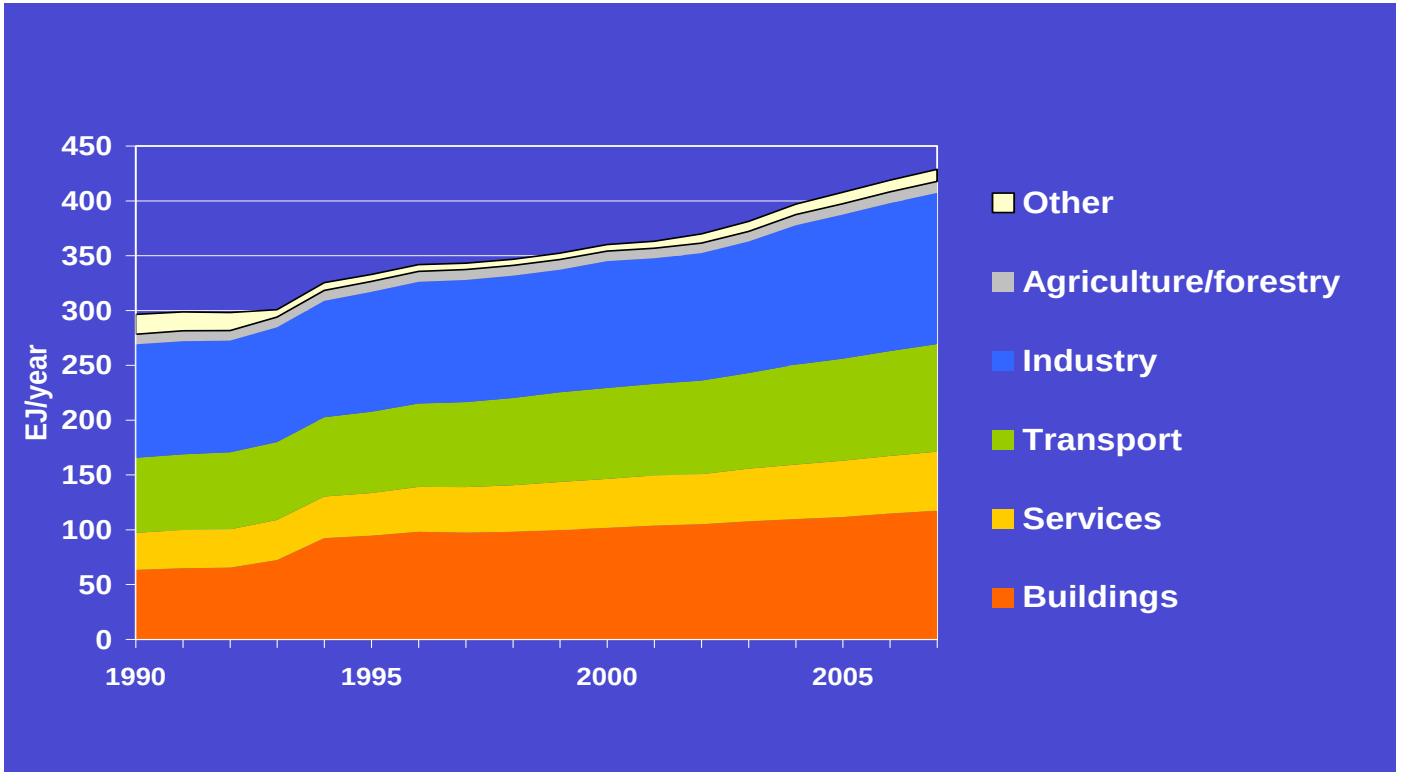


Energy Efficiency Key to Reduce CO_2 Emissions by 2030



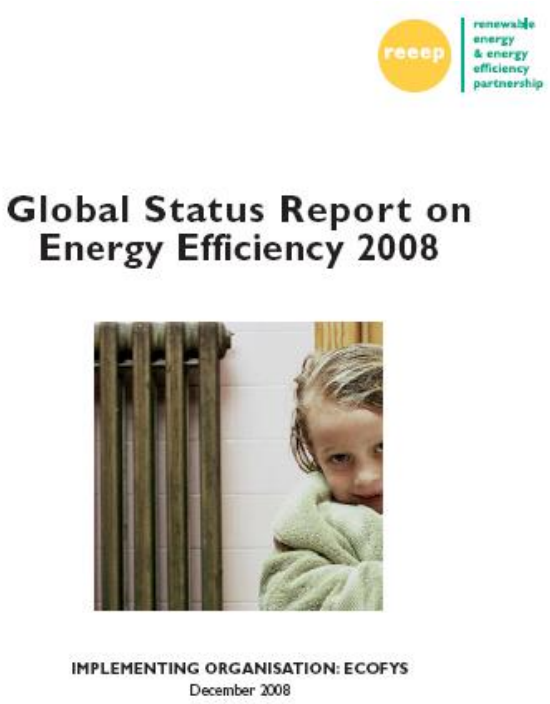
Improvements in end-use efficiency contribute more than half of decrease in emissions

Energy Use Higher Without Efficiency



- **World energy demand would have been much higher without energy efficiency efforts since the 1970s**
- **But not sufficient to stabilize world energy use**

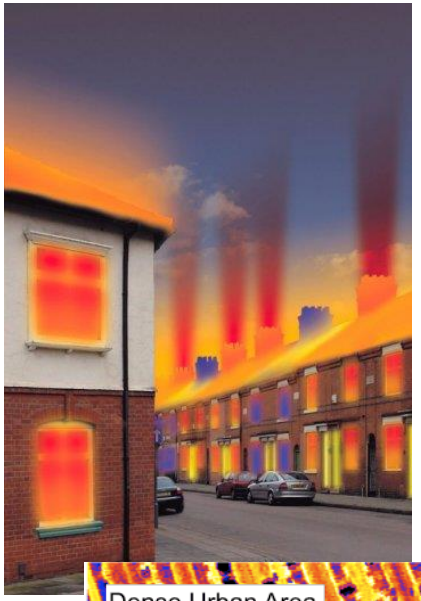
Global Efficiency Effort too Small

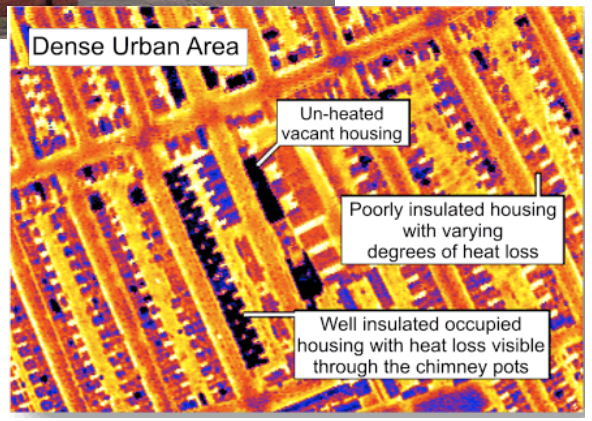


- **Global investment in energy efficiency in 2007 was 60 billion Euro**
- **Promising developments in some sectors and some countries**
- **Overall effort too small, global energy use grew by 3% per year (2003- 2007)**
- **Download from: www.reeep.org**

Energy Efficiency - Buildings

- Buildings responsible for 10.6 $GtCO_2$-eq. of GHG emissions, of which 80% from energy use
- Between 20 and 40% of energy used to maintain building environment
  - Building envelope
    - Walls
    - Windows
  - Passive and active use of solar energy
  - Efficient appliances
- Lighting and appliances other key areas





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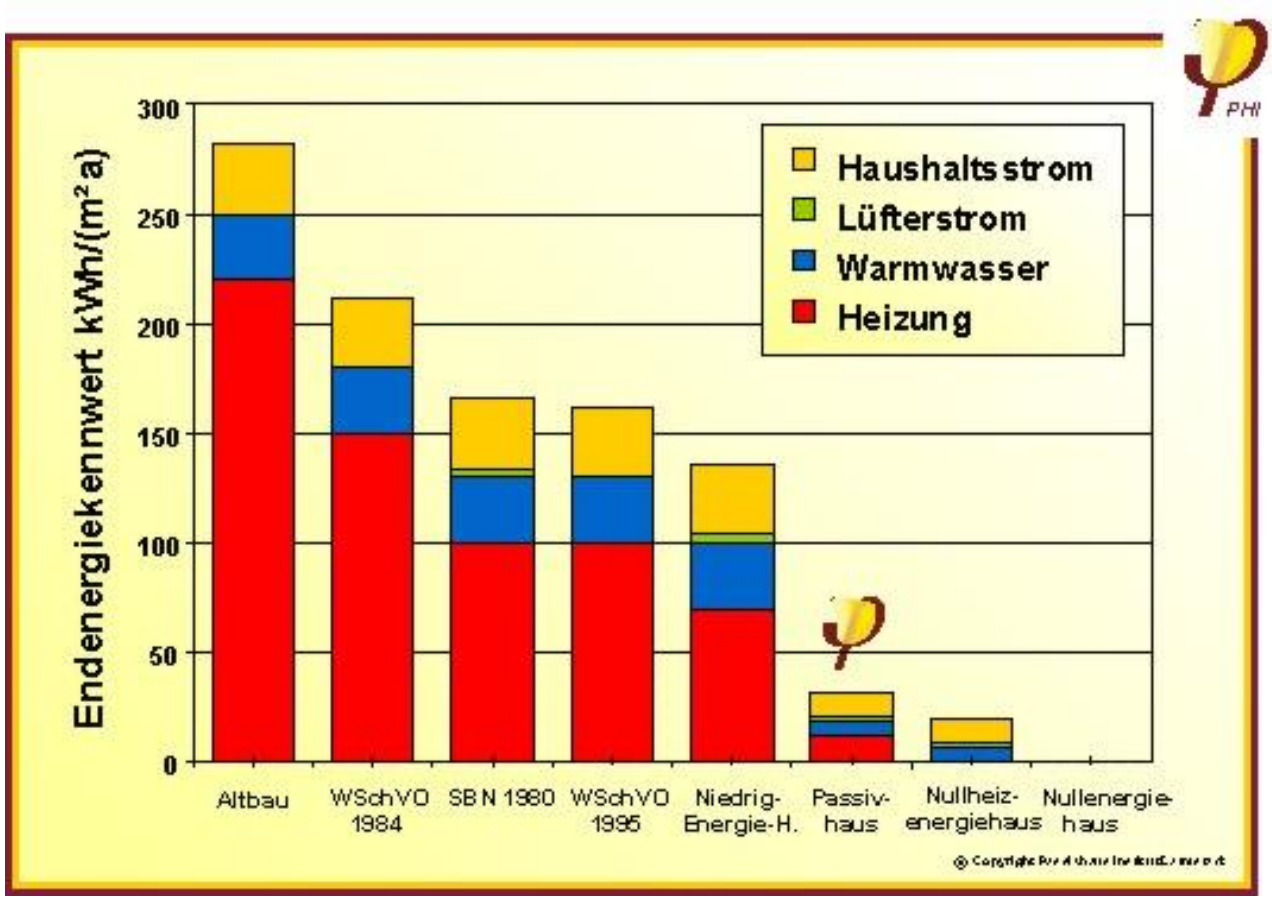
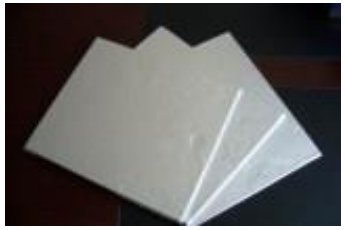
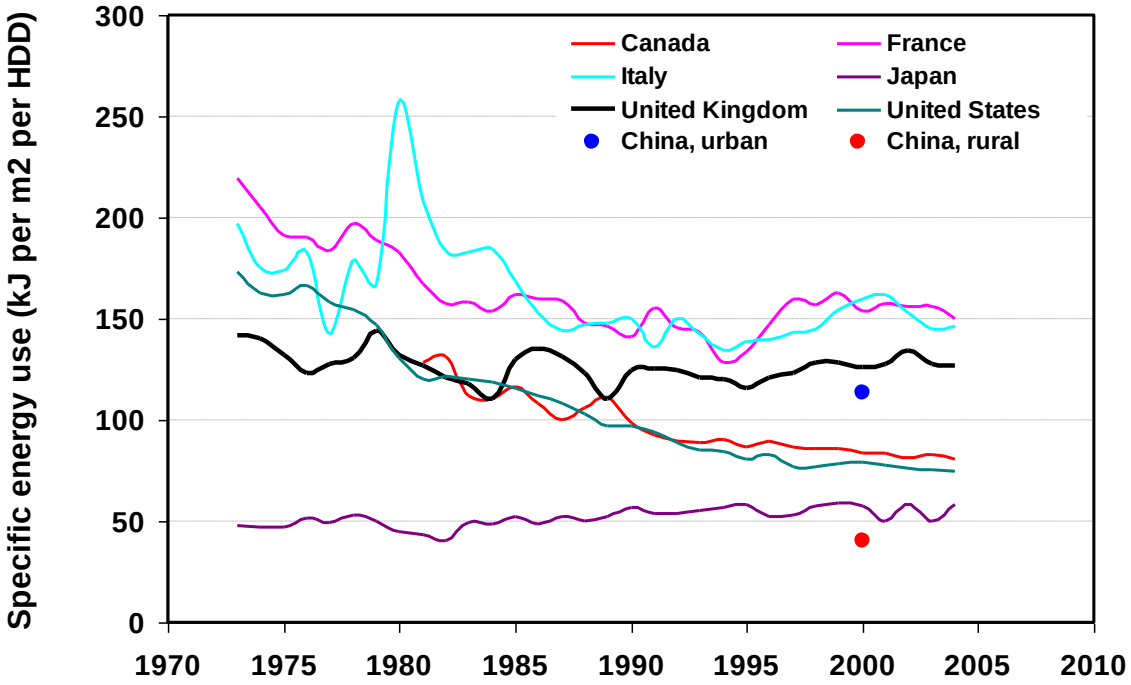
Insulation and Building Standards Key to Realize Building Efficiency



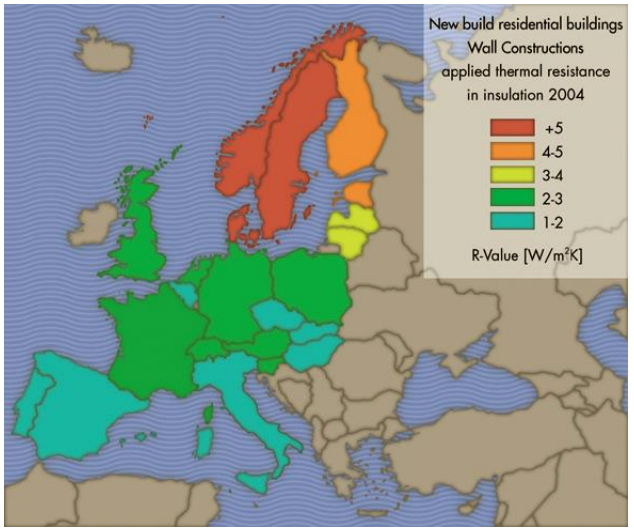


Germany: Passivhaus Targets www.passiv.de

Insulation Levels Not Optimized



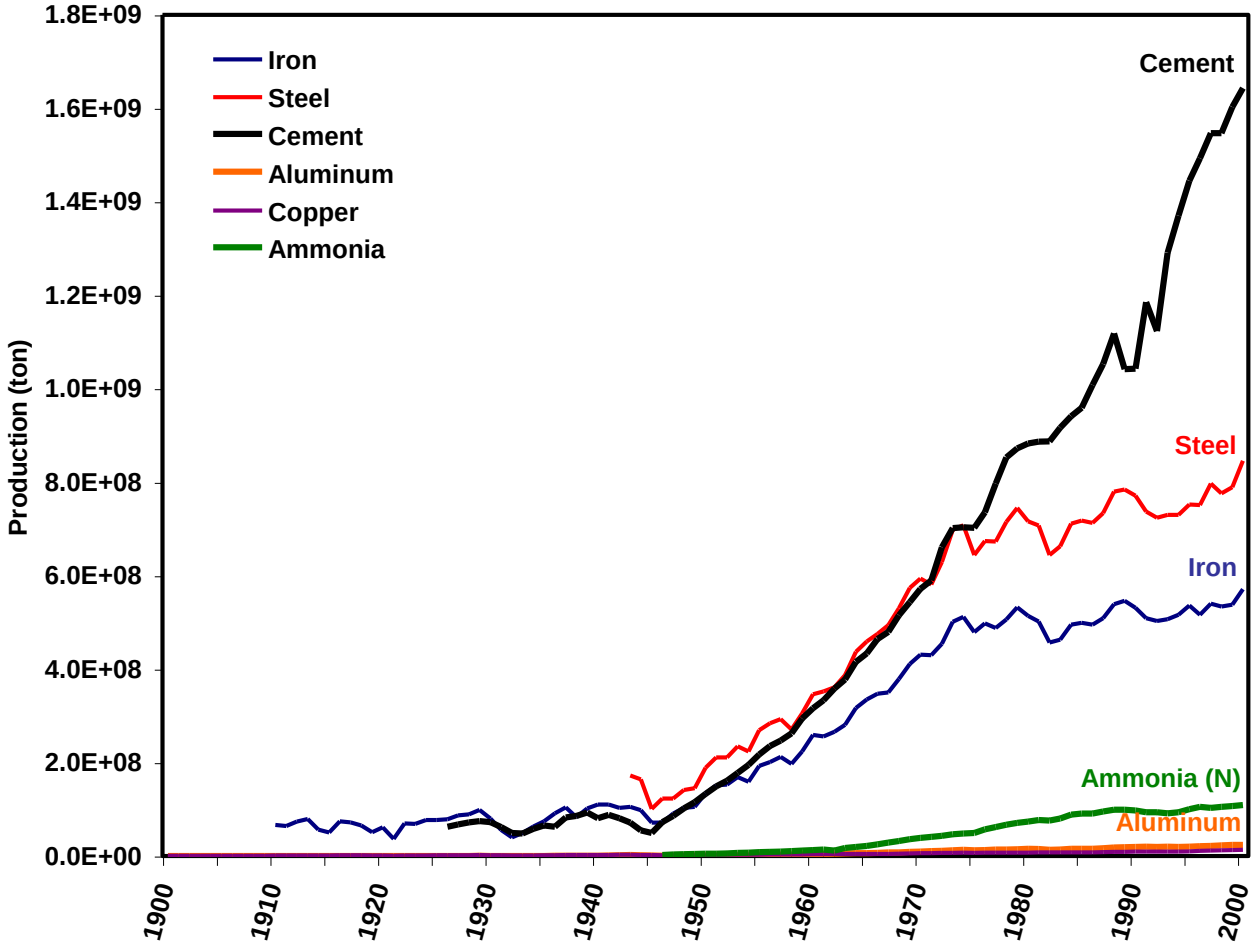
Wall Insulation Levels New Construction



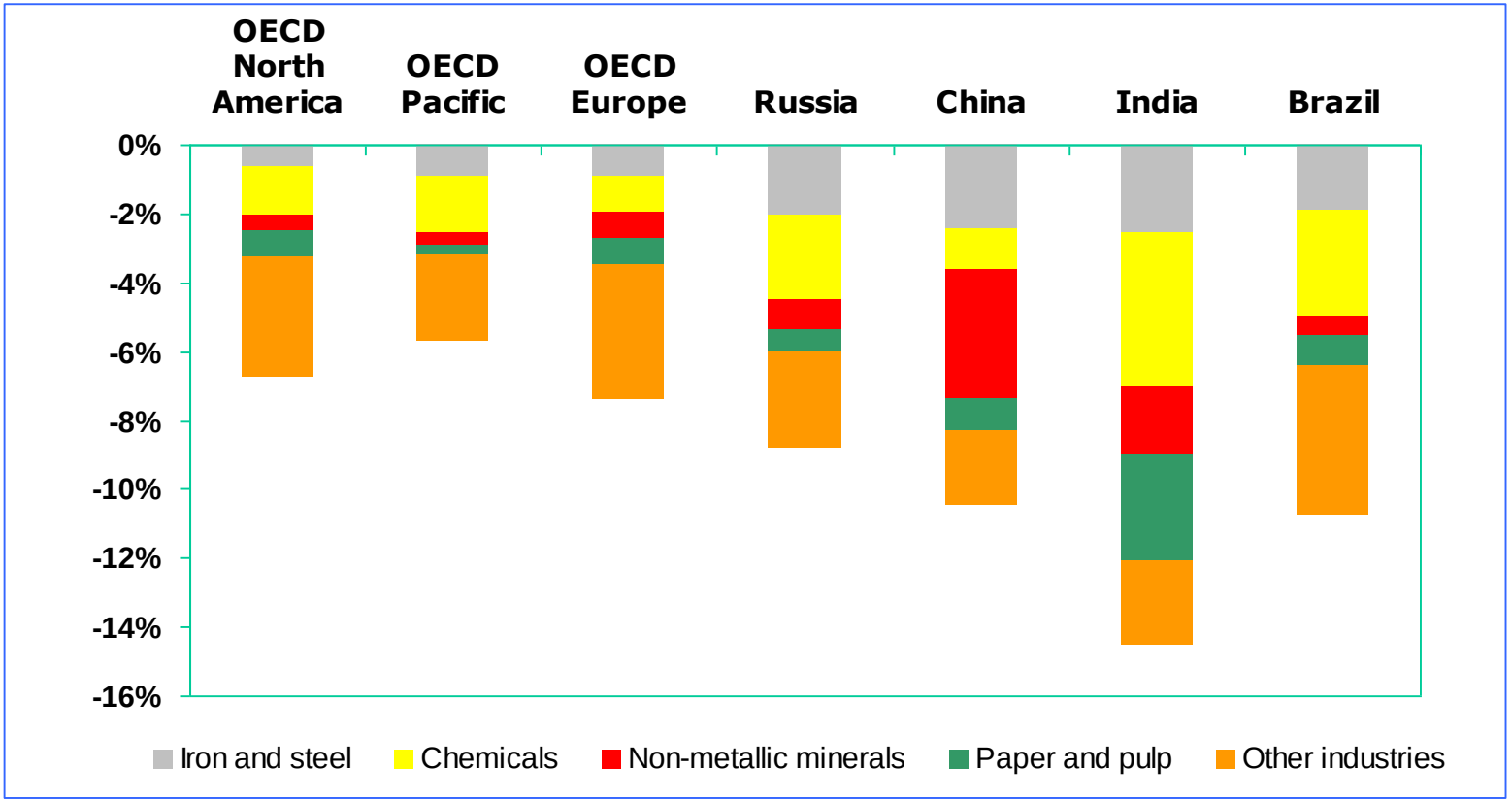
Success is Possible: Top Runner

TV receivers	1997-2003	26%
VCRs	1997-2003	74%
Room air conditioners	1998-2004	68%
Refrigerators	1998-2004	55%
Freezers	1998-2004	30%
Passenger vehicles	1995-2005	23%
Freight vehicles	1995-2005	22%
Vending machines	2000-2005	37%
Computers	1997-2005	99%
Magnetic disc units	1997-2005	98%
Fluorescent lights	1997-2005	36%

Industry: Global material consumption increases Rapidly

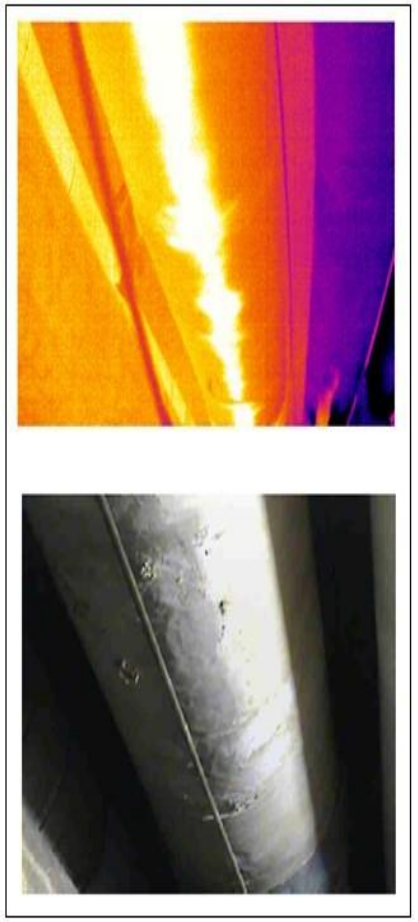


Potentials exists in all Industrial Sectors (2030)



Industrial Energy Efficiency Opportunities

- Cross-Cutting
  - Steam systems 10-20%
  - Cooling/Refrigeration 20-40%
  - Motor Systems ~ 30%
- Sector Specific
  - Iron & Steel 15-40%
  - Cement 10-40%
  - Chemicals 20-25%



Emerging technologies: Iron & Steel

- Steel industry consumes 18% of global industrial energy use, emitting 26% of industrial CO_2
- Collection of batch processes
- Innovative technologies integrating production steps
- Large variations in energy intensity demonstrate potential for efficiency improvement

New Electric Arc Furnaces

- **Base-case**

  1994 average EAF-performance

  – Electricity: 481 kWh/t

  – Fuel: 0.16 GJ/t

- **New Technology**

  Advanced EAF (scrap preheating, increased oxygen use)

  – Electricity: 265 kWh/t

  – Fuel: 0.47 GJ/t

  – Commercially available

- **Primary energy savings**

  – 2.9 GJ/t (36%)

- **Cost-Effectiveness**

  – Investments: 4$/t over conventional EAF

  – Annual cost change: -8$/t

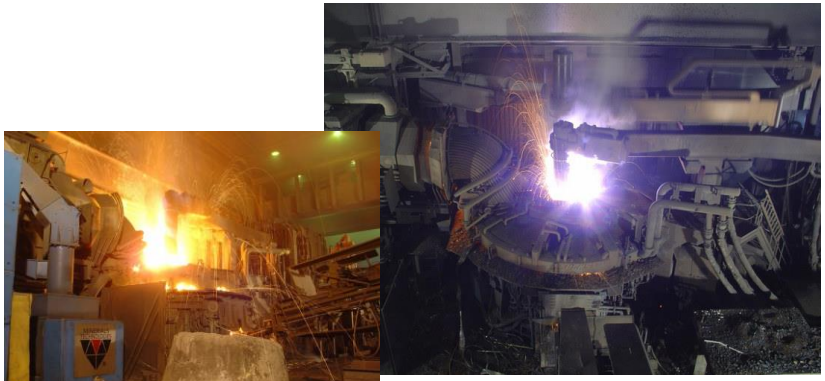
  – Payback period: 0.3 year

  – IRR: 305%

- **Productivity benefits**

  – reduced tap-to-tap time

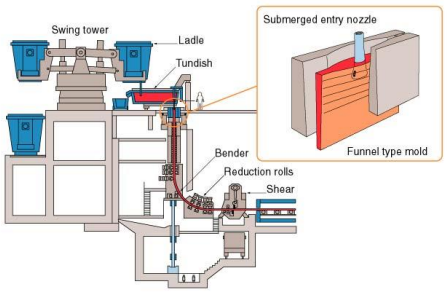
  – reduced electrode use



Process Integration – Near Net Shape Casting

- Demand can be reduced by integrating processes, reducing material flows
- Near net shape casting in the steel industry combines casting and hot rolling
- Current: continuous casting and hot rolling consume about 206 kWh/tonne hot rolled steel (mostly drives)
- Thin slab caster including rolling stand consumes about 30 kWh/tonne, reducing demand for direct drives by 90%!
- Thin slab casters are being introduced in the steel industry for various product types

6G Thin Slab Caster



Realizing Savings: Manage your Energy

- **Successful management:**
  - Energy bill is not an act of God
  - Recognizes the “human factor”
  - Creates an organization-wide system and program for managing energy
  - Delivers sustained reductions over time and is designed for continual improvement
  - Relates itself to the core business of the organization

Energy Management Pitfalls

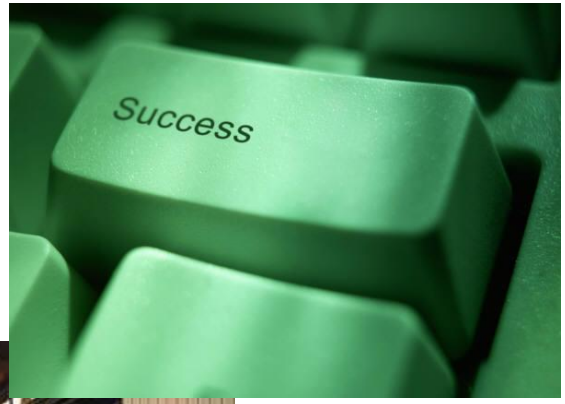
Energy typically considered a “technical issue”:

- Decentralized and not strongly organized
- Under-staffed or out-sourced
- Changes in management and organization
- Technology oriented
- Project and not program oriented
- Reactive
- Undervalued
- Considered capital intensive
- Lack of upper management support or involvement

Resulting in poor planning and decision making

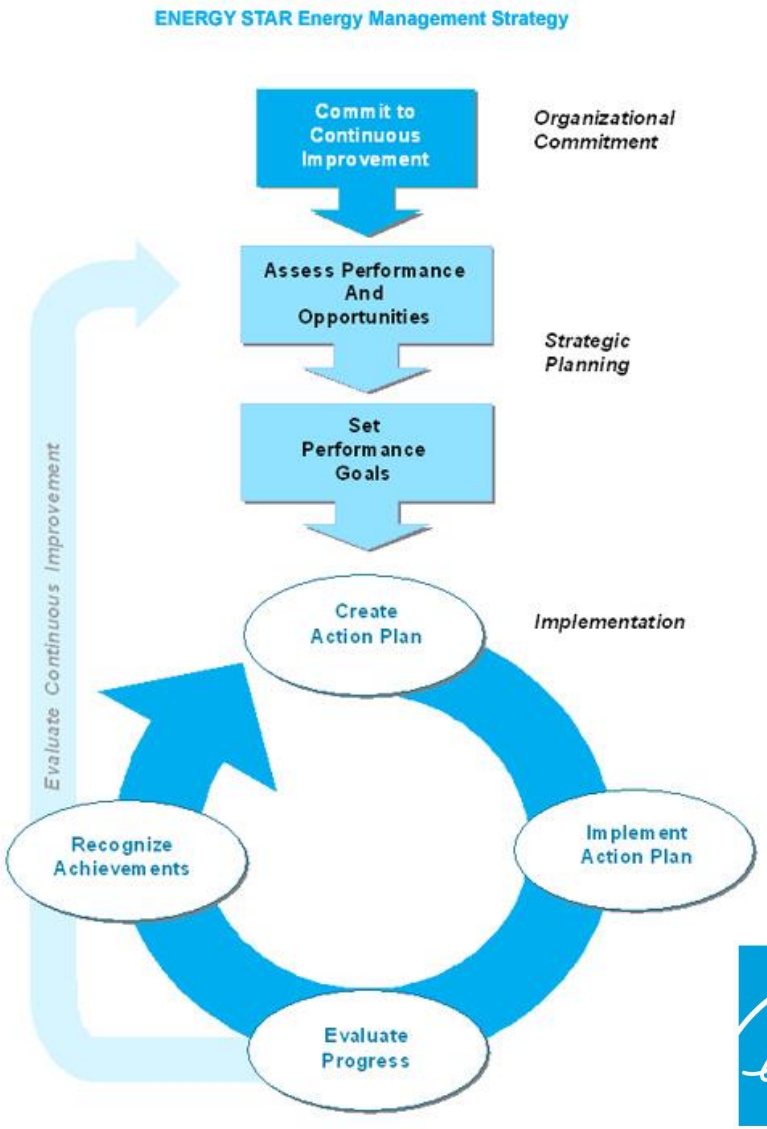
Success Factors for Energy Management

- Commitment of top management
- Clear and measurable targets
- Information and management systems in place
- Regularly assess and track performance
- Involvement of all levels in organization
- Stable organization
- Resources and time allocated
- Continuous program
- Excellent communication
- Networking
- External sparring partners
- Recognition



A Systematic Approach

- Plan (target)
- Do (implement)
- Check (monitor)
- Act (adjust)



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Energy Management: Seven Steps to Change the Mindset

1. Make commitment to continuous improvement
2. Assess performance
3. Set goals
4. Create action plan
5. Implement action plan
6. Evaluate progress
7. Recognize achievements

Conclusions

- Climate change is here to stay as a driver
- Energy-efficiency is the key response strategy for industry
- There is substantial potential for energy efficiency improvement in the short, medium and long-term
- We are not running out of technologies to improve energy efficiency, economic and environmental performance, and neither will we in the future: vacuum insulation is an example
- Continuous innovation is key for further bridging the gap between thermodynamics and current energy use
- Strategic energy management is essential to recognize and realize the promise of energy efficiency

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Thank you for your attention

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