

# The Role of Informatics in Addressing the Big Global Challenges.

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# First , what are the Big Global Challenges ?

Global Warming

Ageing Society

Energy

Public Health

Water/Food

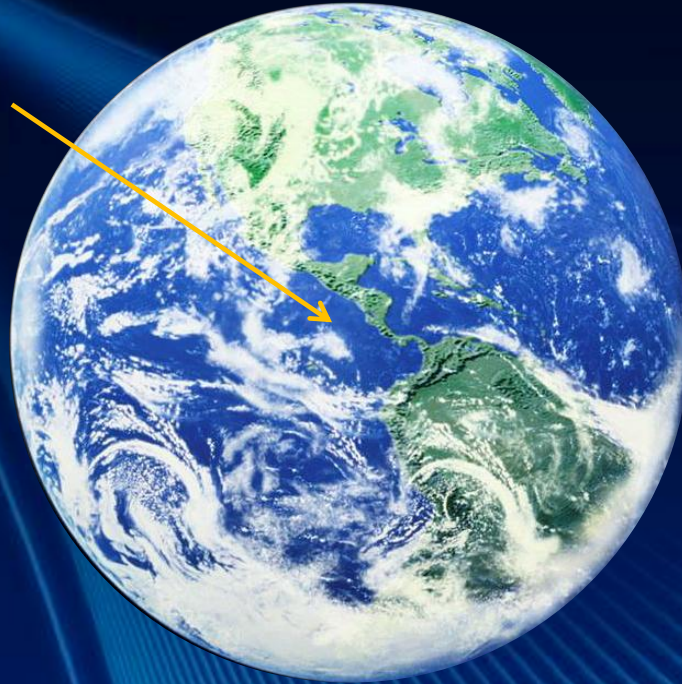
Security

...



# Global Warming

Global Warming



# Global Challenges and Policy

## Responses

### Global Challenges

"We have **less than 10 years** to halt the global rise in greenhouse gas emissions if we are to avoid catastrophic consequences for people and the planet. It is, simply, the greatest collective challenge we face as a human family."

(39th plenary assembly of the World Federation of United Nations Associations, 10th August 2009)



Ban Ki-moon

### Policy Responses

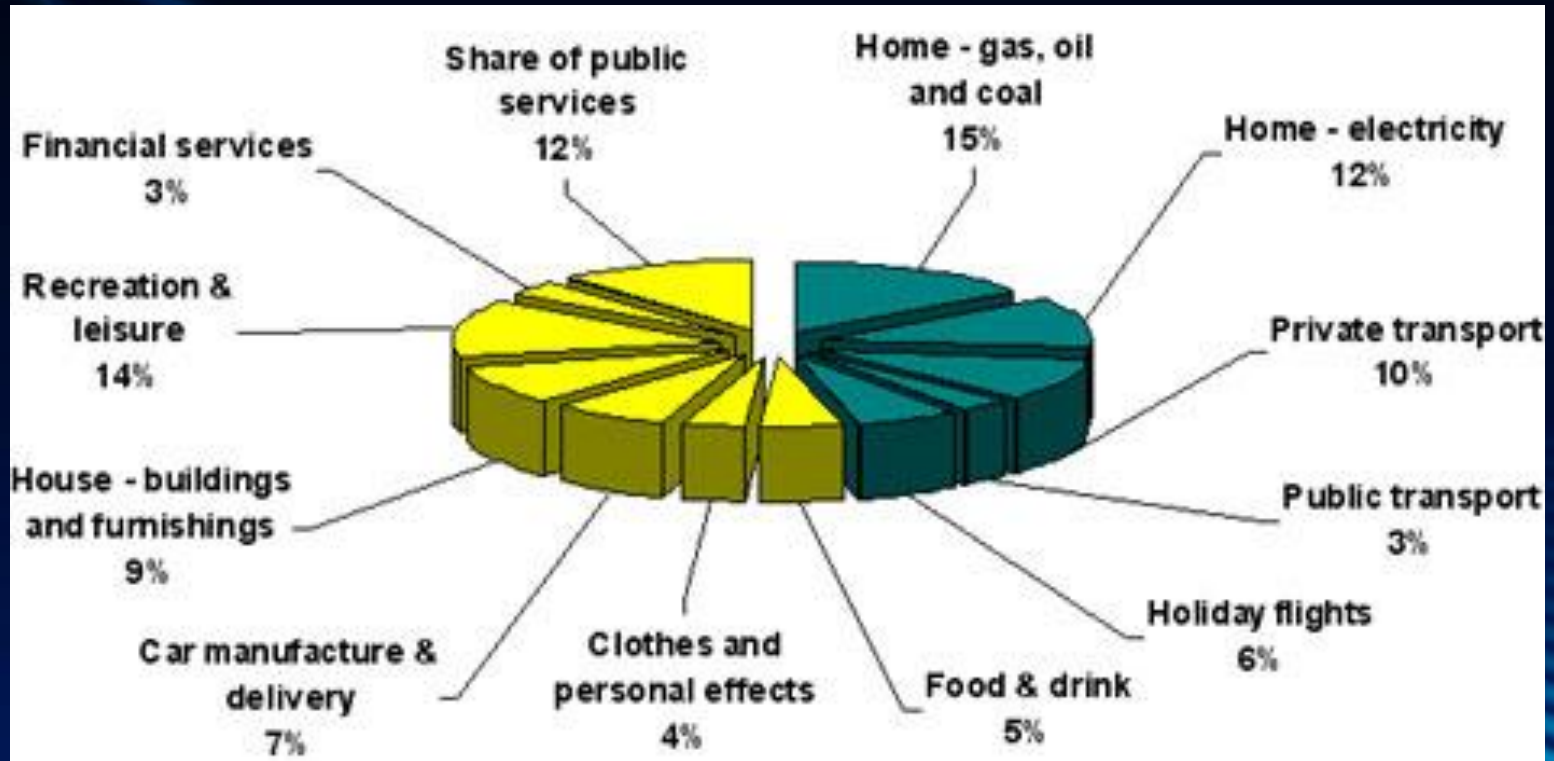
**"Climate policy must be based on sound science.** We know what the problem is. We know what we must do. Now is the time to do it. Now is our moment.

We need a deal in Copenhagen that will enable deep cuts in emissions, that promotes green growth, that that will provide the resources and structures needed for adaptation. We will pay a high price if we do not act and if we do not invest now. The cost of inaction today will be far greater than the cost of action tomorrow, not just [for] future generations, but for this generation too."

(World Climate Conference, Geneva, 3<sup>rd</sup> September 2009)

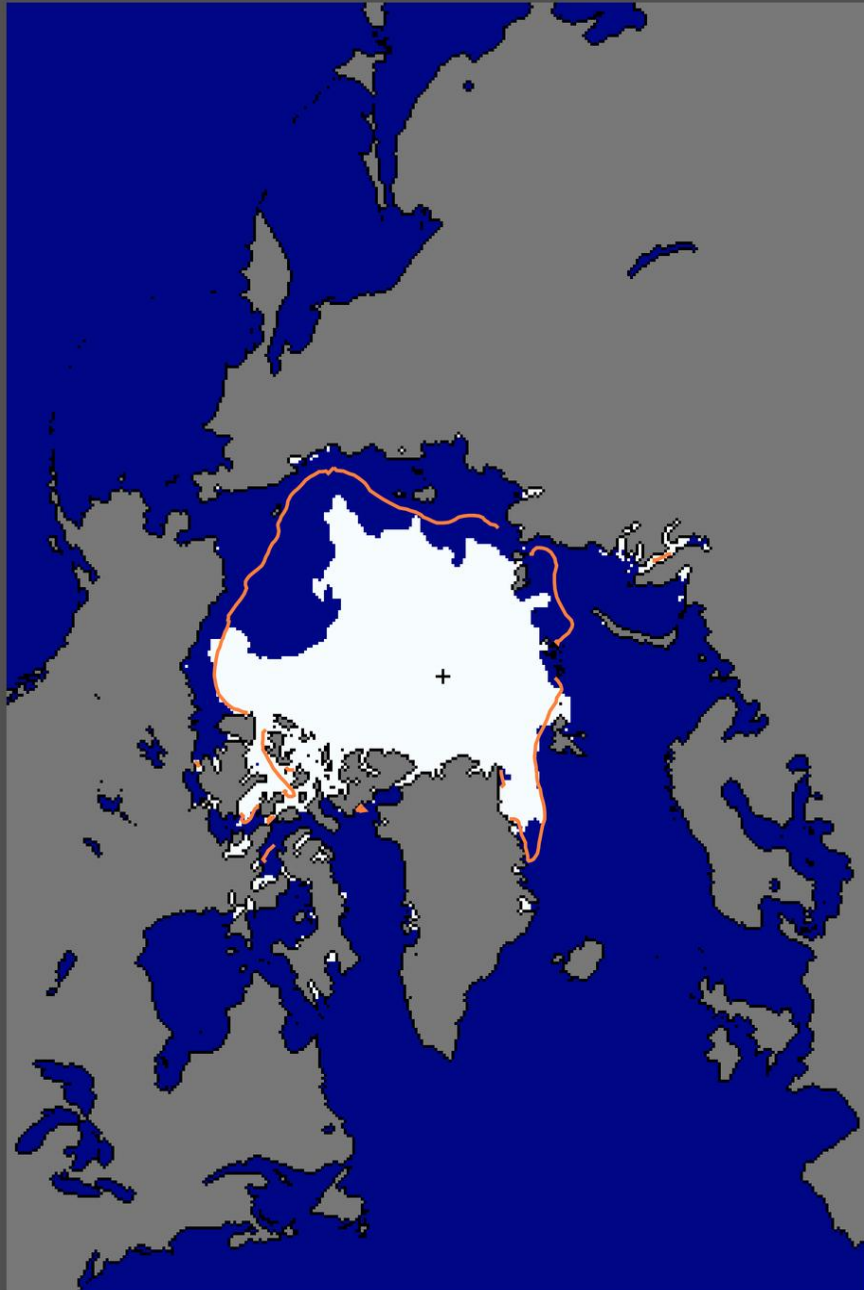


# What is our Global CO2 Footprint ?



[www.carbonfootprint.com](http://www.carbonfootprint.com)





National Snow and Ice Data Center, Boulder, CO

median  
1979-2000

**September 2009 will probably see the 3<sup>rd</sup> least Arctic sea ice on record (after 2007)**





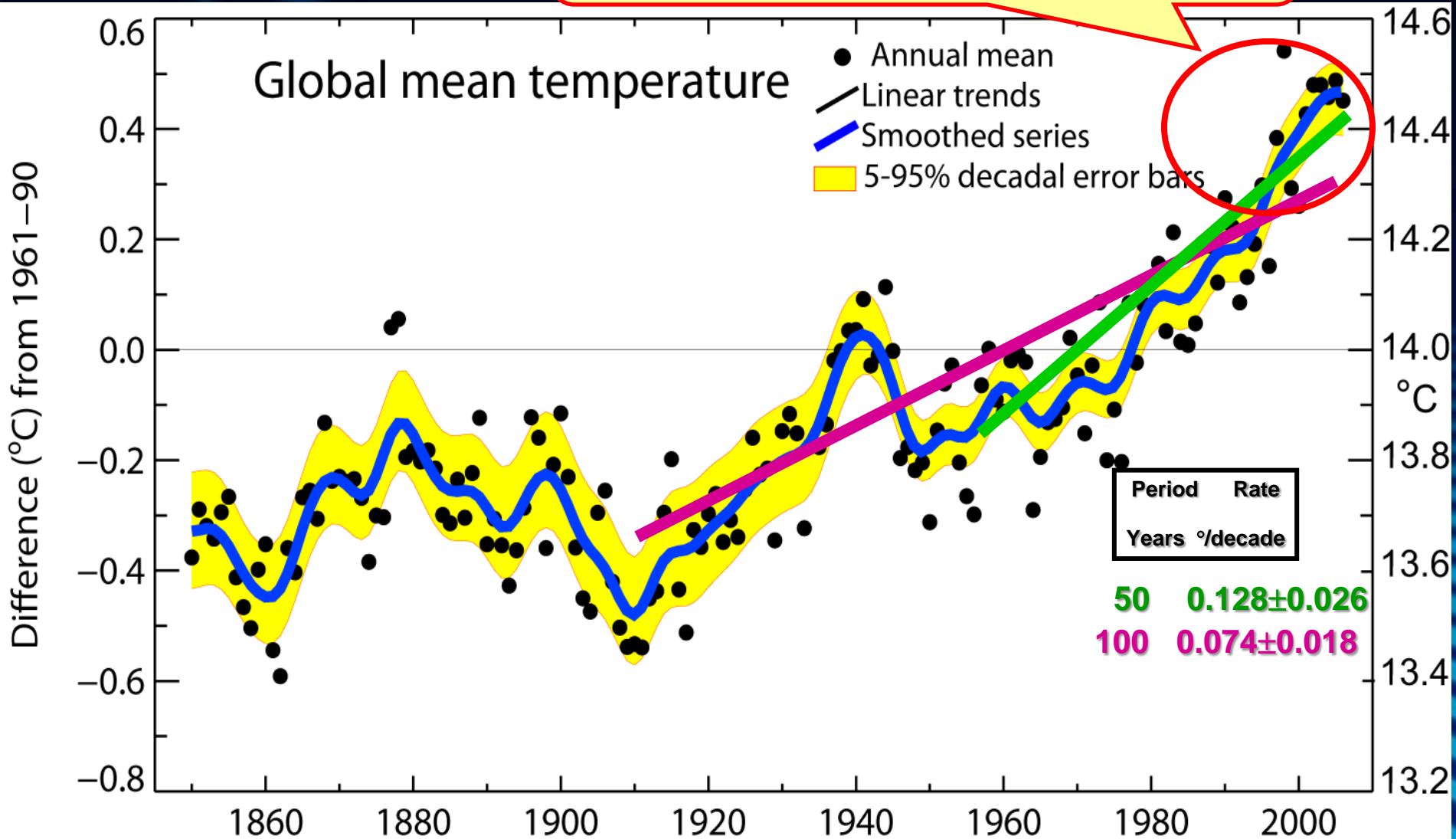
**Muir Glacier, Alaska, August 13, 1941,  
photo by W.O. Field**



**Muir Glacier, Alaska, August 31, 2004,  
photo by B.F. Molnia**

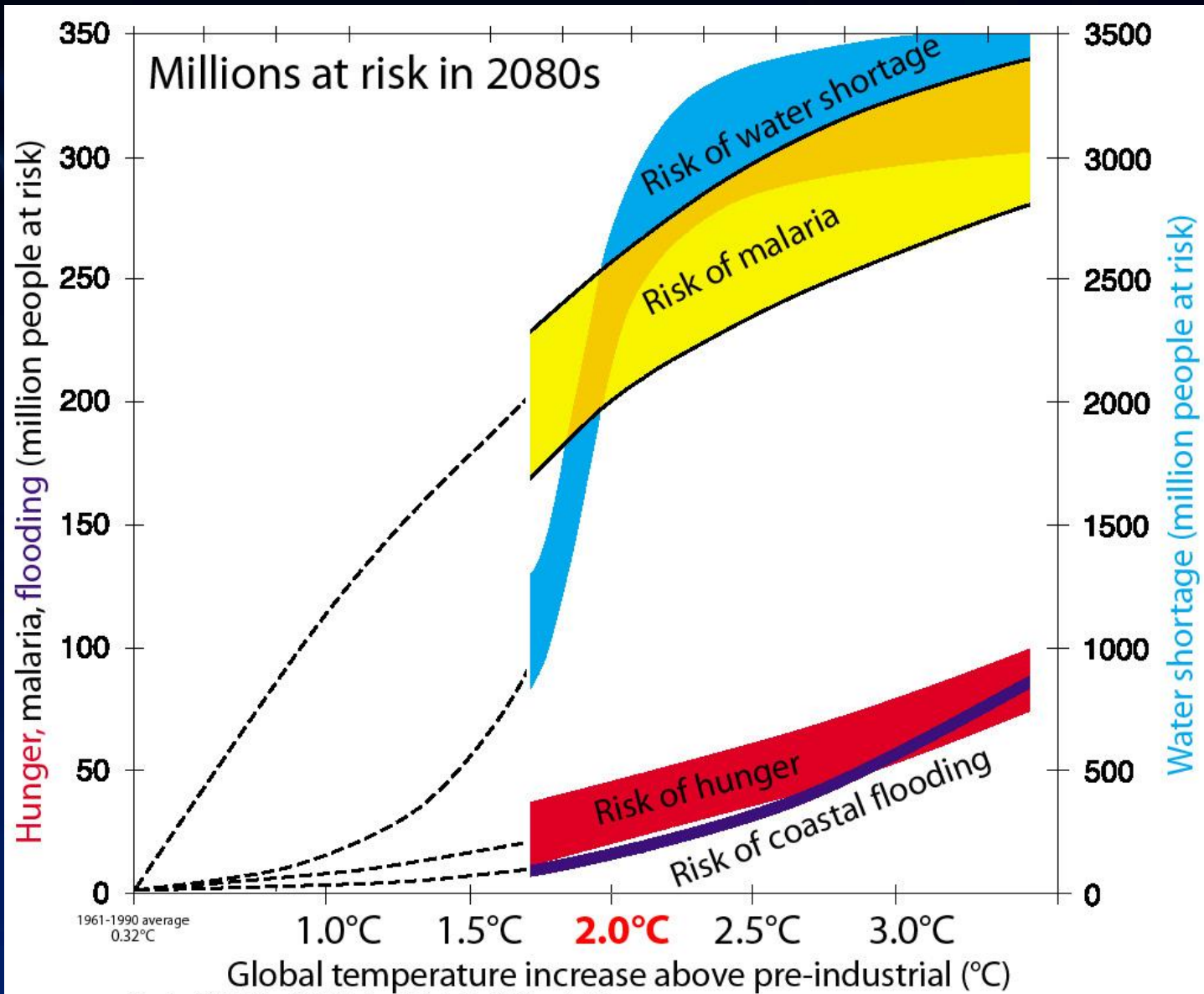
# Global mean temperatures are rising faster with time

**Warmest 12 years:**  
1998, 2005, 2003, 2002, 2004, 2006,  
2001, 1997, 1995, 1999, 1990, 2000





# Millions at Risk (Parry et al., 2001)



Source: Parry et al. (2001) "Millions at Risk" Glob. Env. Change. Graph adapted by M. Meinshausen, Nov. 2004  
Note: The original graph presented temperature levels above 1961-1990 average (see Hulme, Mitchell et al. 1999), not above pre-industrial. The 1961-1990 average is 0.32°C above pre-industrial levels (1861-1890). Thus, a 0.32°C temperature difference has been added to the original scale. Furthermore, the original graph presented temperature levels in 2080 for different CO2 equivalence (t) stabilization scenarios. For a climate sensitivity of 2.5°C (as underlying the work of Parry et al.), the 2080 temperature level for the S550 CO2eq emission path has been about 1.4°C above 1990 (2°C above pre-industrial).



# Energy

Energy

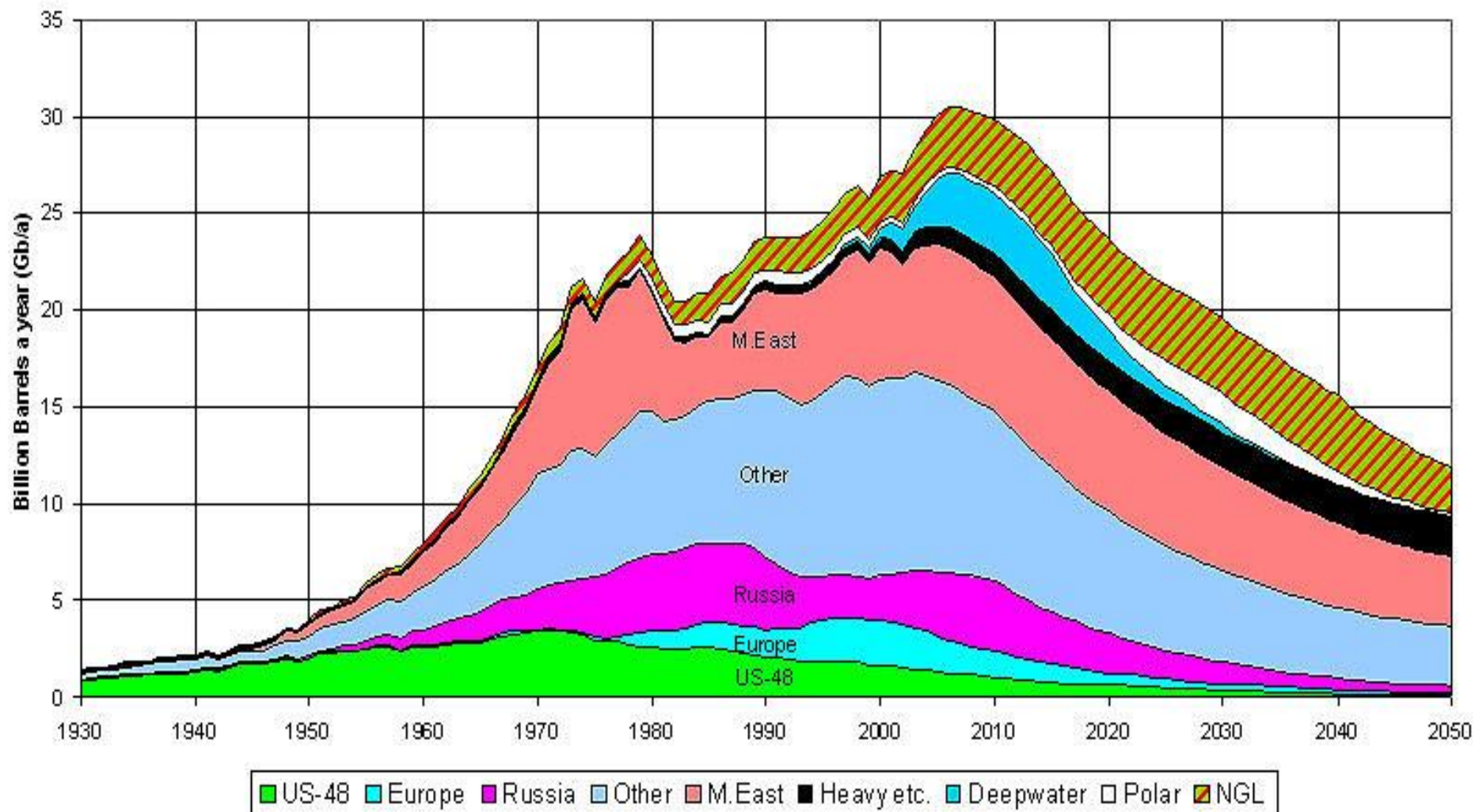


*Will the world have enough energy?*

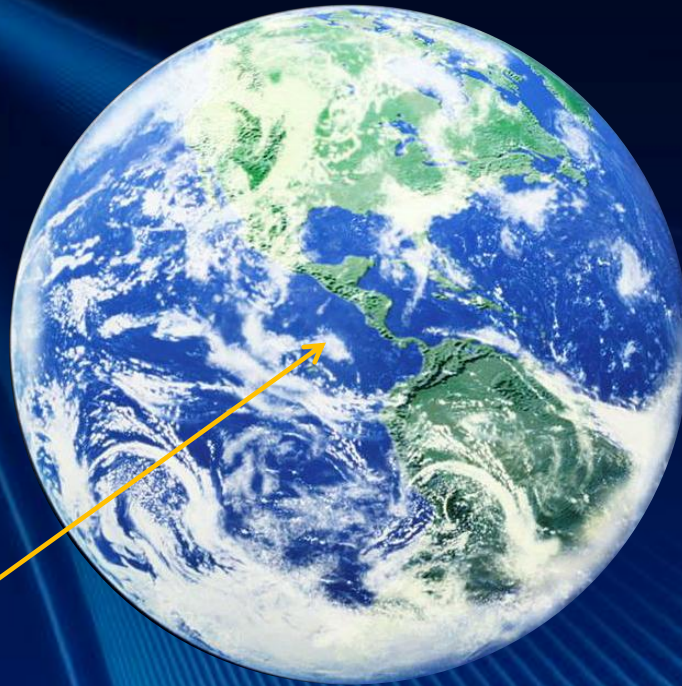


# Global oil production has peaked or is close to its peak

## OIL AND GAS LIQUIDS 2004 Scenario



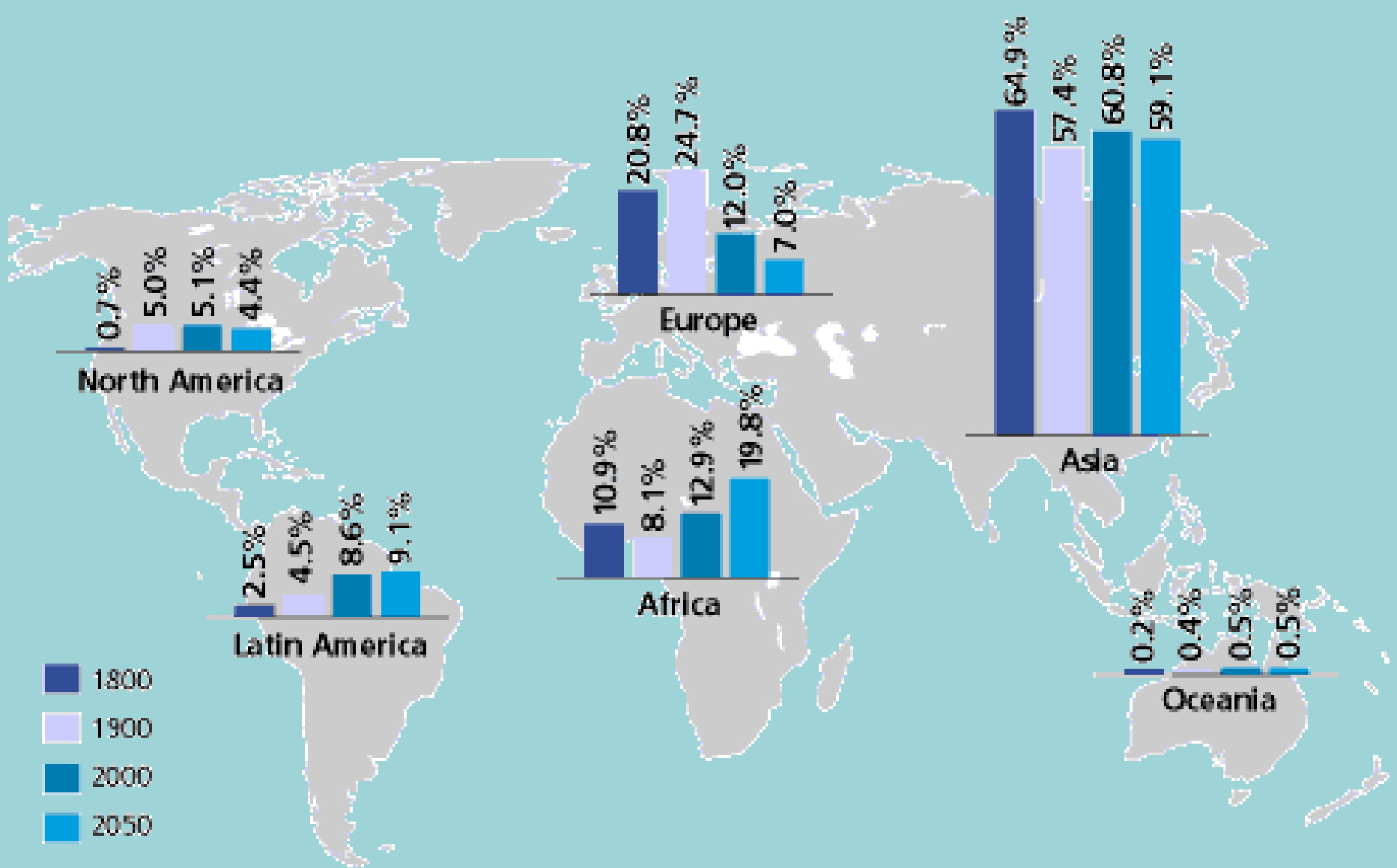
# Water / Food



Water/Food

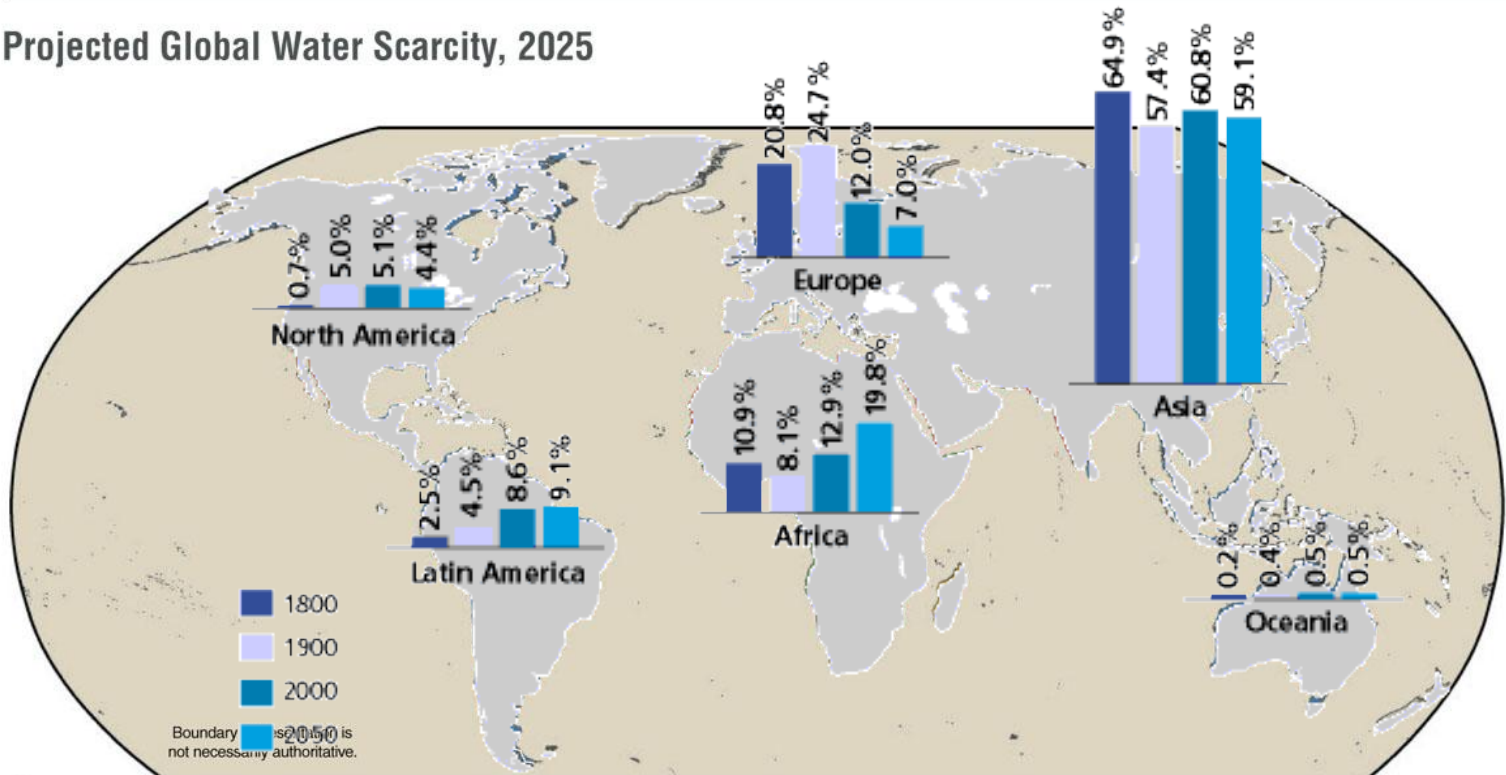


# Changing Distribution of the World's Population



# Water Scarcity 2025

Projected Global Water Scarcity, 2025



- Physical water scarcity:** More than 75% of river flows are allocated to agriculture, industries, or domestic purposes. This definition of scarcity — relating water availability to water demand — implies that dry areas are not necessarily water-scarce.
- Approaching physical water scarcity:** More than 60% of river flows are allocated. These basins will experience physical water scarcity in the near future.

- Economic water scarcity:** Water resources are abundant relative to water use, with less than 25% of water from rivers withdrawn for human purposes, but malnutrition exists.
- Little or no water scarcity:** Abundant water resources relative to use. Less than 25% of water from rivers is withdrawn for human purposes.
- Not estimated**

Source: International Water Management Institute.



# *How will these changes affect Food Production?*



25,000 die  
daily from  
starvation

815m suffer  
from  
malnutrition



# Aging Society



Ageing Society



## Kofi Annan 2000

One of the greatest success stories of modern times is the increasing number of people living into old age

However this triumph of humanity is also one of our greatest challenges



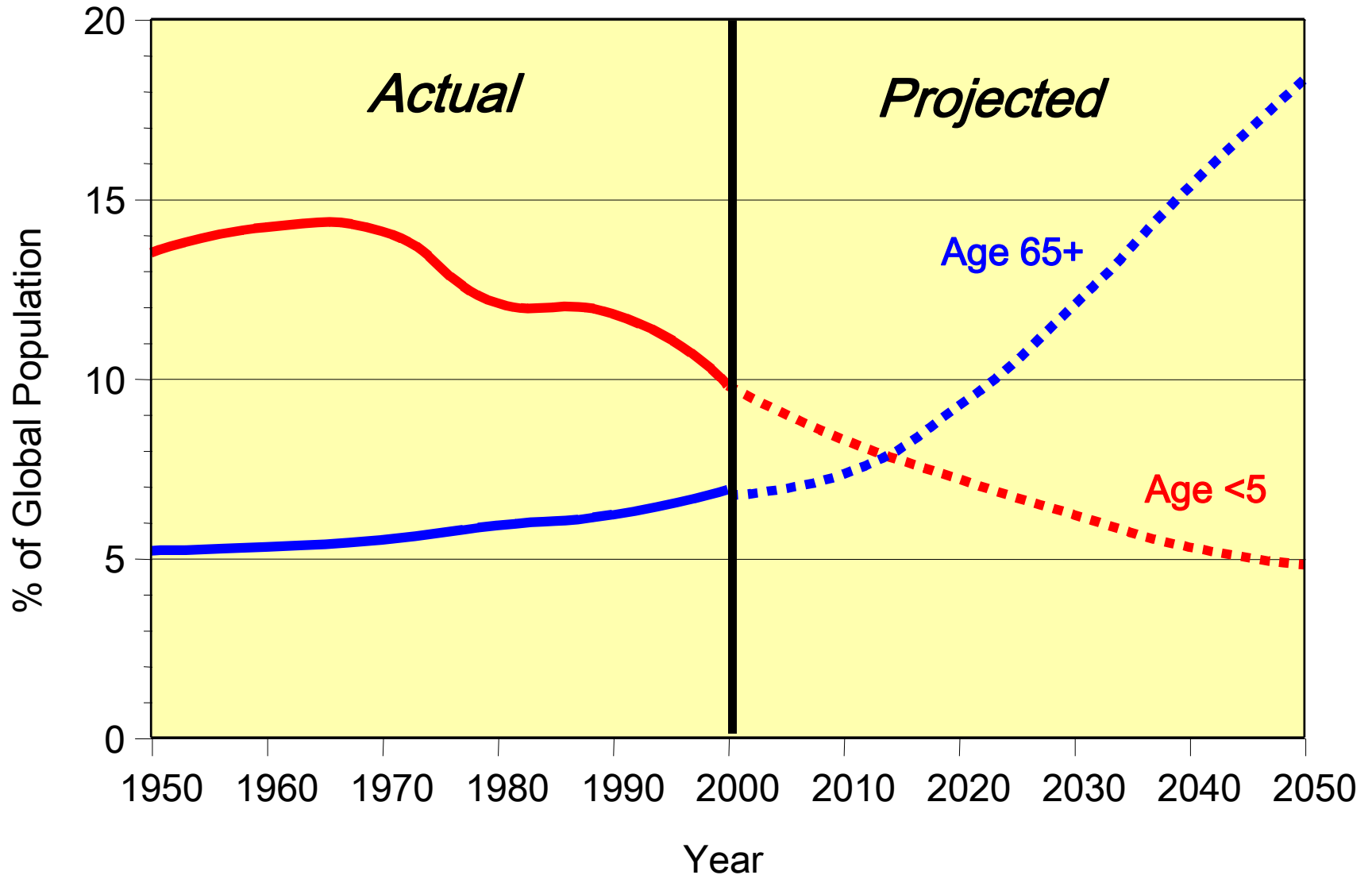


**Demographic Ageing is  
*changing* our world .....now**

By 2050, 21 percent of the world population—nearly 2 billion people—will be 60 and older

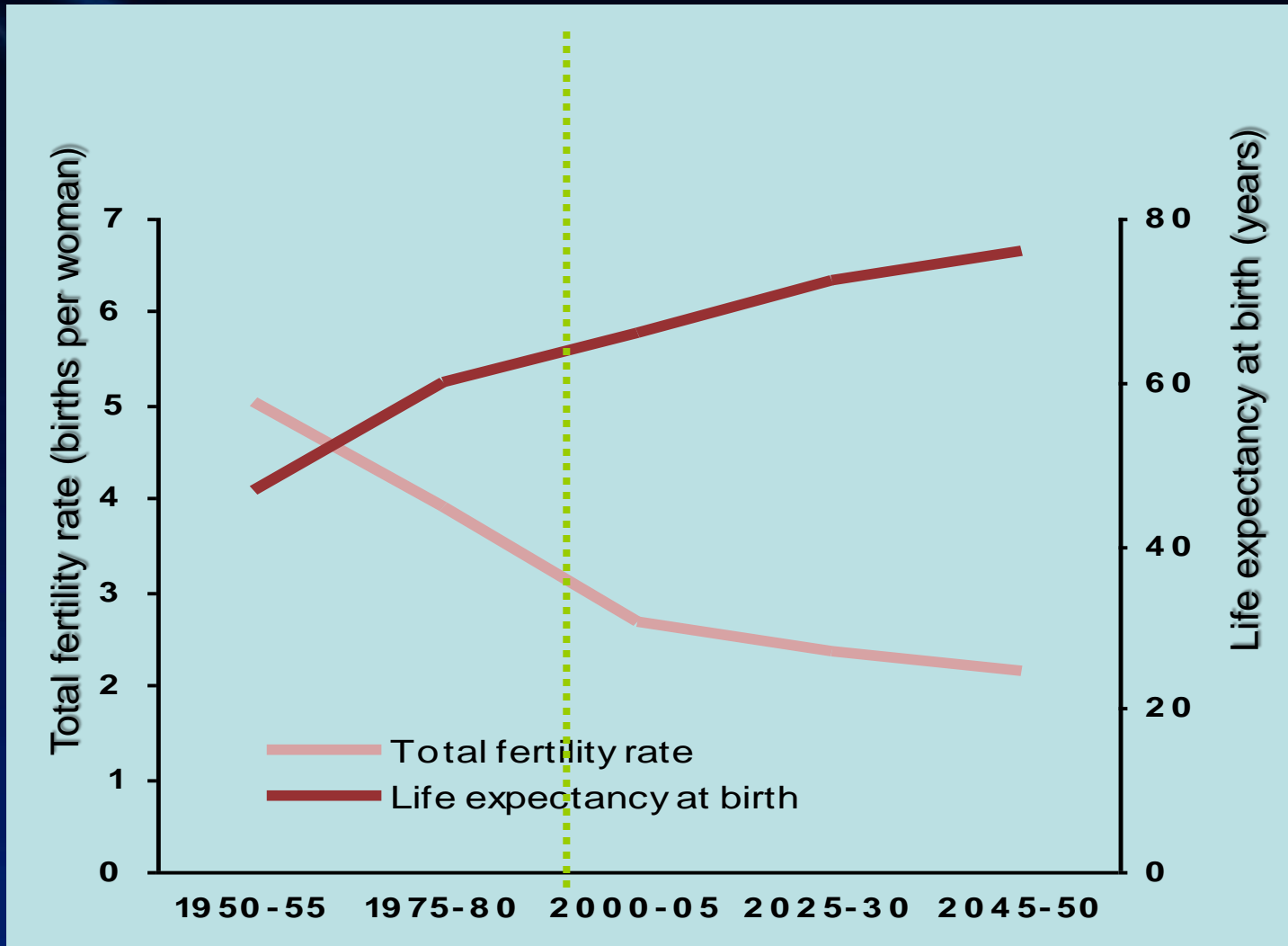
Source: United Nations "Population ageing 2002"

# United Nations Projected Percentages of Global Population

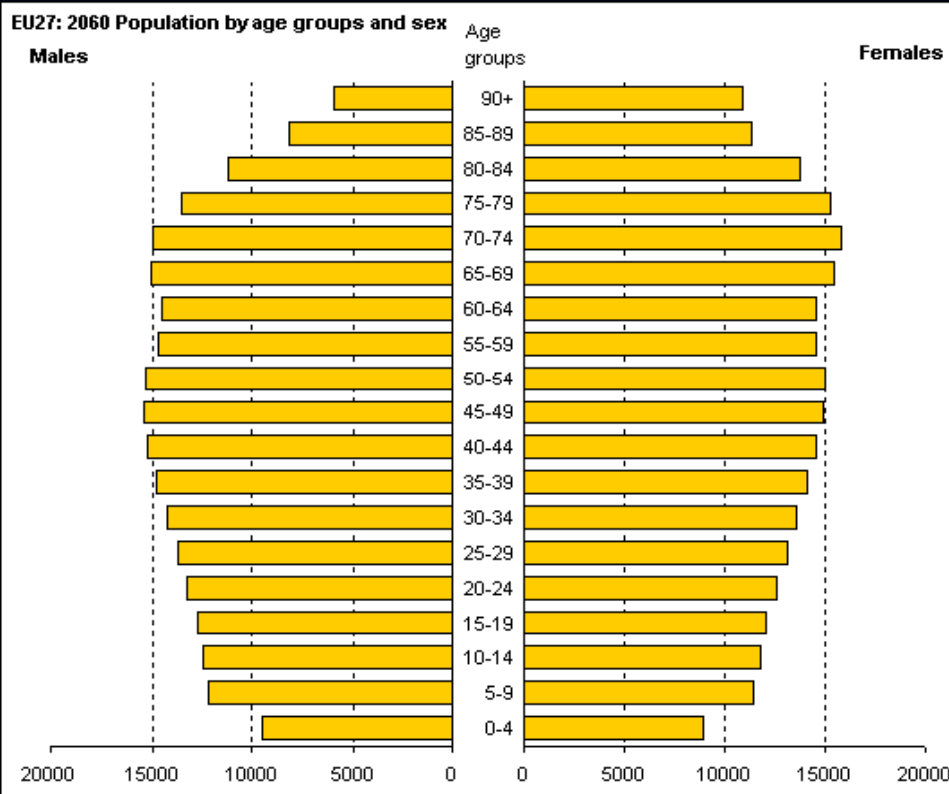
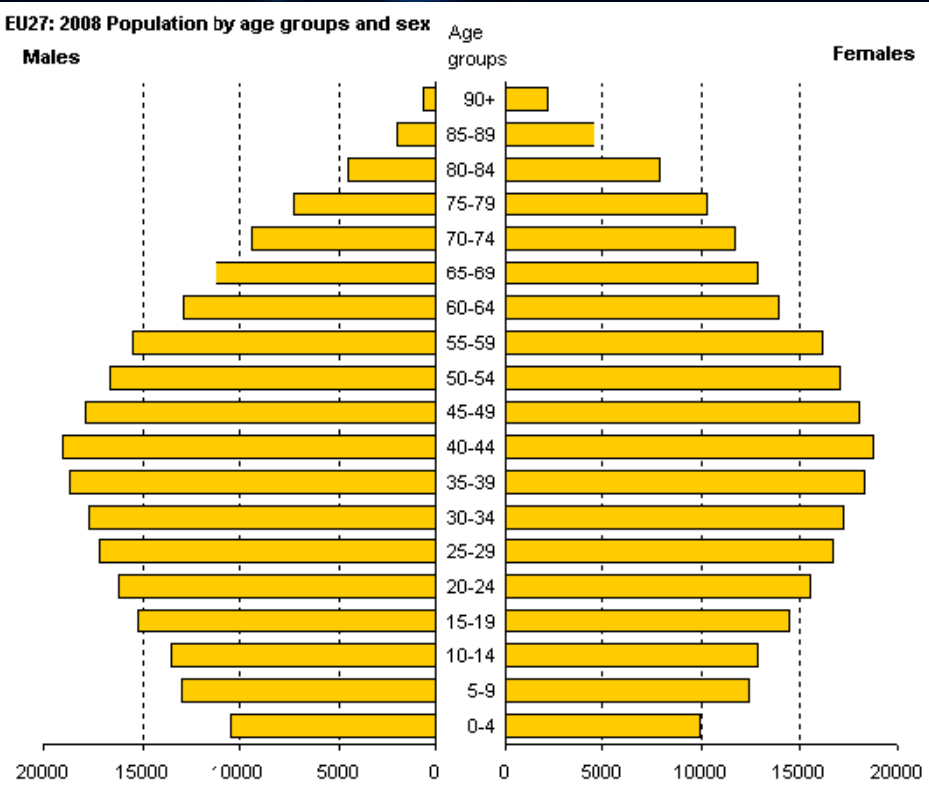


Source: World Population Prospects: The 1996 Revision, Annex 2 (low-variant projection). UN Population Division.

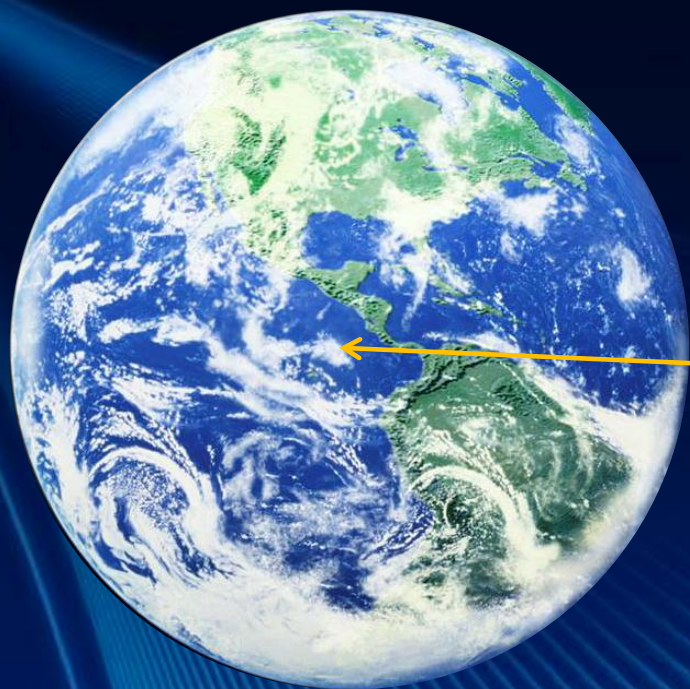
# The demographic causes of global population ageing: Total fertility rate and life expectancy at birth: World, 1950-2050



# Demography shifting



# Public Health



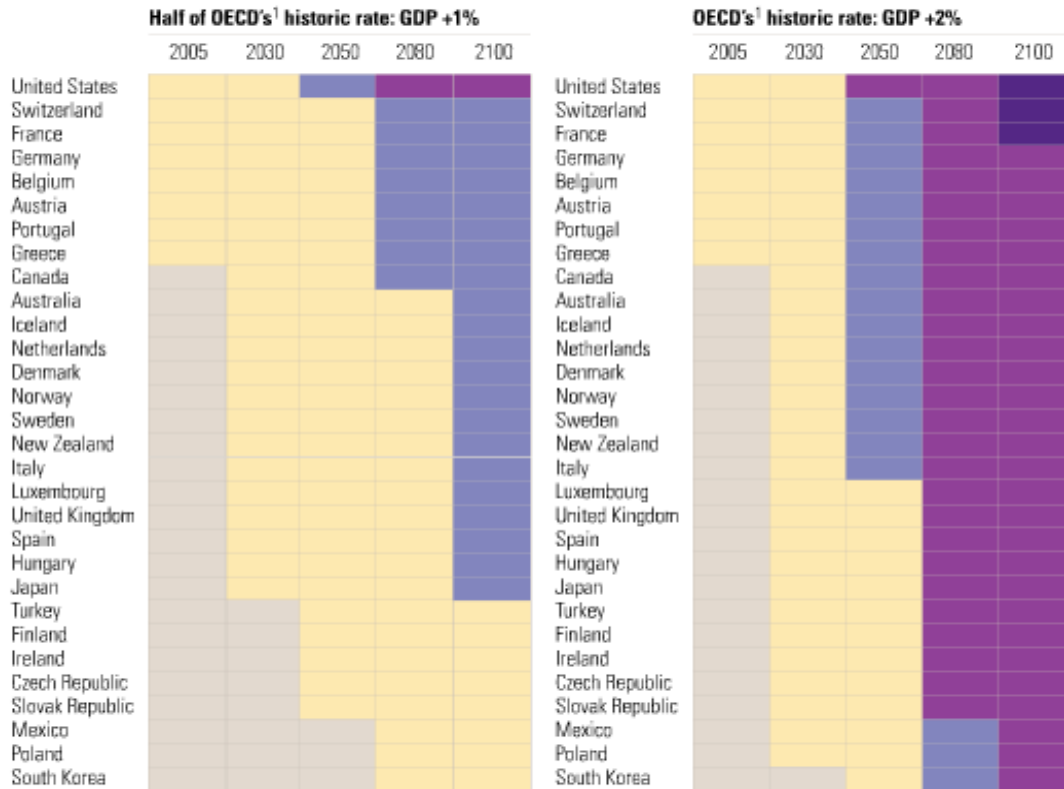
Public Health





## Two scenarios for future spending

Projected health care spending as % of GDP for member countries of OECD<sup>1</sup>



## Health care spending over the next 100 years?

At the historic growth rate, health care will consume an ever-growing proportion of the developed nations' wealth, reaching 30 percent of GDP in the United States in 2040 and 30 percent of the median OECD GDP by 2070.

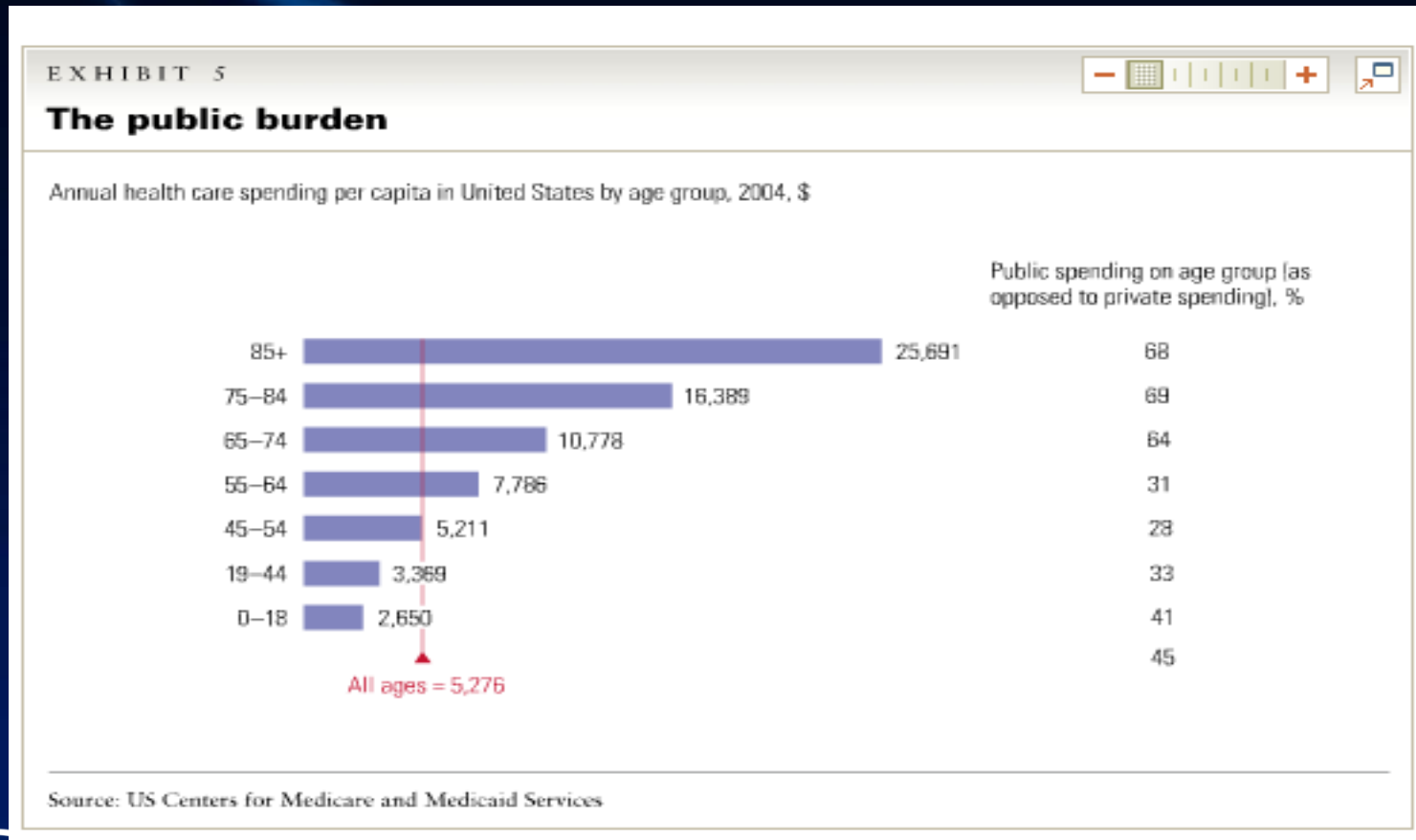
<sup>1</sup> Organisation for Economic Co-operation and Development; forecasts assume real GDP growth of 2%, with health care spending growing at 1 or 2 percentage points above that.

Source: Global Insight; Ignazio Visco, "Policy implications of the new economy," speech delivered on May 16, 2001, at the Organisation for Economic Co-operation and Development Forum 2001, *Sustainable Development and the New Economy*, in Paris; McKinsey analysis



# The already acute economic pressures healthcare spending places on society will grow

A significant part of an average person's health care spending throughout life occurs in its second half, especially the last two years. In many countries, the tax-financed part of health care represents a massive transfer from young taxpayers to older health care users.



# Security



Security



# Security

- Using ICT to communicate we leave data all over the internet.
- At the moment the data is fragmented, but consolidation is more and more possible and happening.
- For data security the data needs to be validated and the owner needs to have control of the flow.
- Our medical records, driving records, sick leave, buying tendencies, our bank account data etc. could otherwise be bartered over the internet.
- Security raises many challenges caused by the ever increasing usage of ICT, but can also be solved through ICT together with the right EU/Global policies.



# Additional Challenges for Informatics !



# The Informatics (ICT) Dilemma



“Right now, three-quarters of the fastest-growing occupations require more than a high school diploma. And yet, just over half of our citizens have that level of education. We have one of the highest high school dropout rates of any industrialized nation. And half of the students who begin college never finish.”

*Barack Obama, President of the United States of America*



“A highly skilled and adaptable workforce is the foundation for Europe’s competitiveness. ICT scientific and technology skill, digital literacy and lifelong learning are particularly important parts of this. But , and it is catastrophic, while demand for ICT skills is growing, supply is declining in Europe.”

*Viviane Reding, European Commissioner for Information Society and Media*



# Decline in Interest for Informatics !

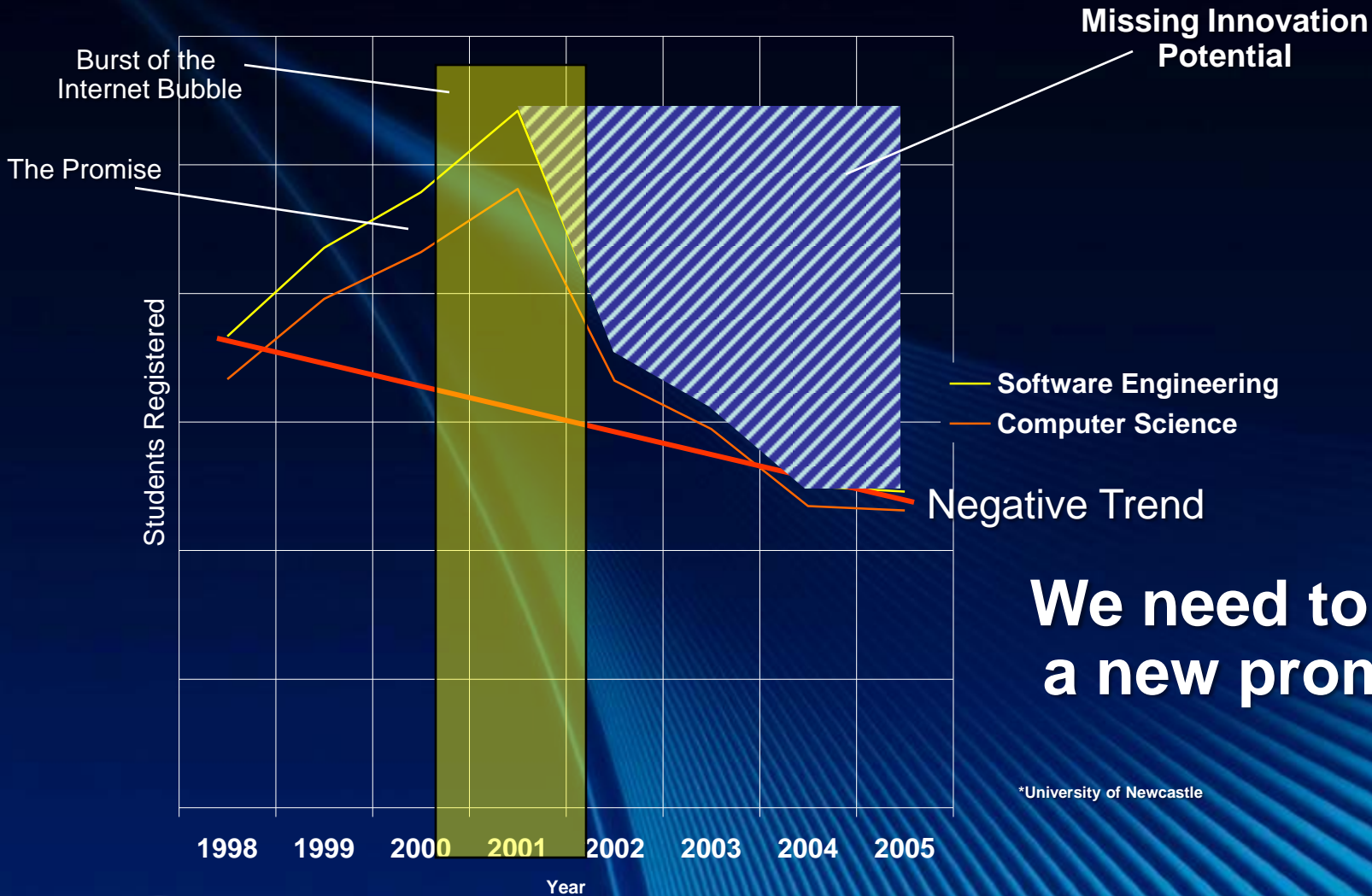
Recent declines are particularly pronounced in computer science. The percentage of college freshmen planning to major in computer science dropped by **70%** between 2000 and 2005. In an economy in which computing has become central to innovation in nearly every sector, this decline poses a serious threat to American competitiveness. Indeed, it would not be an exaggeration to say that every significant technological innovation of the 21st century will require new software to make it happen.

Bill Gates (2007)



# Decline in interest for ICT disciplines in Universities (back to pre-1997 levels)

Development of Students Registered in ICT disciplines Example: UK



**We need to build a new promise !**

\*University of Newcastle

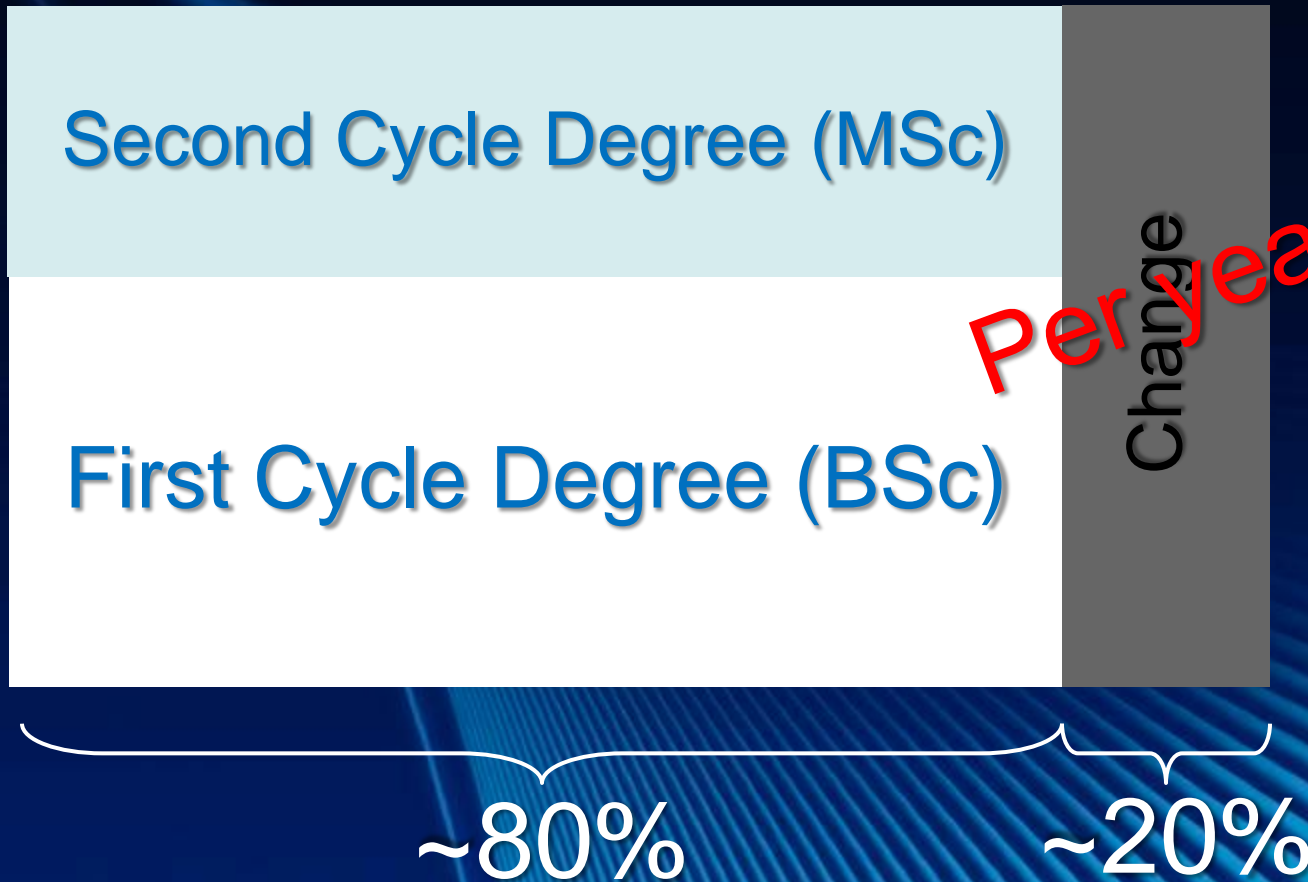


**In addition we have Brain Drain !**





# Challenge of Change



# The shift to massive computing parallelism in commodity devices

- For decades Moore's law has defined the increase of Hardware component complexity as well as performance.
- Now with Multi-Core and Many-core technology, Moore's Law has been transported into the Software world, with massive implications.
- Current typical programming skills are not enough to take advantage of the resulting performance boosts now available to everyone.

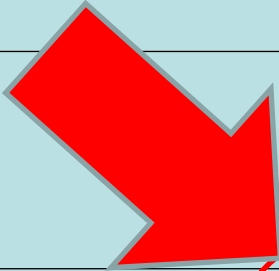


# Annual number of Graduating Students Worldwide

	Mathmatics and Computer Sciences	Engineering	Total By Region/Geo
<b>APAC</b>	<b>88,753</b>	<b>406,745</b>	<b>495,498</b>
Asia			373,035
Oceania			122,463
<b>PRC</b>			<b>442,463</b>
<b>ASMO</b>			<b>318,655</b>
North America			229,969
South America			88,686
<b>EMEA</b>	<b>198,417</b>	<b>521,913</b>	<b>720,330</b>
Europe	157,269	438,852	596,121
Africa	8,744	12,750	21,494
Middle East	32,404	70,311	102,715
<b>Total by discipline</b>	<b>422,284</b>	<b>1,554,662</b>	<b>1,852,737</b>
<b>Total students taught WW in 2009</b>		<b>4% of students are PP savvy</b>	<b>89,969</b>

In the area of Parallel Programming, we have barely touched the surface (4%p.a.)

And what about the existing programmers in the industry ?



# Challenge of SKILLS

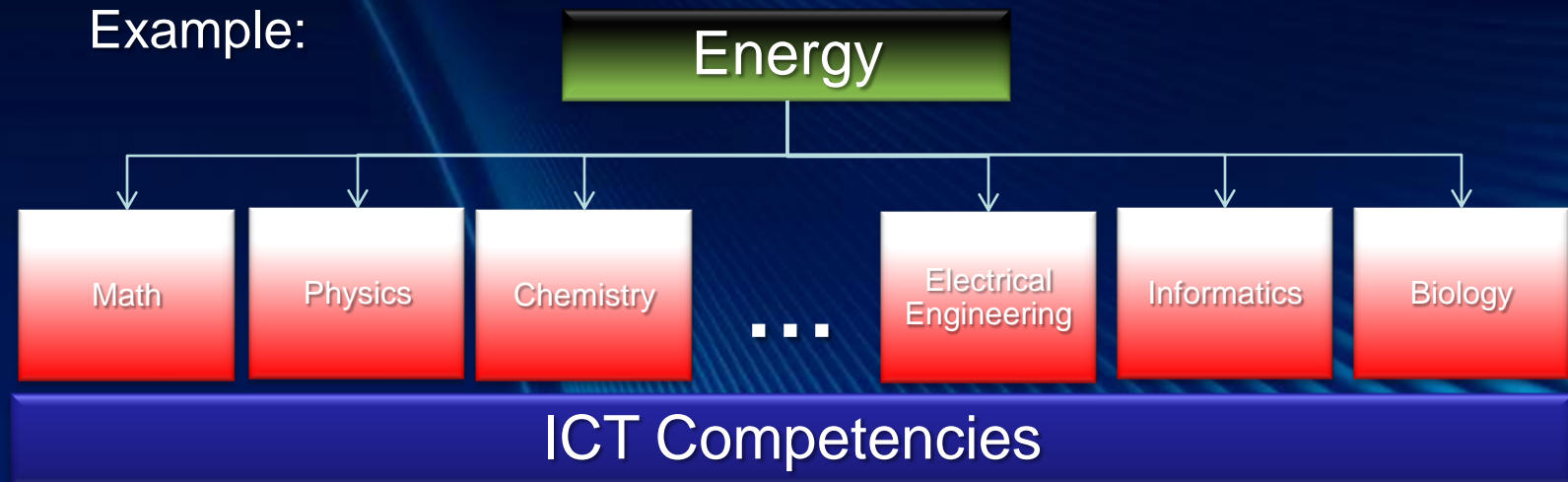


# Challenge of Orientation

Today Students choose to become: Mathematicians,  
Physicists, Chemists, Computer Scientists,  
Biologists....

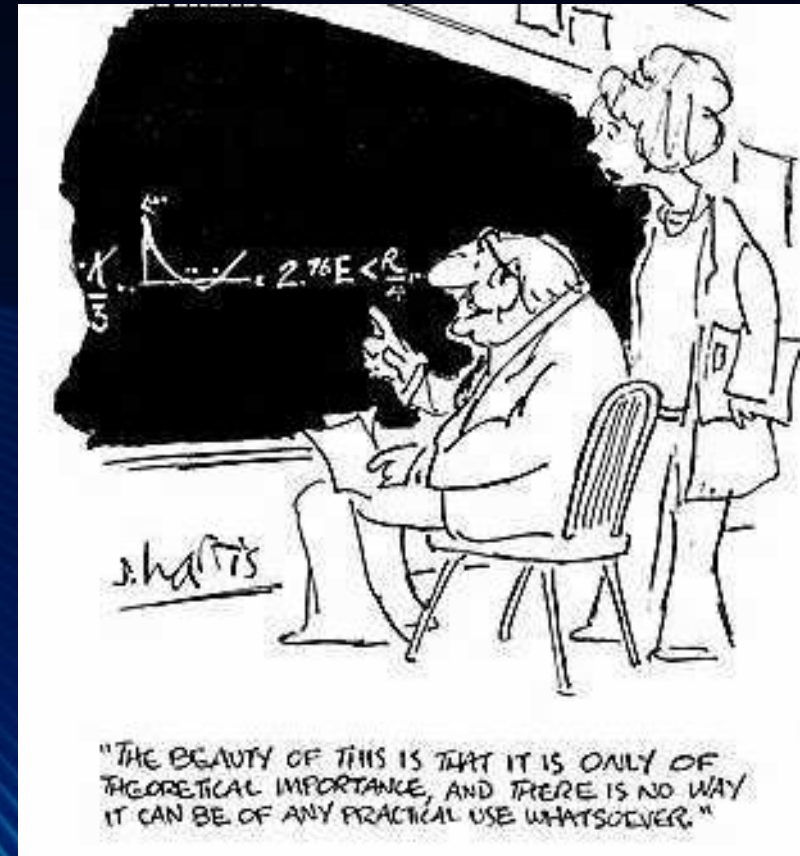
To solve the big world problems, students need to have  
multiple competencies !

Example:



# Today's and Tomorrow's role of Informatics

- So we have many Big Challenges, both globally and in drawing interest to Informatics, we must also be agile and change as quickly as do the technologies to stay in-front.
- Our image is that of “geeks” and support functions, but mostly not as a strategic asset to corporations and society.



“Geek” image



# Today's and Tomorrow's role of Informatics

- We must move Informatics (ICT) into being a strategic asset for society in tackling these Big Global Challenges.
- The move from “geek” to “strategic” should also help turn around the interest in Informatics.
- A move from “white” and “blue” collar workers to the “green collar” worker, adding value to society.



# But How ? And Where ?

- In tackling these Challenges there are surely thousands of areas to discuss.
- In the following a number of leading technology areas that are likely to be integral to the solutions.



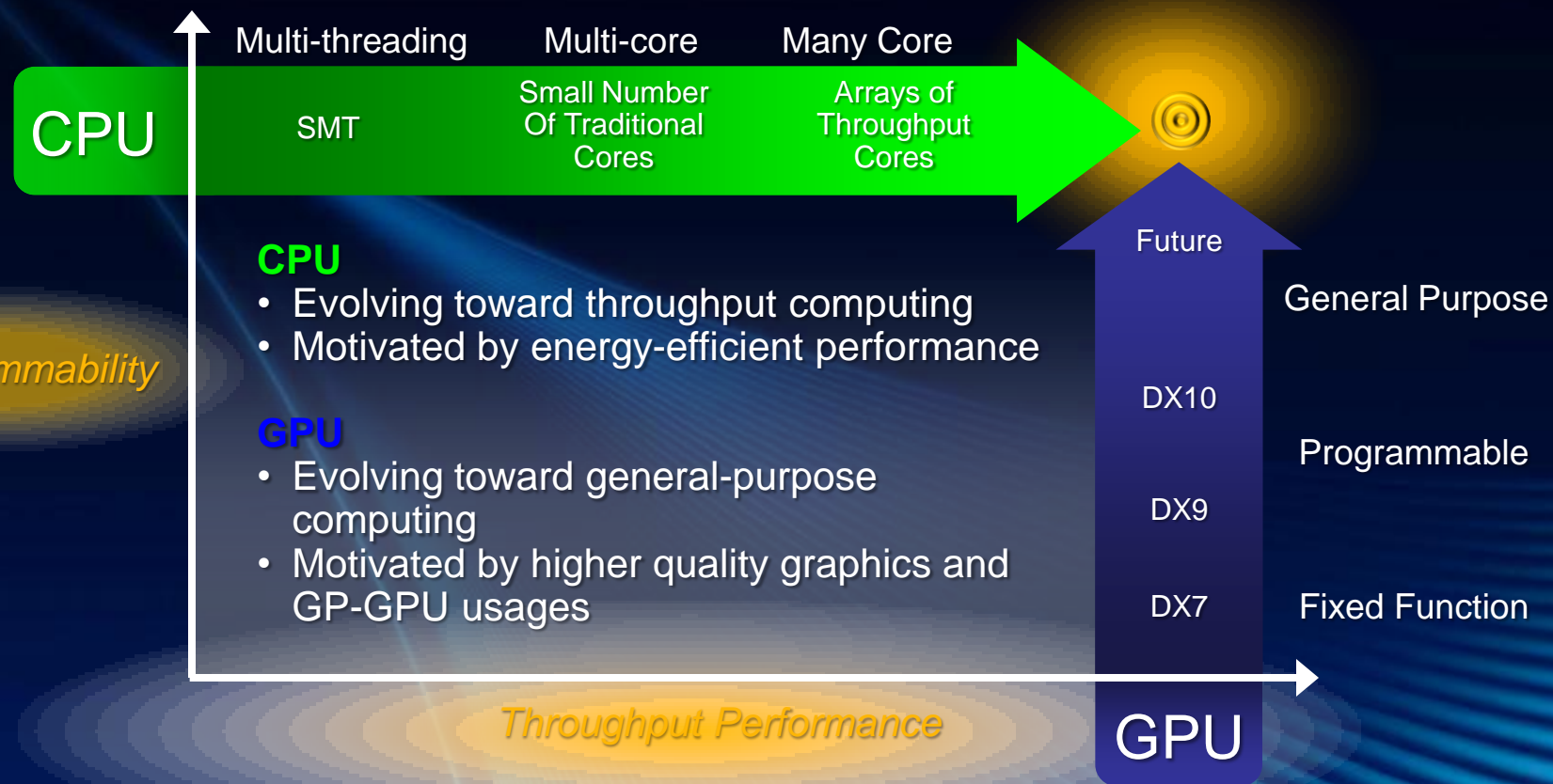


# Visual Computing



**The next Frontier**

# Computing Evolution: A Collision Course



**Battle For Control Of The Computing Platform**





Ron Fedkiw



# Visual Computing:

*Acquiring, Analyzing, Modeling and Synthesizing Visual Environments*

Photorealistic  
3D Rendering



Immersive  
User Interface



3D  
Audio and Video



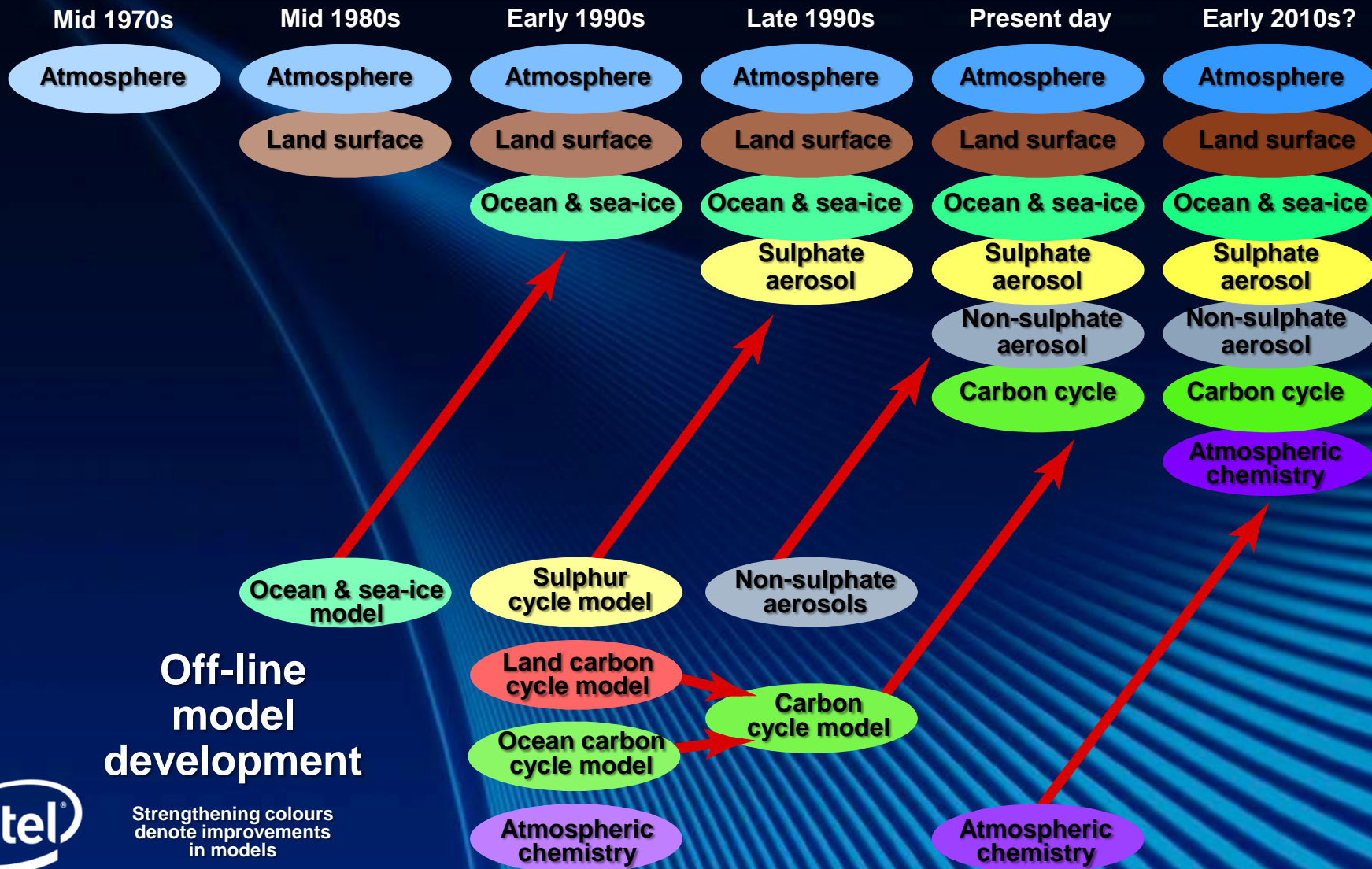
Multi-Modal  
Computing



*With a Programmable, Ubiquitous, and Unified Architecture*



# The Development of Climate models, Past, Present and Future



Strengthening colours denote improvements in models

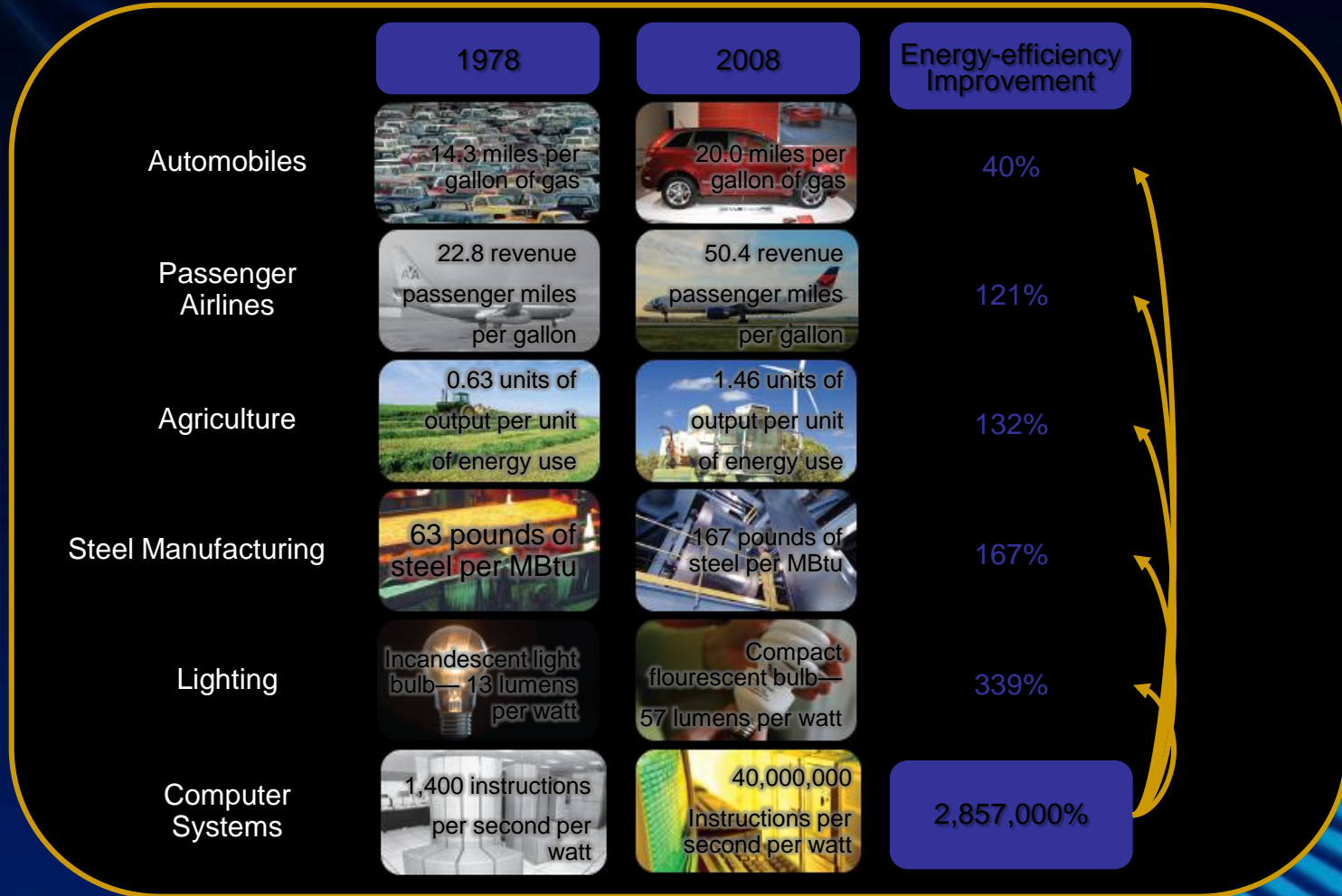
# Green (by) ICT

ENERGY EFFICIENT ICT  
STARTS WITH THE MICROPROCESSOR  
BUT DOESN'T END THERE

# Increasing Energy Efficiency

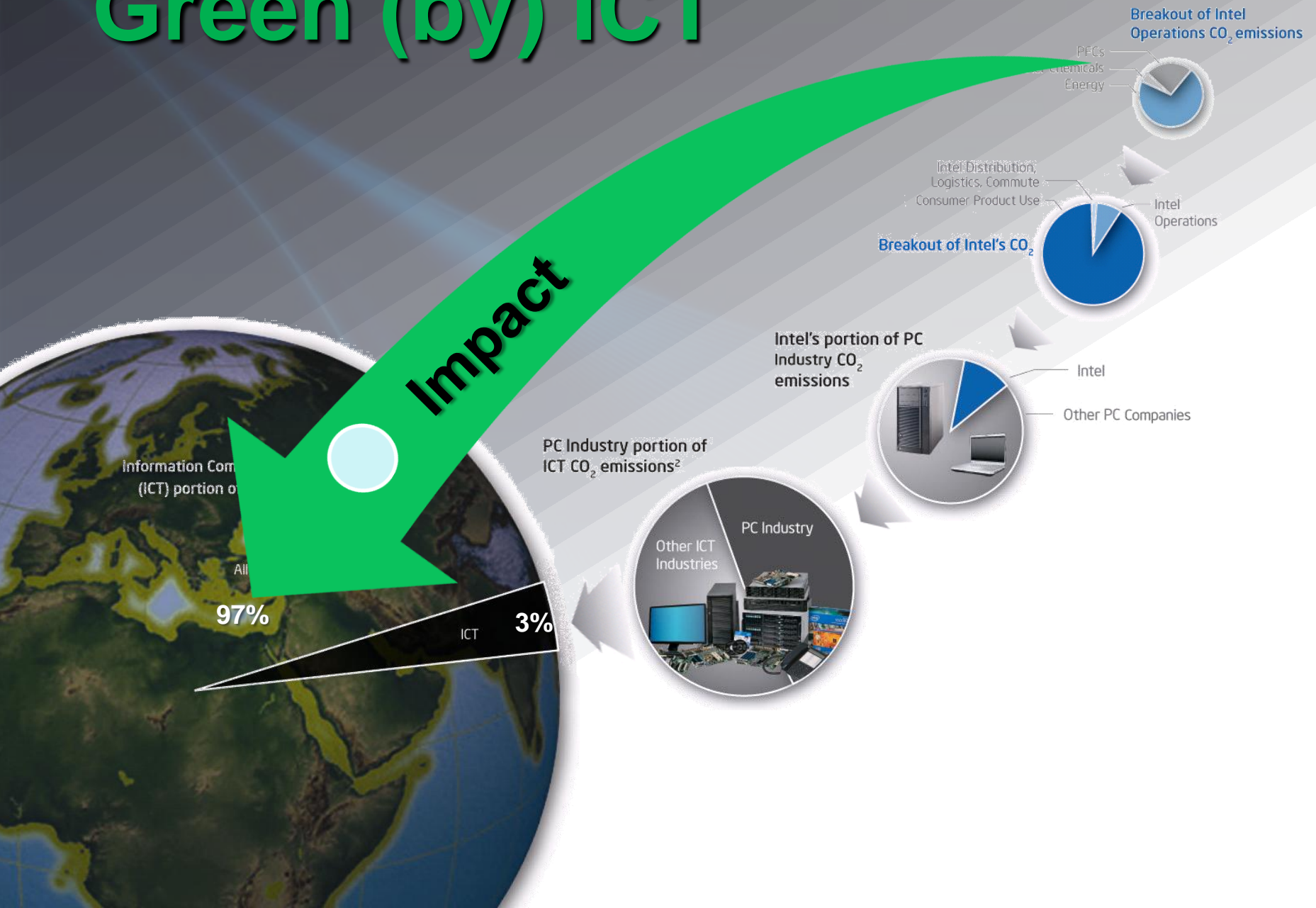
ICT leading sector in energy efficient improvements :

need to take advantage of this out-performance.



Source: "A Smarter Shade of Green," ACEEE Report for the Technology CEO Council, 2008.

# Green (by) ICT



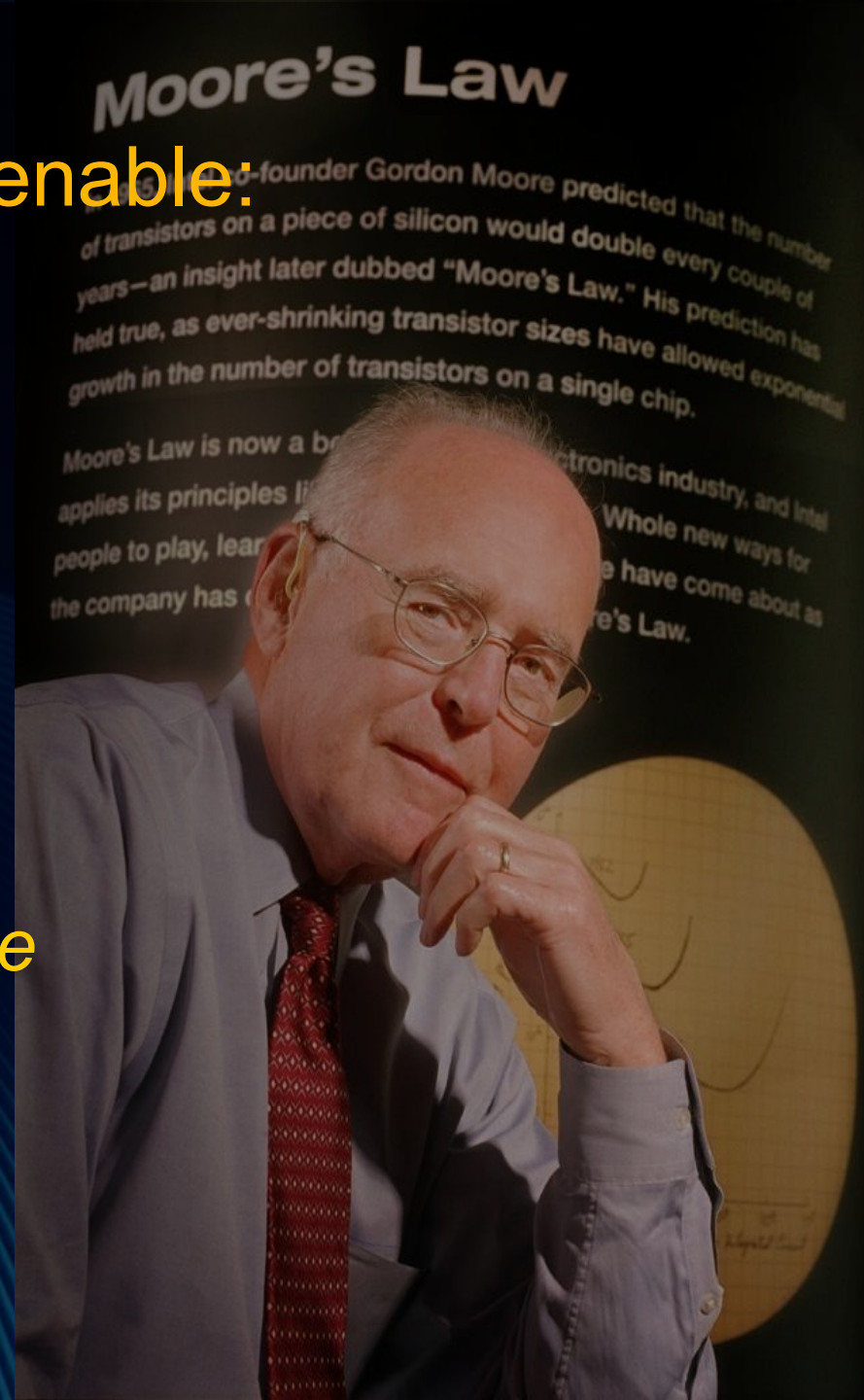


# Moore's Law continues to enable:

Mobile devices with  
Higher functionality & complexity

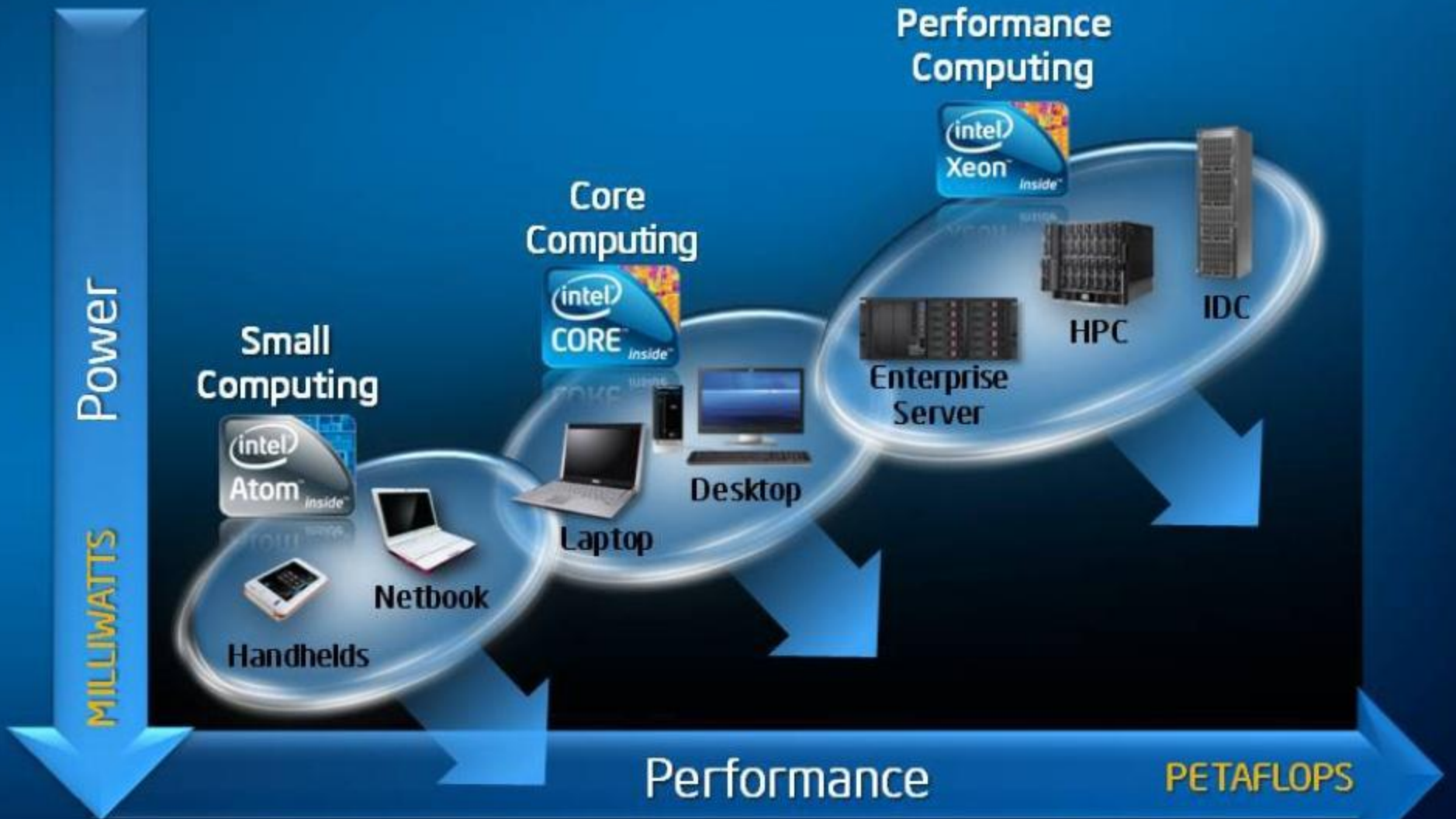
While controlling

*Power, cost, and size*



# Intel Architecture:

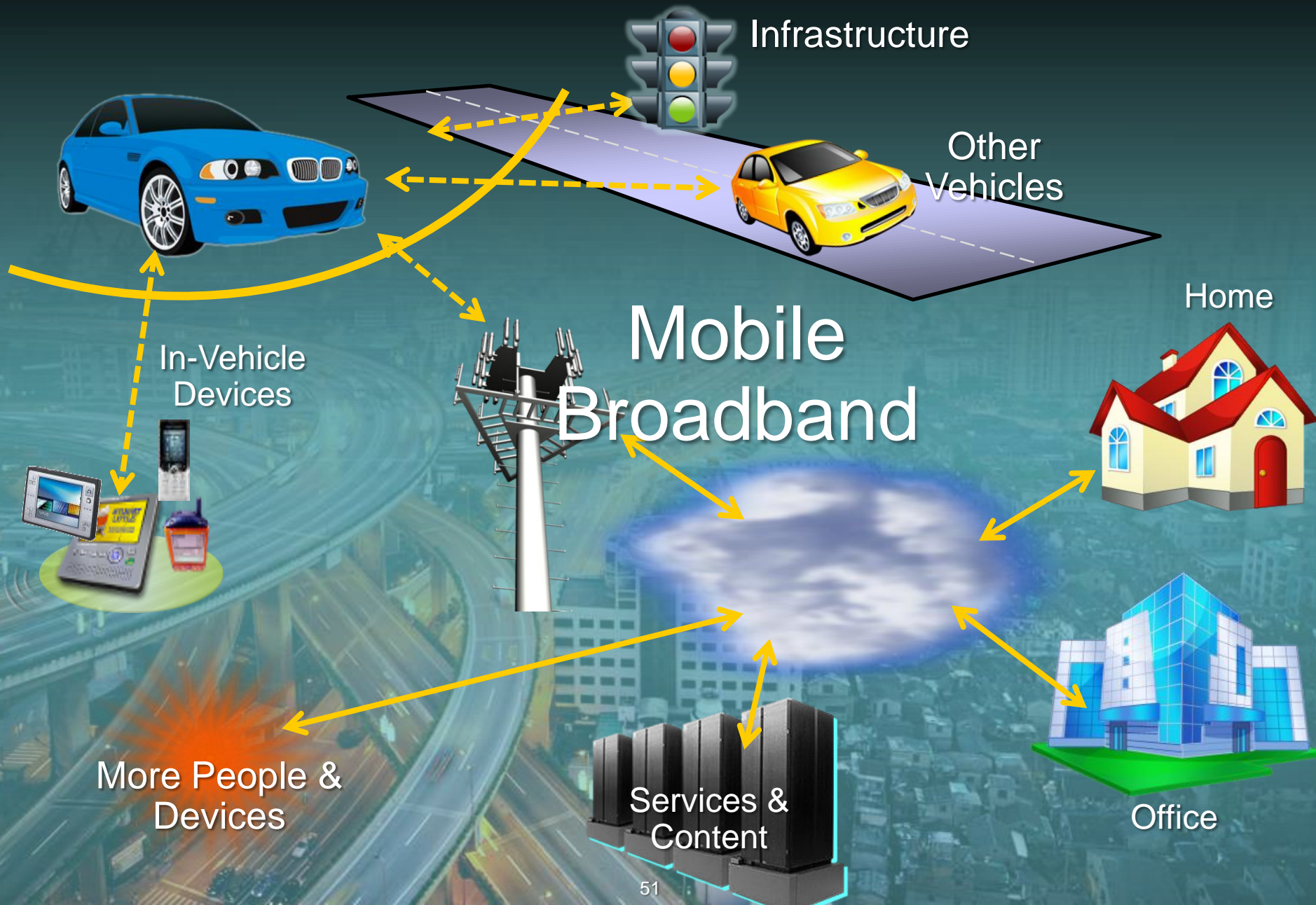
*Optimized Products from Milliwatts to Petaflops*



*More Performance, Lower Power Needed Across All Segments*



# Ex.: Vehicular Communications



# Ex.: Car-to-Car

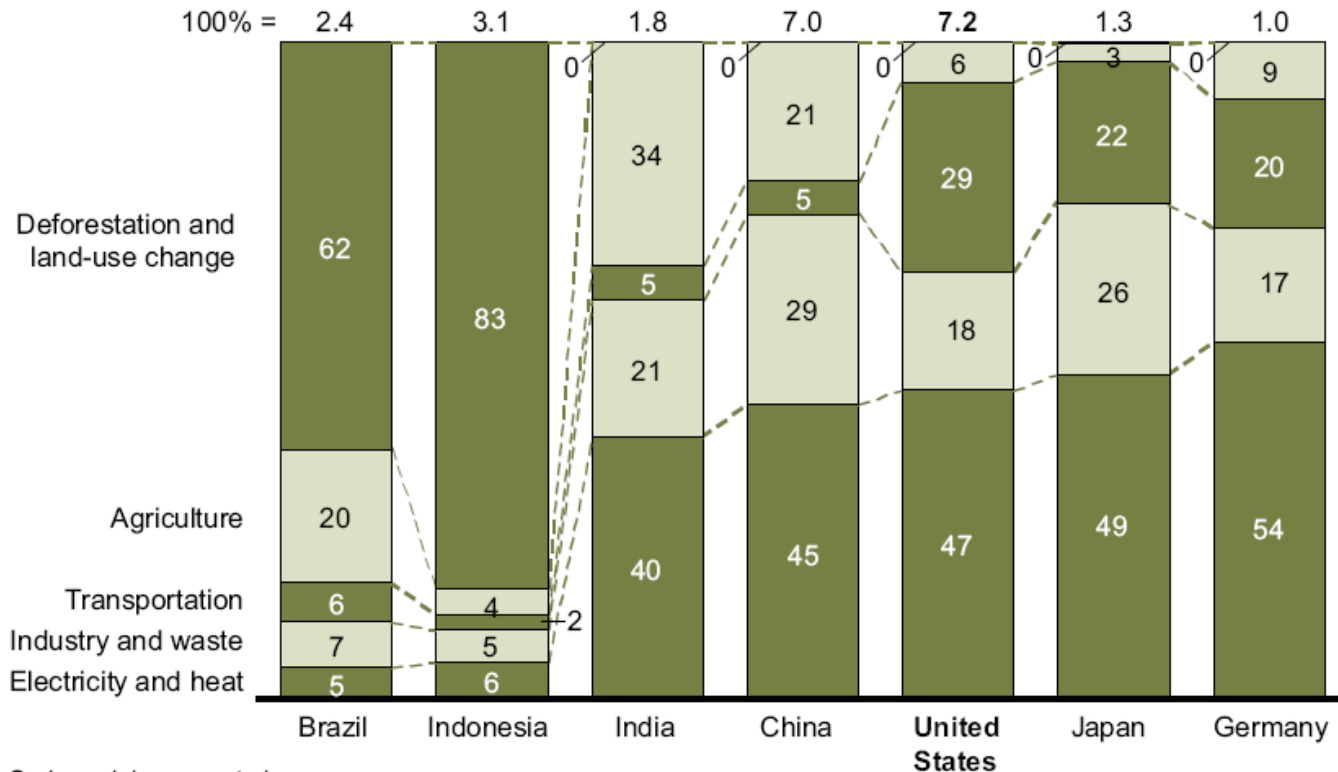


[www.car-to-car.org](http://www.car-to-car.org)

# Ex.: Green House Gases (GHG) Emissions

## GHG EMISSIONS PROFILES FOR SELECT COUNTRIES – 2005\*

Percent, Gigatons CO<sub>2</sub>e

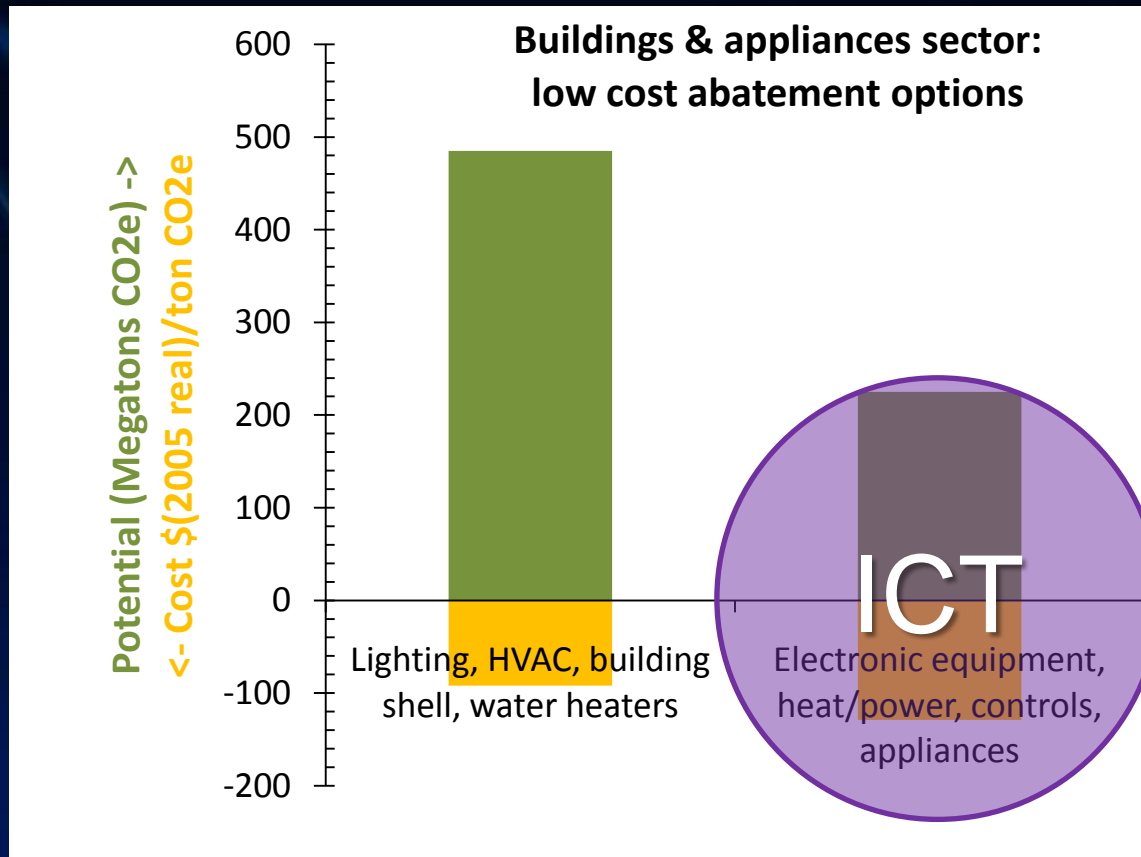


\* Carbon sinks are not shown

Source: UNFCCC, WRI, IEA, EPA, McKinsey analysis



# SMART buildings



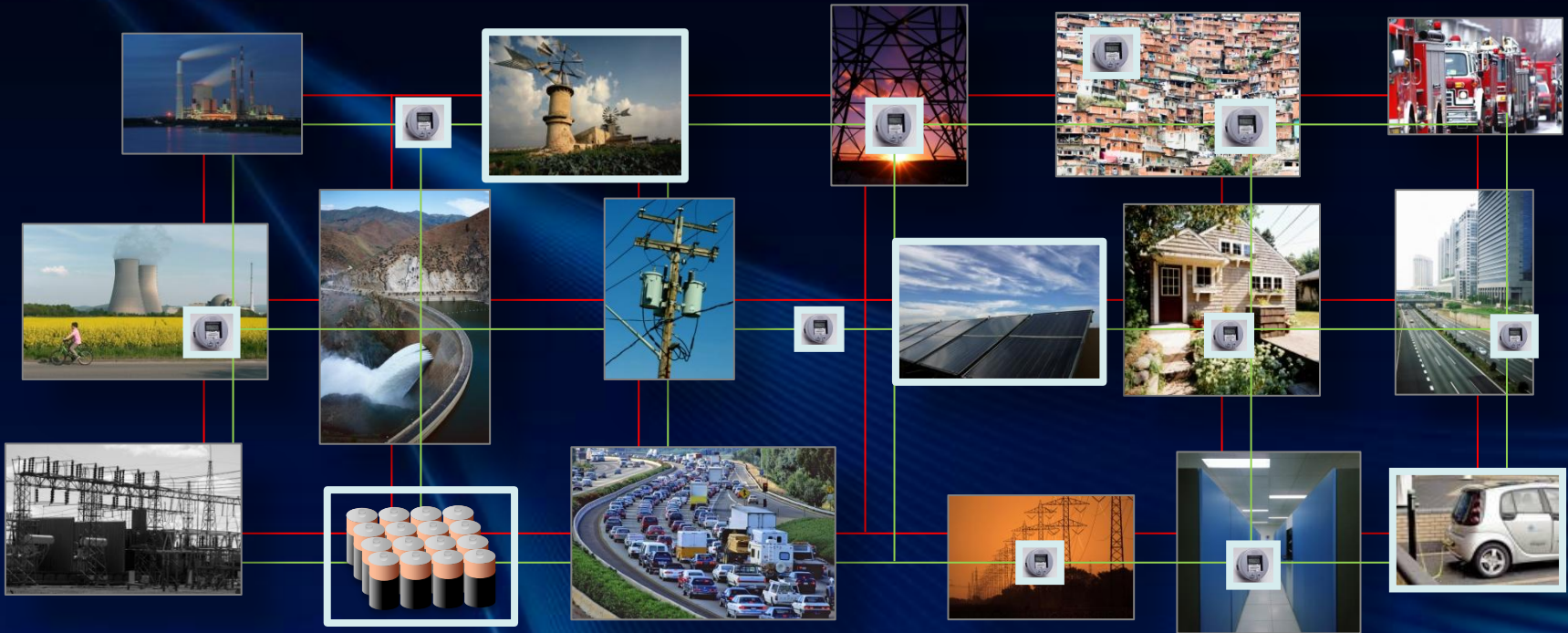
Intergovernmental Panel on Climate Change, 2007:

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



Adapted, with changes, from McKinsey & Company, "Unlocking Energy Efficiency in the U.S. Economy", 2009

# The SMART Grid



Generation

Transmission

Consumption

**SMART grid = SMART buildings + SMART power + SMART vehicles + ...**

**=> Energy storage, renewable sources, ...**

**=> Ubiquitous sensors, ICT, ...**



# Summary:

- We have great global and internal challenges ahead of us.
- These challenges also represent enormous opportunities for Informatics.
- Informatics needs to revise its past role and take the leadership role it was meant to have all along.







# The Path to a Better World will be paved By Informatics !

Prof. Dr. Mark Harris

Intel® Director Higher Education and Research EMEA

Senior Fellow International Entrepreneurship Academy

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# Questions ?



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Revenue and the gross margin percentage are affected by the timing of new Intel product introductions and the demand for and market acceptance of Intel's products; actions taken by Intel's competitors, including product offerings and introductions, marketing programs and pricing pressures and Intel's response to such actions; and Intel's ability to respond quickly to technological developments and to incorporate new features into its products. 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