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Global Energy Perspectives

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*Director-General, The Energy and
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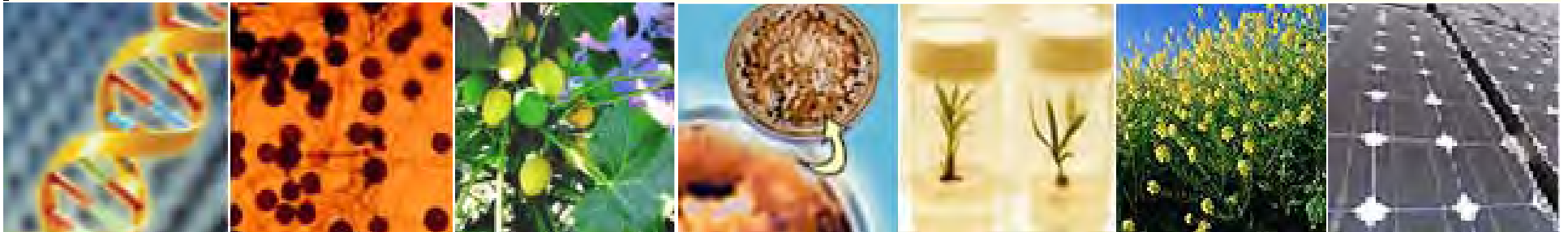
2010 Deloitte Energy Conference

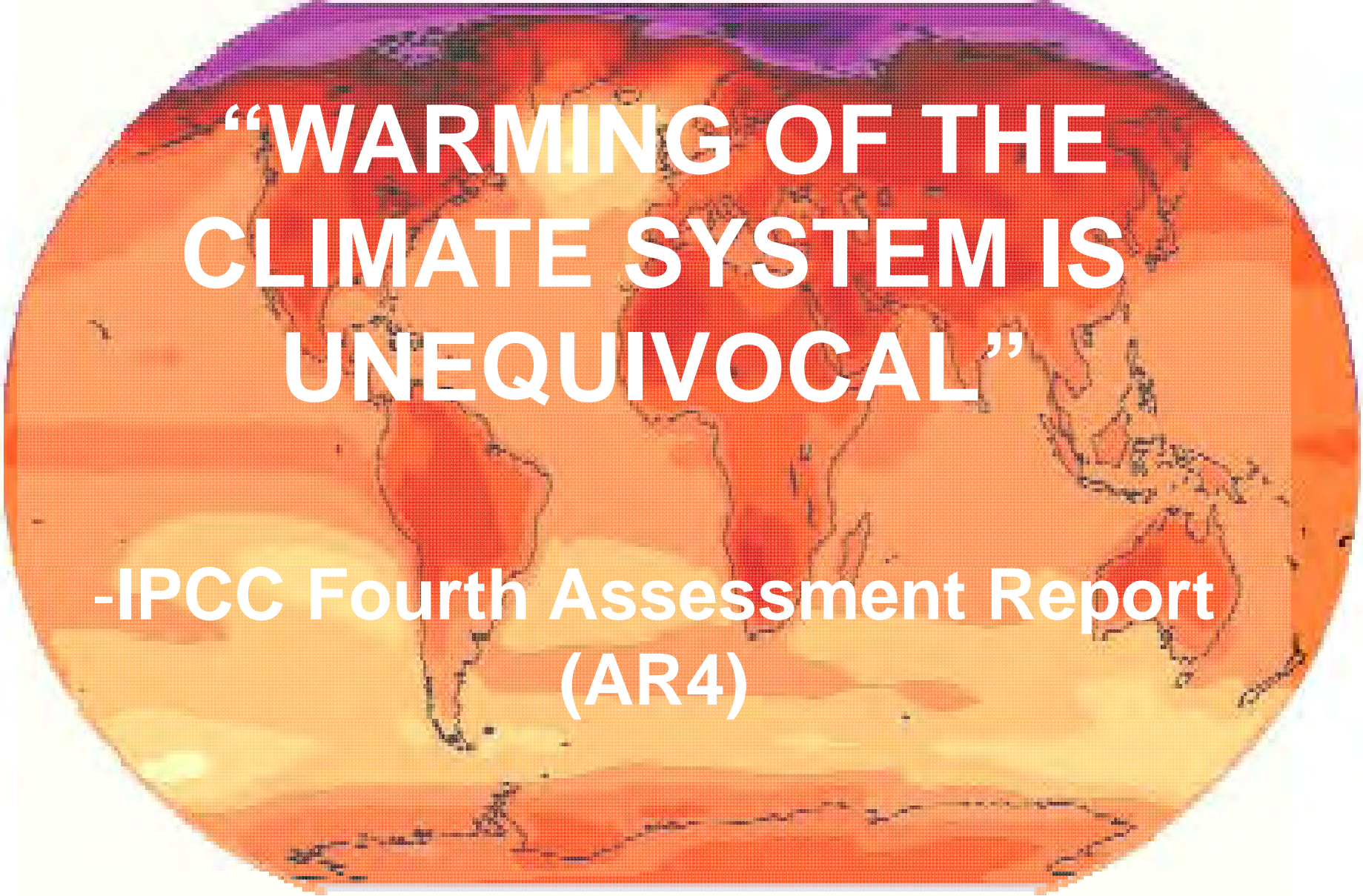
CHANGING THE GREAT GAME: CLIMATE, CUSTOMERS AND CAPITAL

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Chairman, Intergovernmental Panel on Climate Change
Director-General, The Energy and Resources Institute
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Washington D.C., USA
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A world map showing temperature anomalies. The map is color-coded, with the warmest areas (red and orange) concentrated in the mid-latitude regions, particularly over the North Atlantic and the North Pacific. The coldest areas (purple) are located in the high northern latitudes. The map is overlaid with a grid of latitude and longitude lines. The text is centered over the map.

**“WARMING OF THE
CLIMATE SYSTEM IS
UNEQUIVOCAL”**

**-IPCC Fourth Assessment Report
(AR4)**





OBSERVED CHANGES

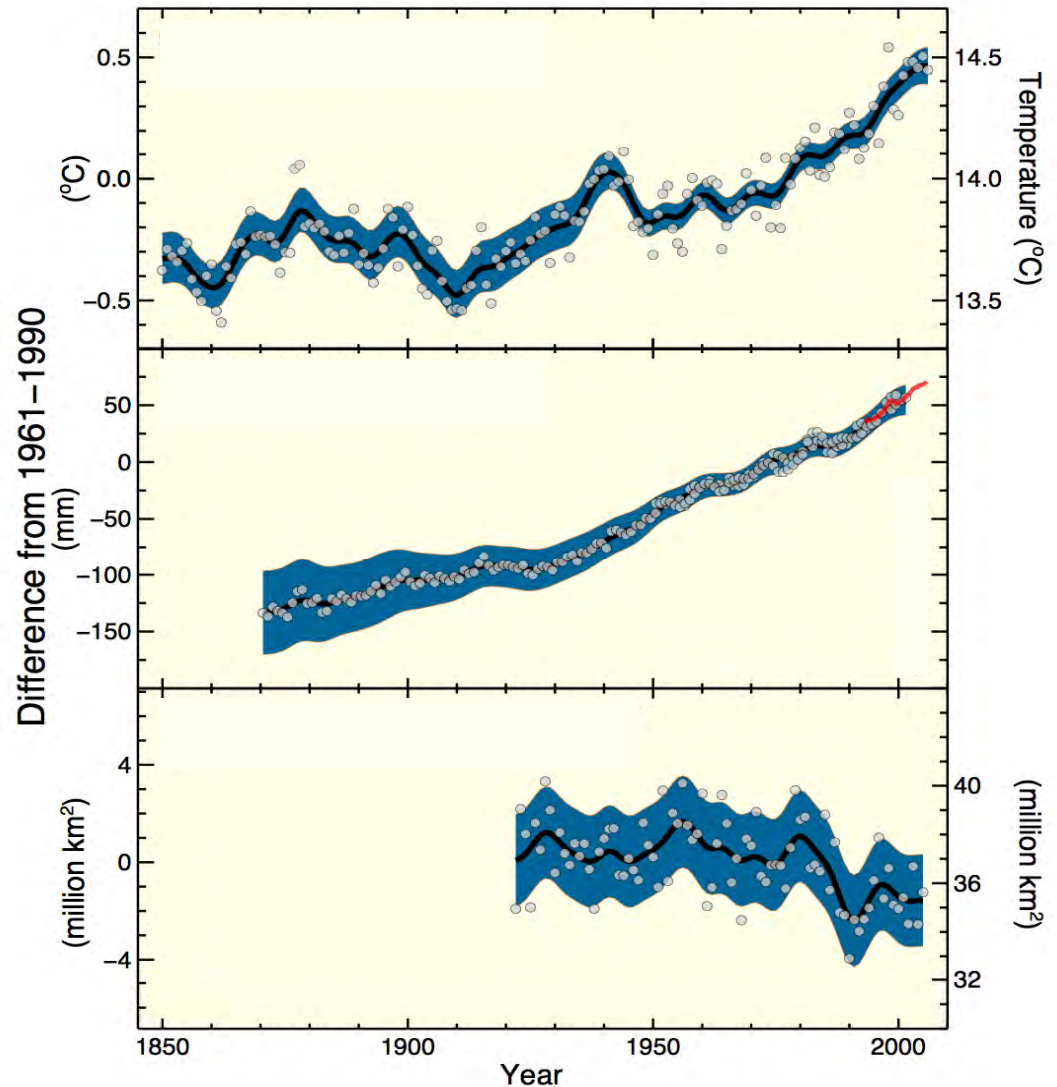
Global average temperature



Global average sea level



Northern hemisphere snow cover



Source: IPCC Fourth Assessment Report: Climate Change 2007

An aerial satellite-style photograph of a tropical cyclone over the North Atlantic. The storm features a well-defined eye and a dense, swirling cloud structure. The surrounding ocean is dark, and the landmasses are visible in the upper left and lower left corners.

**INTENSE TROPICAL CYCLONE ACTIVITY HAS
INCREASED IN THE NORTH ATLANTIC SINCE
ABOUT 1970**

- *Hurricane Katrina, 2005: up to \$200 billion cost estimate*

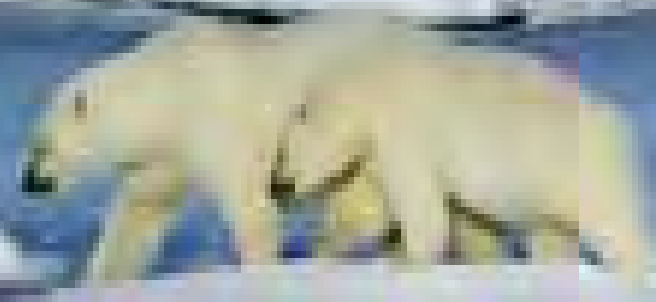
A photograph of a man riding a bicycle through a flooded street in Mumbai, India. The man is wearing a blue and white striped shirt, dark shorts, and a blue hat. He is carrying a large brown sack on his back. The street is wet and reflective, and the background shows buildings with closed shutters. The text is overlaid on the image.

**THE FREQUENCY OF HEAVY PRECIPITATION
EVENTS HAS INCREASED OVER MOST LAND
AREAS**

- *Rainfall in Mumbai (India), 2005: 1 million people lost their homes*

AVERAGE ARCTIC TEMPERATURES INCREASED AT ALMOST TWICE THE GLOBAL AVERAGE RATE IN THE PAST 100 YEARS

- Annual average arctic sea ice extent has shrunk by 2.7% per decade*





**HEAT WAVES HAVE BECOME MORE
FREQUENT OVER MOST LAND AREAS**

- Heat wave in Europe, 2003: 35 000 deaths

An aerial photograph of a traditional village, likely in a semi-arid region. The buildings are constructed from mud-brick and feature distinctive conical thatched roofs. The structures are arranged in a somewhat organized layout, with some larger rectangular buildings and many smaller, circular huts. The ground is dry and dusty, and there are several small trees scattered throughout the village. In the foreground, a large group of white sheep is gathered, and several people can be seen walking around. The overall scene depicts a rural, traditional settlement.

**MORE INTENSE AND LONGER DROUGHTS
HAVE BEEN OBSERVED OVER WIDER AREAS
SINCE THE 1970s, PARTICULARLY IN THE
TROPICS AND SUBTROPICS**



CHARACTERISTICS OF STABILIZATION SCENARIOS

POST-TAR STABILIZATION SCENARIOS

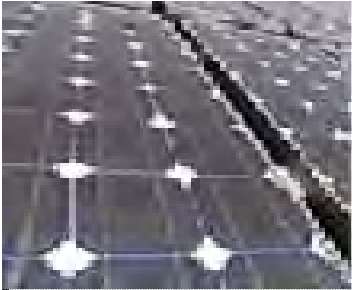
Stabilization level (ppm CO ₂ -eq)	Global mean temp. increase (°C)	Year CO ₂ needs to peak	Global sea level rise above pre-industrial from thermal expansion (m)
445 – 490	2.0 – 2.4	2000 – 2015	0.4 – 1.4
490 – 535	2.4 – 2.8	2000 – 2020	0.5 – 1.7
535 – 590	2.8 – 3.2	2010 – 2030	0.6 – 1.9
590 – 710	3.2 – 4.0	2020 – 2060	0.6 – 2.4

Source: IPCC Fourth Assessment Report: Climate Change 2007



All stabilization levels assessed can be achieved by deployment of a portfolio of **technologies that are currently available or expected to be commercialized** in coming decades

This assumes that **investment flows, technology transfer and incentives** are in place for technology development

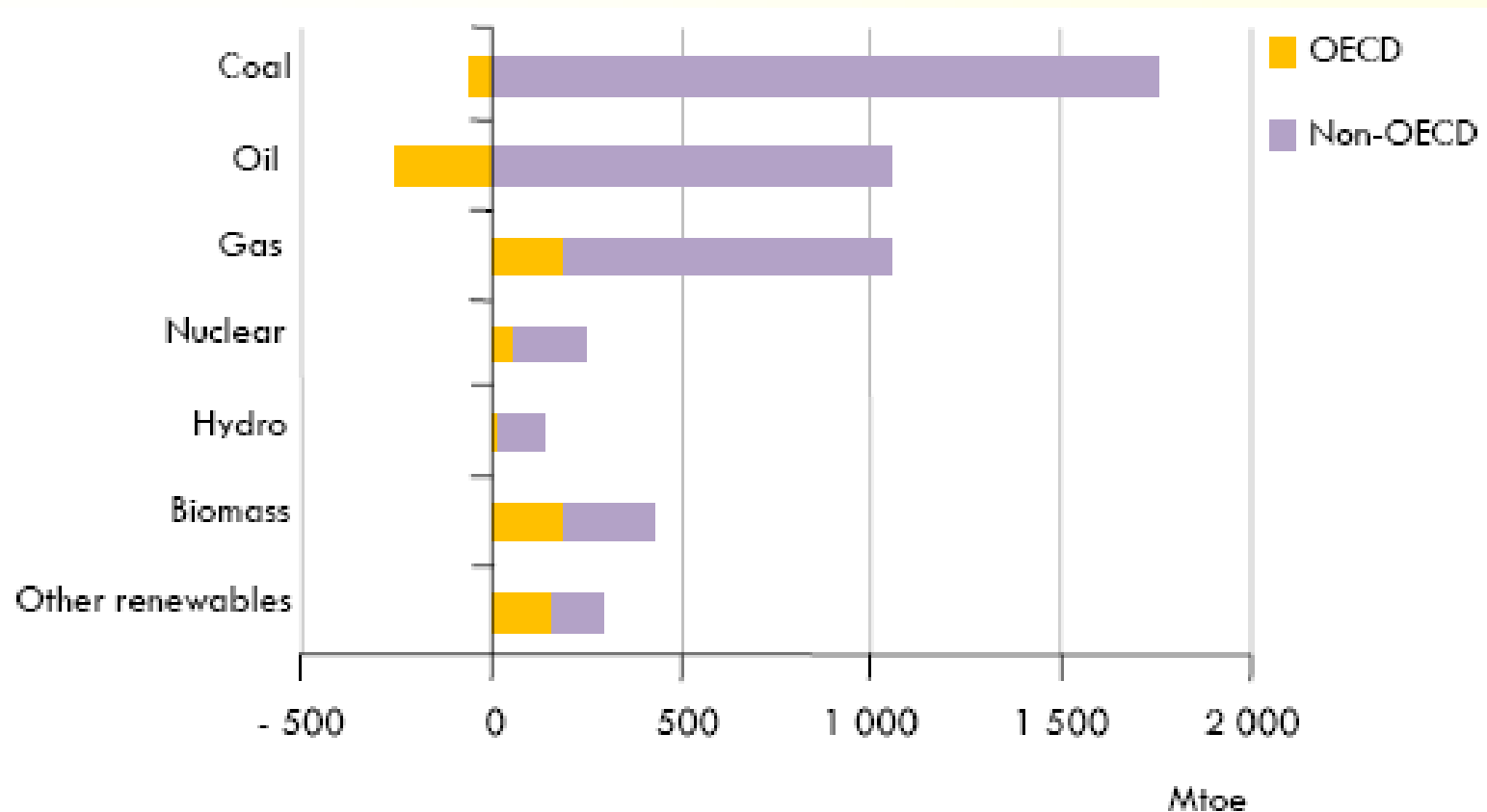


INVESTMENT NEEDS IN ENERGY

ENERGY, EMISSIONS AND MITIGATION

- 60-80% of GHG reductions would come from **energy supply & use and industrial processes**
- Initial estimates show that returning global energy-related CO₂ emissions to 2005 levels by 2030 would require a **large shift in investment patterns**, although the net additional investment required ranges from negligible to 5-10%
- This would be offset by the reduced investment requirements resulting from improved **end-use efficiency**

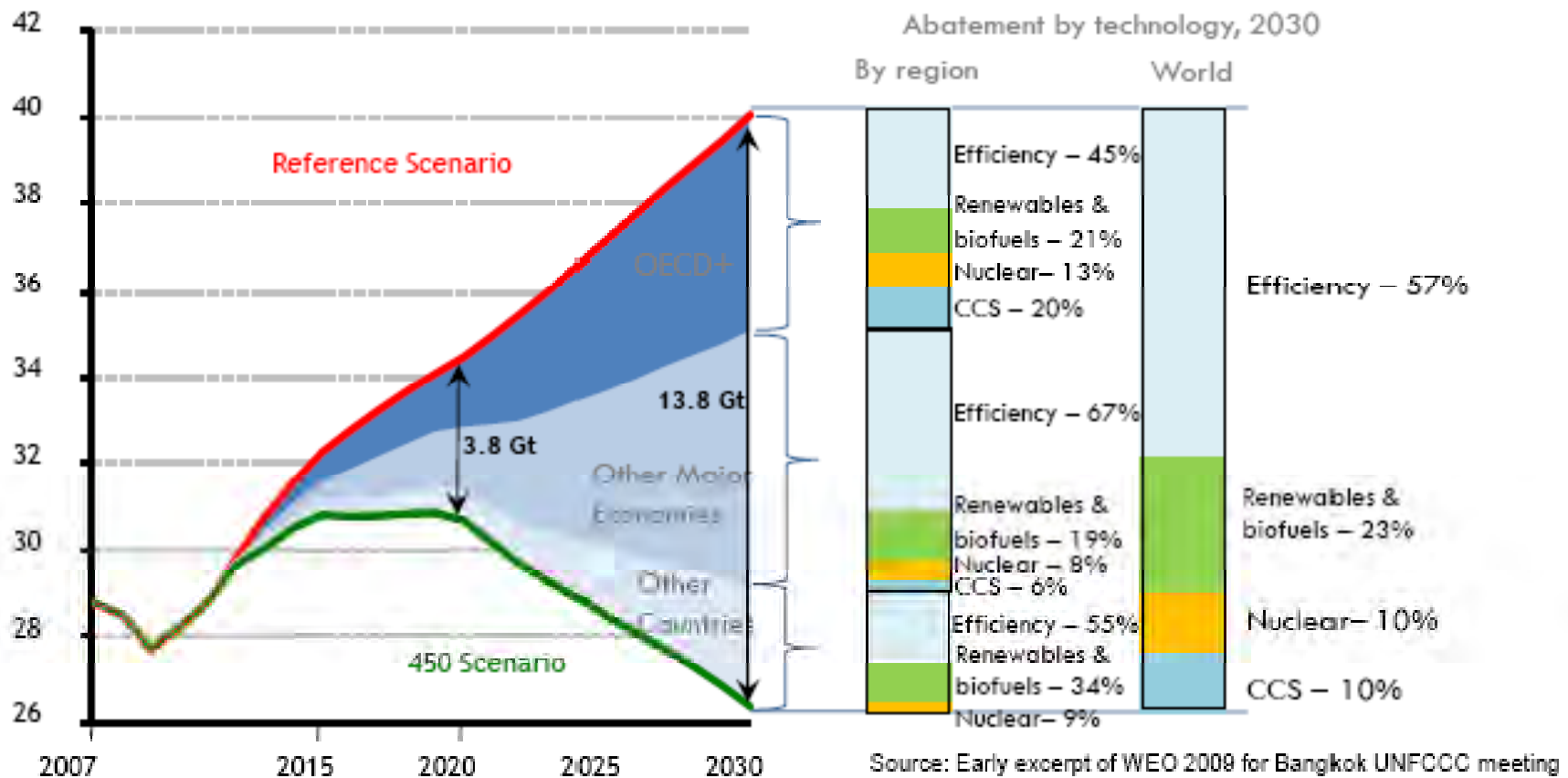
CHANGE IN PRIMARY ENERGY DEMAND BY REGION IN THE REFERENCE SCENARIO, 2007-2030



- **Non-OECD countries account for 93% of the increase in world primary energy demand & all of the growth in oil demand, which rises from 85 mb/d in 2008 to 105 mb/d in 2030**

Source: Dr. Nobuo Tanaka, Executive Director, IEA , Ninth Arab Energy Conference, Doha, 9 May

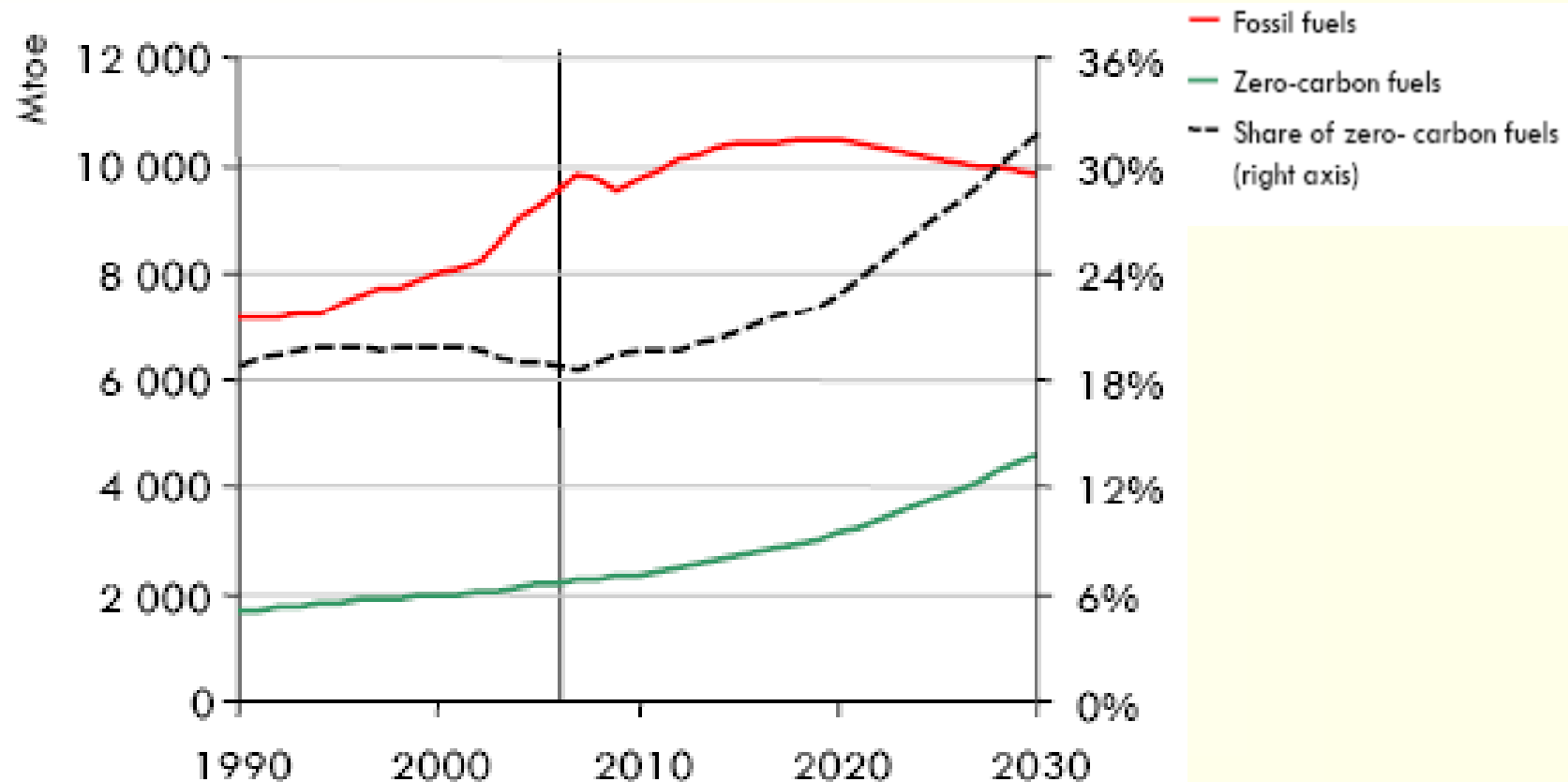
SUSTAINABLE ENERGY FUTURE: THE 450 SCENARIO



- Efficiency measures account for 2/3 of the 3.8Gt abatement in 2020. Renewables contribute 20%. With substantial abatement potential outside the OECD+ region, financing will hold a key to the energy sector meeting a 450 ppm trajectory**

Source: Dr. Nobuo Tanaka, Executive Director, IEA , Ninth Arab Energy Conference, Doha, 9 May

WORLD PRIMARY ENERGY DEMAND BY FUEL IN THE 450 SCENARIO



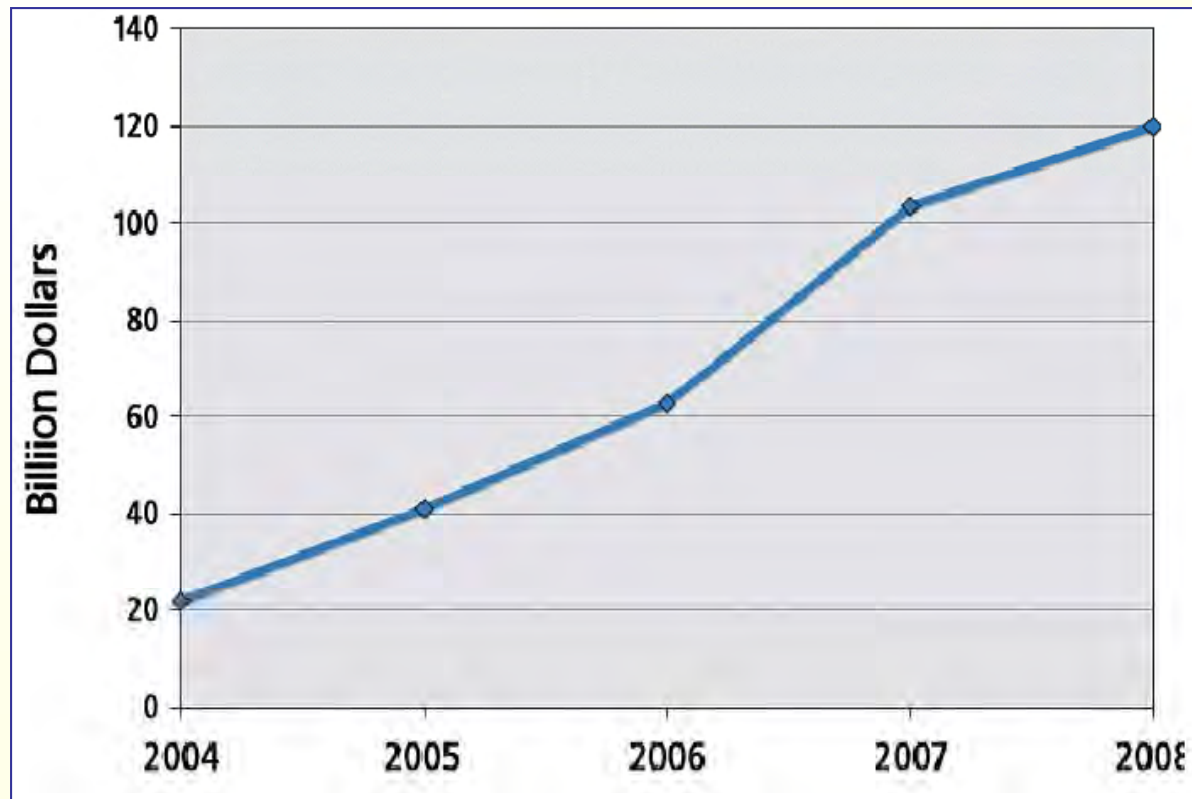
- ***In the 450 Scenario, demand for fossil fuels peaks by 2020, and by 2030 zero-carbon fuels make up a third of the world's primary sources of energy demand***

Source: Dr. Nobuo Tanaka, Executive Director, IEA , Ninth Arab Energy Conference, Doha, 9 May



RENEWABLE ENERGY

GLOBAL INVESTMENT IN 2004 - 2008

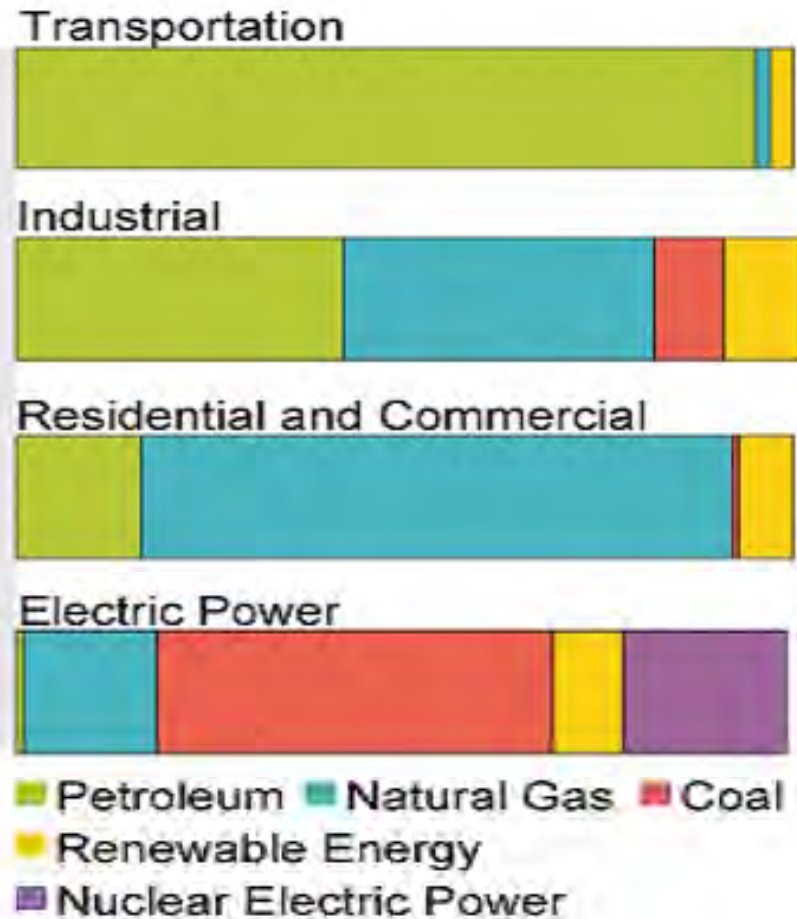
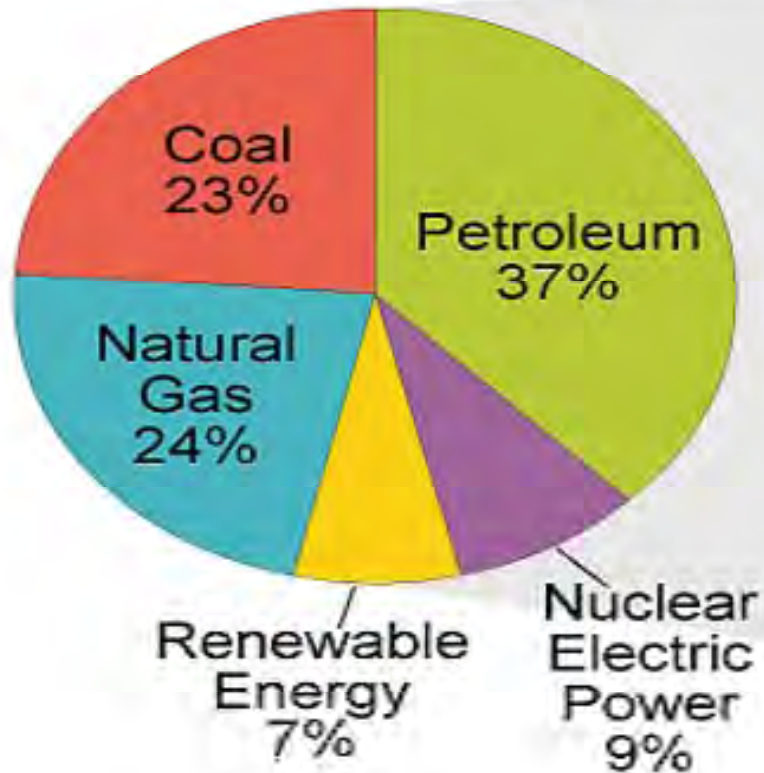


Source: REN21, Renewables Global Status Report: 2009 update



U.S. PRIMARY ENERGY CONSUMPTION, 2008

TOTAL US ENERGY = 99.3 QUADRILLION BTU



Source: Energy Information Administration, *Annual Energy Review 2008*, Tables 1.3, 2.1b-2.1f.



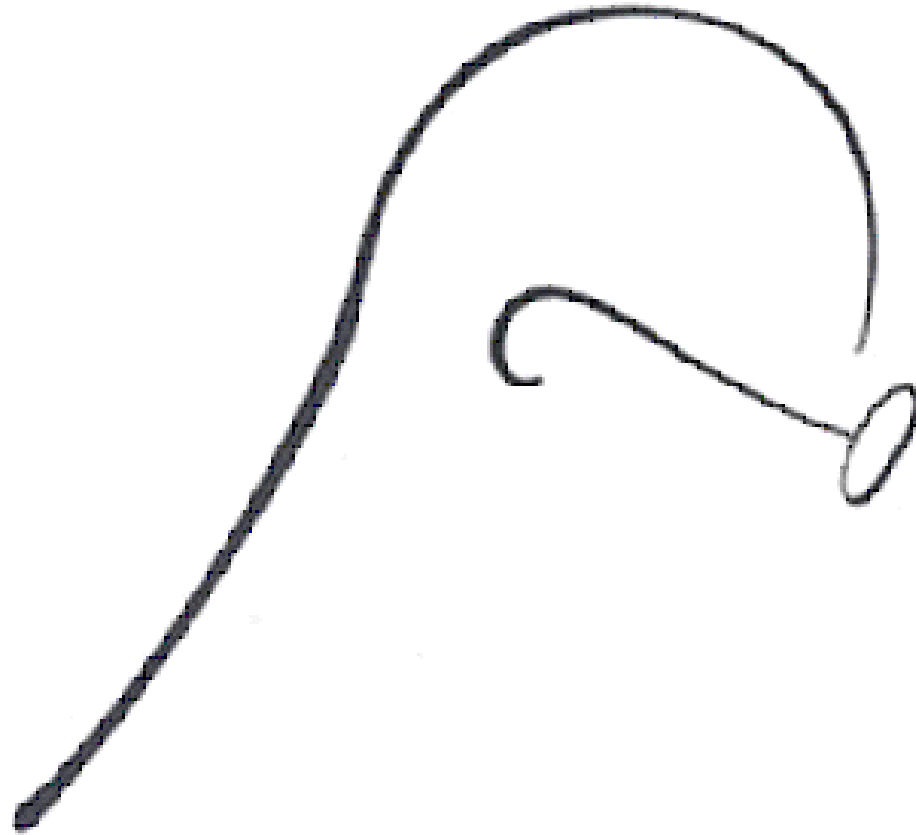
BEYOND TECHNOLOGY INNOVATION

INSTRUMENTS, POLICIES AND PRACTICES

The pace, cost and extent of our response to climate change **will depend critically** on the cost, performance, and availability of technologies

The move towards a low-carbon development pathway requires the adoption of adequate **measures**:

- Effective carbon-price signal
- Regulations, standards, taxes and charges
- Changes in lifestyle



A technological society has two choices. First it can wait until catastrophic failures expose systemic deficiencies, distortion and self-deceptions...

Secondly, a culture can provide social checks and balances to correct for systemic distortion prior to catastrophic failures.