Climate Change

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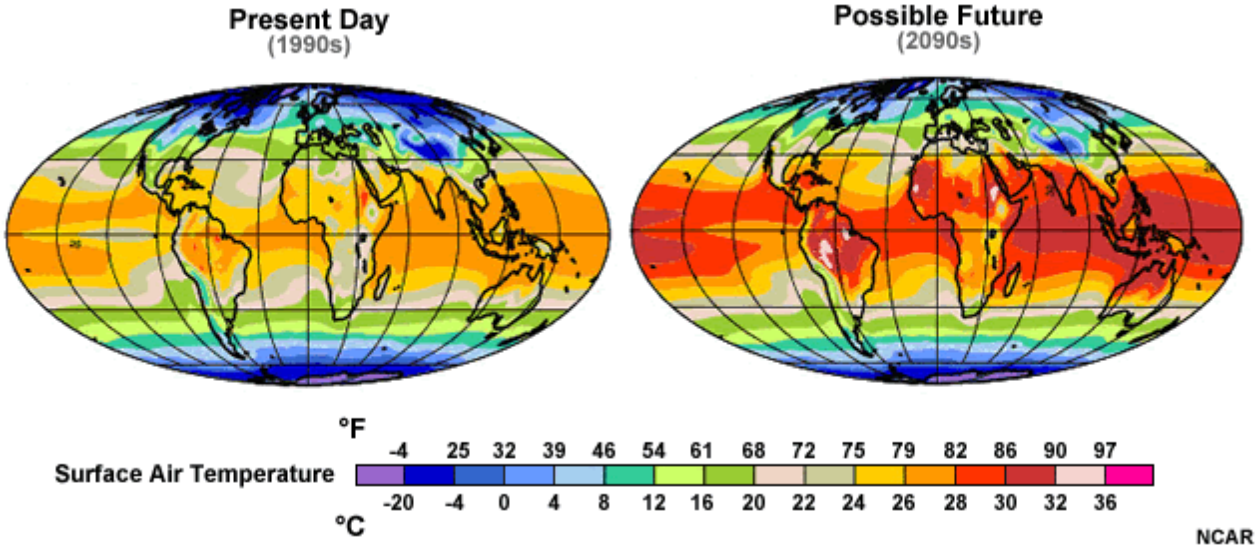
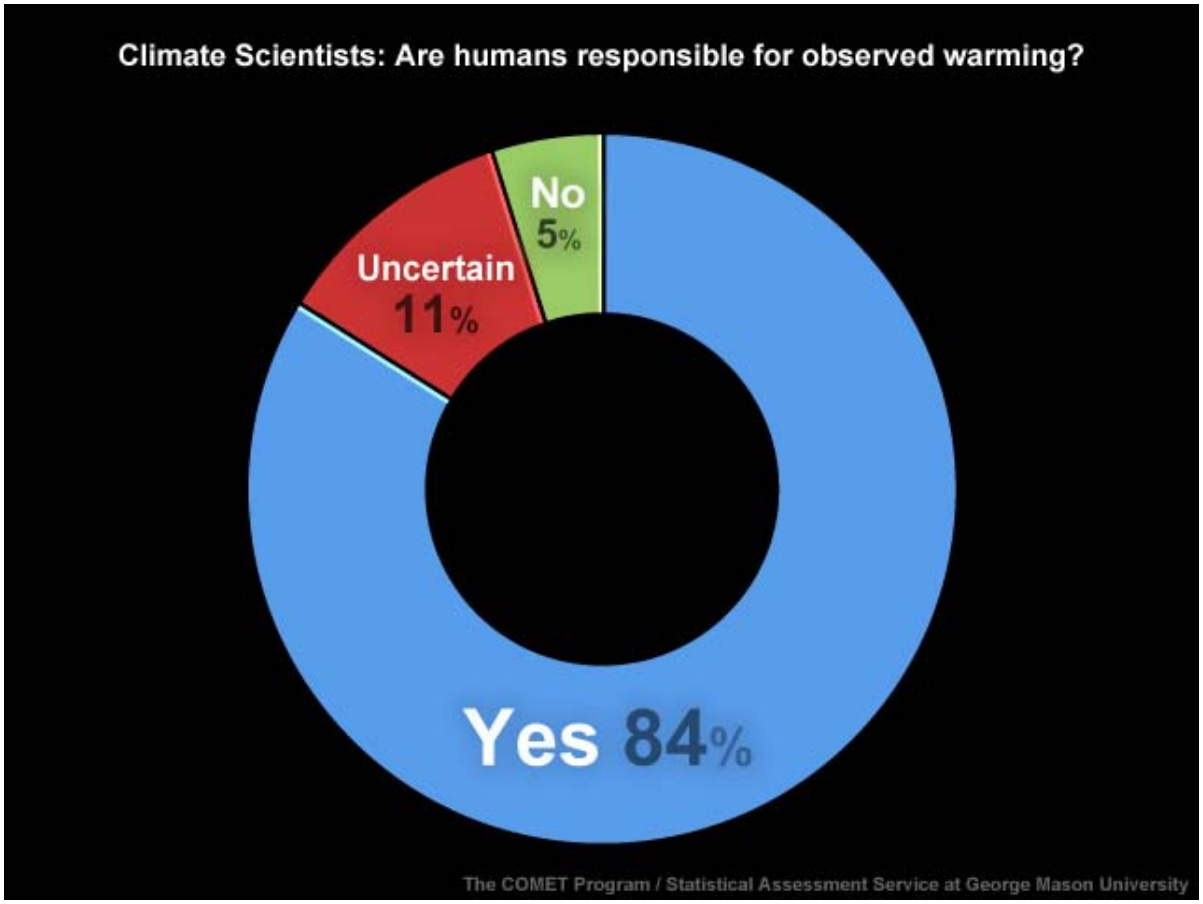
Why should we care?



- Climate change, manifested in the rise of earth's mean temperature, causes glaciers melting, sea-level rise, extreme weather patterns and other adverse phenomena, as documented by IPCC 2007 report.
- The increased concentration of GHGs, which brings global warming, is mainly caused by human activity, with global increase in carbon dioxide(CO2) as a result of fossil fuel use.

Climate scientists' opinion on climate change



IPCC assessment report

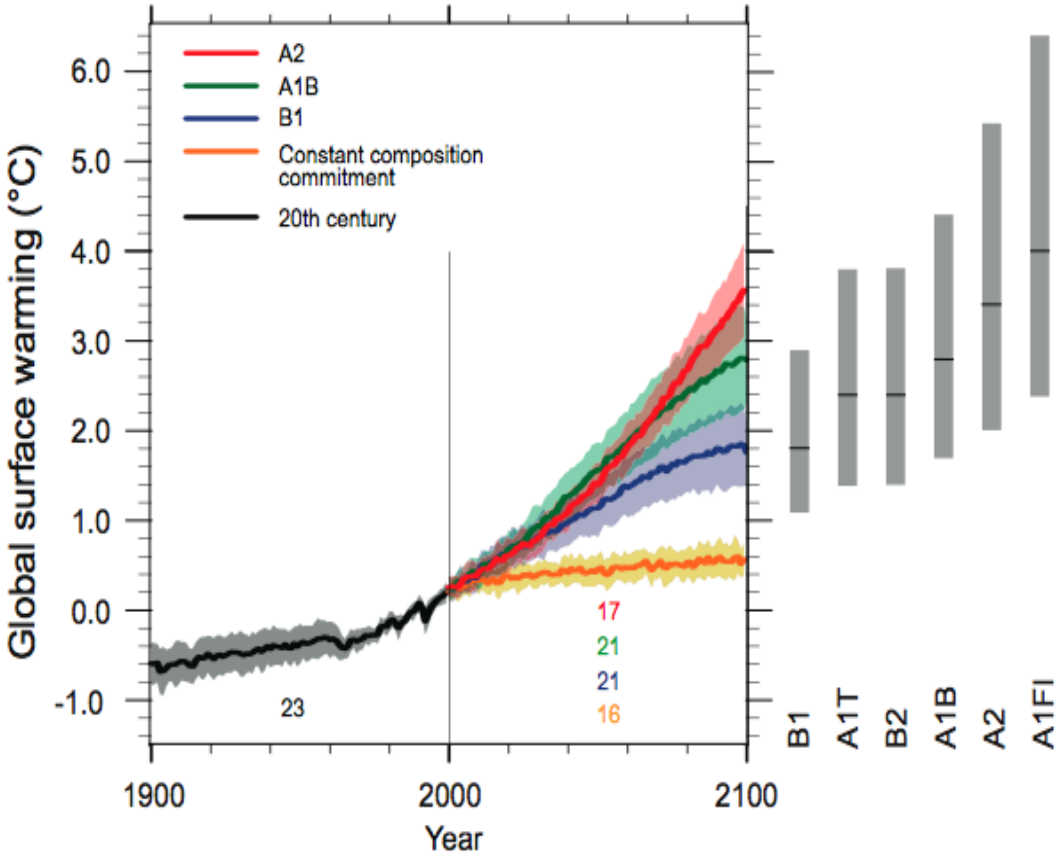
Table 1: Evolution of climate change and sustainable development in the IPCC

IPCC First Assessment Report (1AR; 1990)	IPCC Second Assessment Report (2AR; 1995)	IPCC Third Assessment Report (3AR; 2001)	IPCC Fourth Assessment Report (4AR; 2007)
Climate + impacts	Climate + impacts	Climate + impacts	Climate + impacts
Cost-effectiveness	Cost-effectiveness	Cost-effectiveness	Cost-effectiveness
	Equity	Equity	Equity
		Alternate development pathways	Alternate development pathways
			Sustainable development

- The IPCC was established in 1988 as a scientific advisory organ to the UNEP and World Meteorological Organization (WMO).
- IPCC has produced four assessment reports, and the coverage of climate change-sustainable development links began with the Third Assessment Report (3AR)

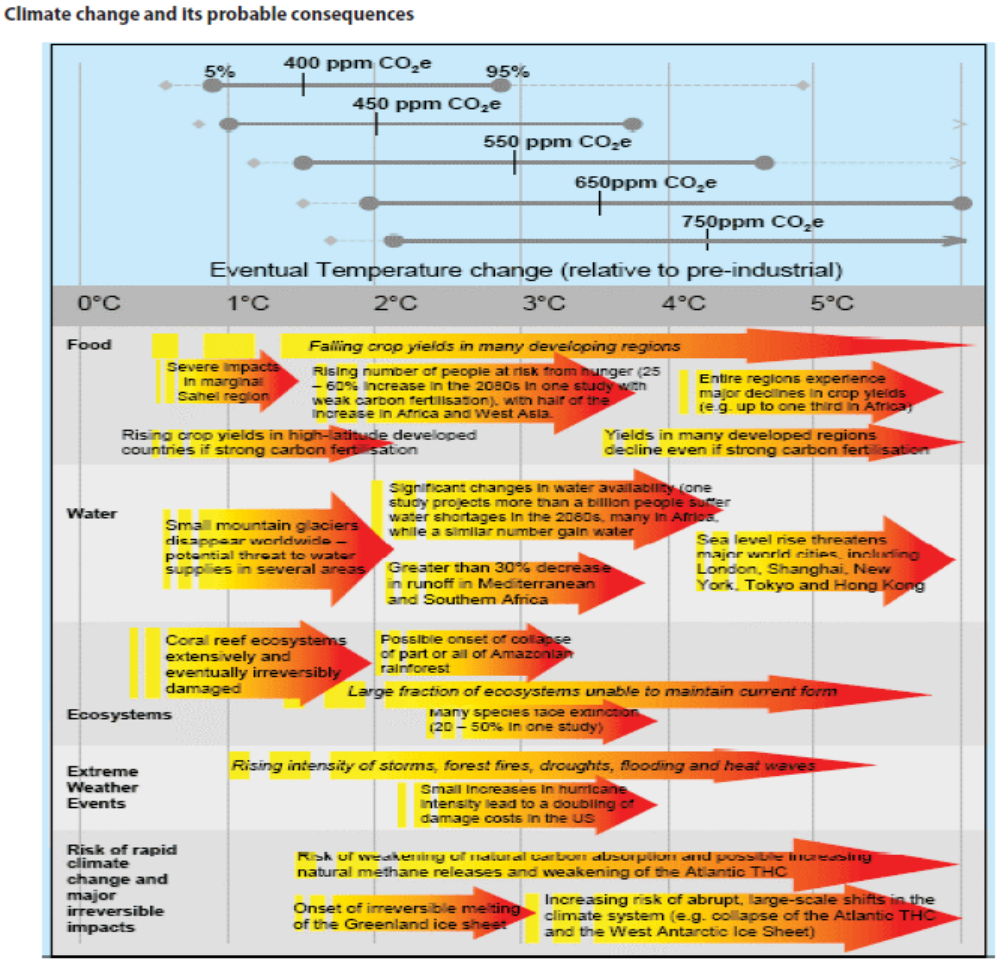
Projections of future changes in climate

low scenario (B1) is 1.8°C (*likely* range is 1.1°C to 2.9°C), and for high scenario (A1FI) is 4.0°C (*likely* range is 2.4°C to 6.4°C).



Climate change and its possible consequences

- This figure shows the relation between more GHGs and the types of impacts that could be experienced.
- The top panel shows the range of temperatures projected and the bottom panel illustrates the range of impacts expected at different levels of warming.
- This figure shows potential changes based on current scientific literature.



Now is the time to stabilize GHGs emissions

- The scientific community has considered an increase of 2 degree Celsius above the pre-industrial level as a threshold beyond which dramatic changes are likely.
- According to the Stern Review, current levels of GHGs in the atmosphere are 430 parts per million (ppm) of Co_2 as compared to 280 ppm before the Industrial Revolution.
- At the current rate of increase in the annual flow of emissions, the stock of GHGs in the atmosphere would reach double the pre-industrial level, namely 550 ppm before 2050.
- Climate change is one of the most urgent tasks to be tackled cooperatively in line with achieving internationally agreed development goals.

Climate change – a “defining issue of our era”

- UN Secretary-General Ban Ki-moon has called climate change a “defining issue of our era” stressing that

  - There is likely to be no single path or solution to all our problems.

  - New technologies, conservation and fuel efficiency programs, carbon-trading, improving land use practices, national environmental regulation all are part of the solution.

- Climate change should be coordinated with social and economic development in an integrated manner, taking account of the needs of developing countries for achieving sustained economic growth and the eradication of poverty.

Annual COP meeting to UNFCCC

- The Conference of Parties (COP) to the United Nation Framework Convention on Climate Change (UNFCCC) meet annually to discuss ways to fulfill the provisions of the Convention.

- **COP I – Berlin (1995)**
- **COP II – Geneva (1996)**
- **COP III – Kyoto (1997)**: the **Kyoto Protocol** is adopted
- **COP IV – Buenos Aires (1998)**
- **COP V – Bonn (1999)**
- **COP VI – the Hague and Bonn (2000)**
- **COP VII – Marrakesh (2001)**
- **COP VIII – New Delhi (2002)**
- **COP IX – Milan (2003)**
- **COP X – Buenos Aires (2004)**
- **COP XI/CMP I – Montreal (2005)**: the **Kyoto Protocol** takes effect
- **COP XII/CMP II – Nairobi (2006)**
- **COP XIII/CMP III – Bali (2007)**: **Bali Road Map** is adopted
- **COP XIV/CMP IV – Poznan (2008)**
- **COP XV/CMP V – Copenhagen (2009)**
- **COP XVI/CMP VI – Cancun (2010)**: the **Cancun Agreements** are adopted
- **COP XVII/CMP VII – Durban (2011)**: it is decided that the **second commitment period of the Kyoto Protocol** will begin on January 1, 2013. The **Durban Platform for Enhanced Action** is launched.

The challenge of stabilization

- The volume of carbon emissions depends on four factors: population size, per capita income, energy intensity and carbon intensity.

- The effect can be summed up in the following identity:

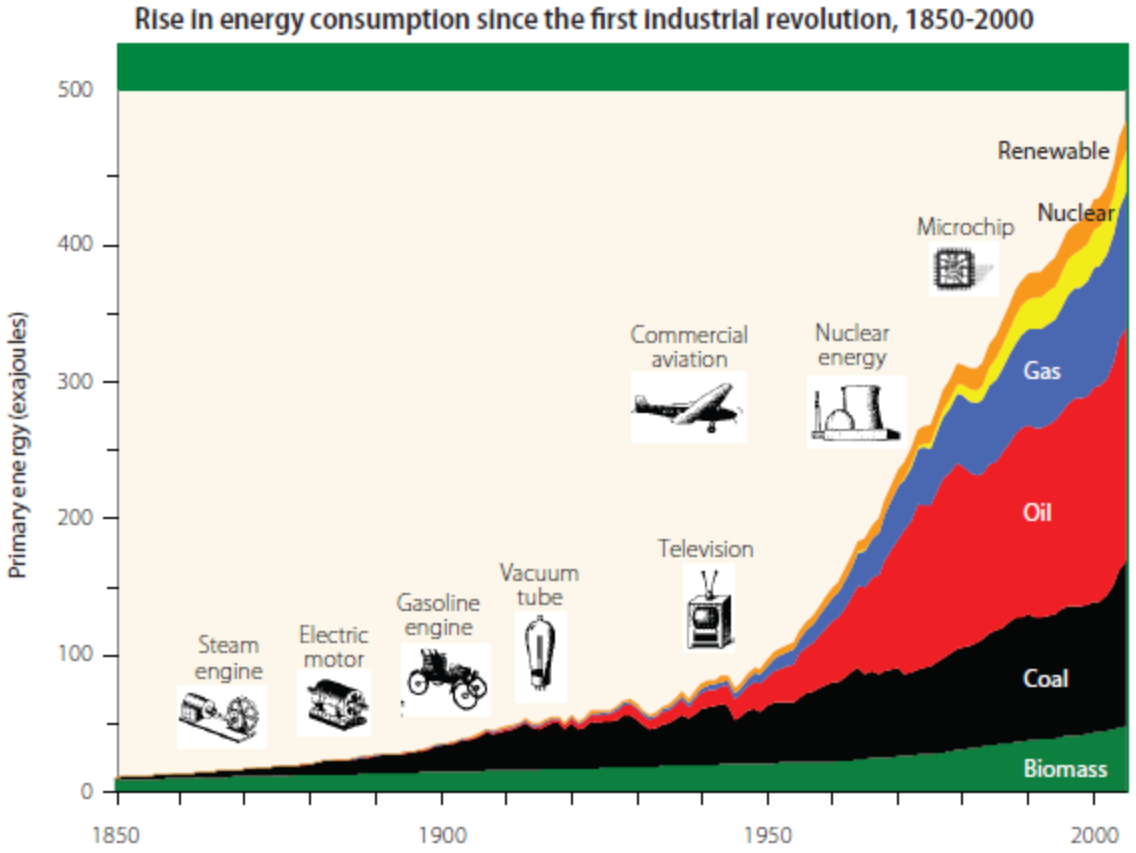
C = P * (Y/P) * (E/Y) * (C/E),

where C is carbon dioxide emissions, E is energy use, Y is GDP, and P is population. E/Y is “energy intensity of GDP” and C/E is “carbon intensity” of energy supply.

	Population (billions)	*GDP/capita (PPP$)*	*Energy intensity (MJ/$)*	*CO_2 intensity ($KgCO_2$/GJ)*	*CO_2 emissions ($GtCO_2$)*
2005 data	6.42	6 541	12.1	54.3	27.5
2100 projections	11.30	29 730	4.5	49.2	75.0
Measures needed for limiting atmospheric CO_2 concentration to 450 ppm	Little change possible, but final figure could be between 9 and 11 billion	Higher income considered desirable, but quality of growth would need to be improved	Major potential for change is in this area. Energy and carbon intensities need to be about 5 per cent of the projected numbers		~4.0

Source: IPCC Special Report 1994: Radioactive Forcing of Climate Change and An Evaluation of the IPCC IS92 Emissions Scenarios.

Rise in energy consumption, 1850-2000

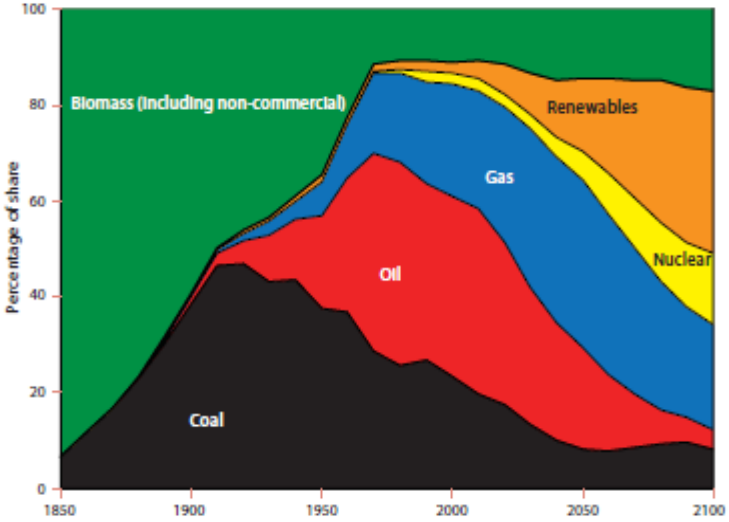


Source: United Nations(2009)

Towards a stabilization scenario

- 2 degree Celsius above pre-industrial level is the maximum allowable limit to prevent dangerous preventions in climate system
- This corresponds to a target GHG concentration of between 350 and 450 ppm , and global emission reduction of 50~80 percent over 1990 level by 2050.
- Figure 1 is consistent with a stabilization scenario, however it requires a break from the past policies, commitment to public investment, and a concerted international efforts

Figure 1. **Evolving energy system: Towards a low-emissions future**

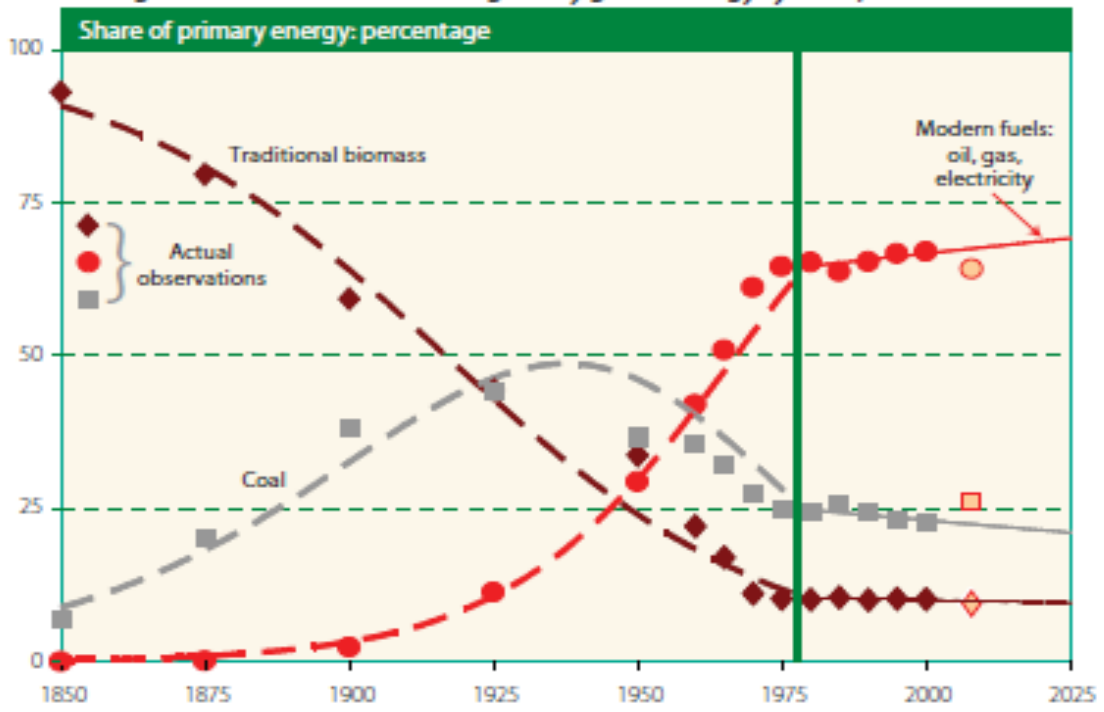


Source: United Nations, World Economic and Social Survey 2009: Promoting Development, Saving the Planet (http://www.un.org/esa/policy/wess/wess2009.pdf), based on Nakicenovic, N., and K. Riahi, eds. (2007). Technological Forecasting and Social Change, vol. 74, No. 7 (September).

Note: a. History and a possible future of the global energy system in IPCC's B1 stabilisation scenario showing relative shares of most important energy sources.

Two grand-scale transitions undergone by global energy systems, 1850-2008

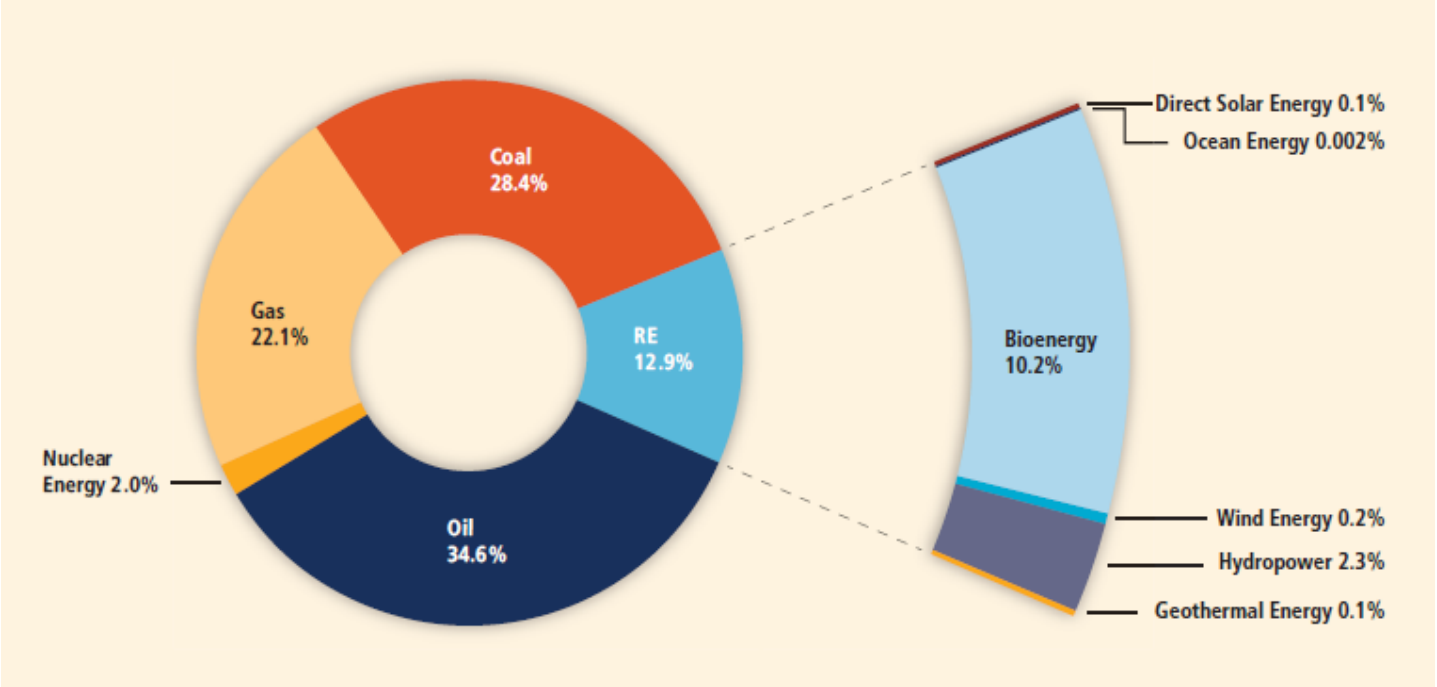
Figure II.3
Two grand-scale transitions undergone by global energy systems, 1850-2008



Sources: British Petroleum (2010); Grübler (2008); and International Energy Agency (2010a)

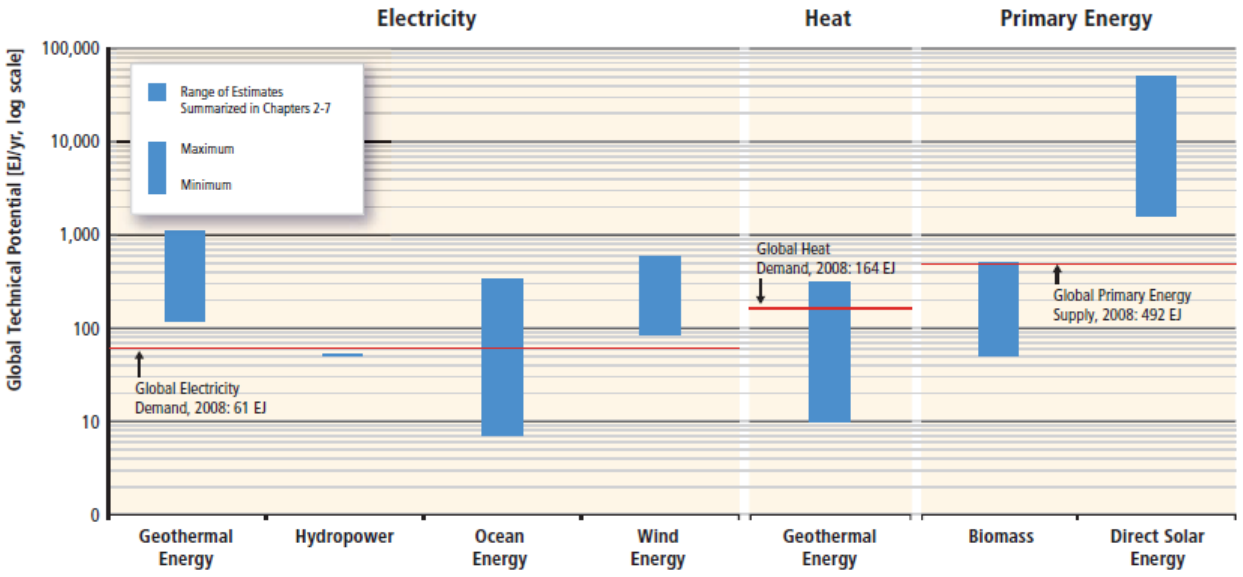
Note: The diamonds, dots and squares are actual data points, including estimated values for 2008. The broken lines are coupled logistic equations fitted on the data over the period 1850-1975.

Shares of energy sources in total global primary energy supply in 2008



Source: IPCC, Renewable Energy Sources and Climate Change Mitigation, 2011

Ranges of global technical potentials of RE sources derived from various studies



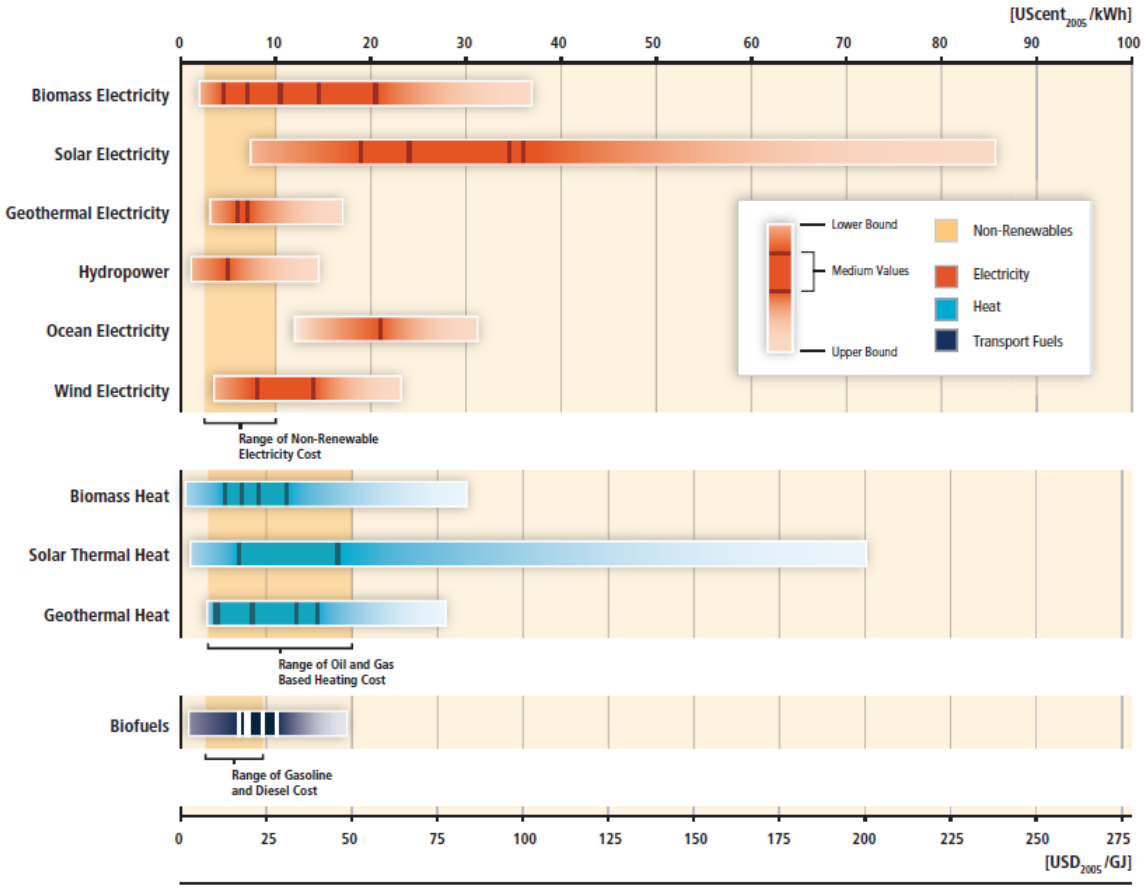
Range of Estimates of Global Technical Potentials

Max (in EJ/yr)	1109	52	331	580	312	500	49837
Min (in EJ/yr)	118	50	7	85	10	50	1575

Figure SPM.4 | Ranges of global technical potentials of RE sources derived from studies presented in Chapters 2 through 7. Biomass and solar are shown as primary energy due to their multiple uses; note that the figure is presented in logarithmic scale due to the wide range of assessed data. [Figure 1.17, 1.2.3]

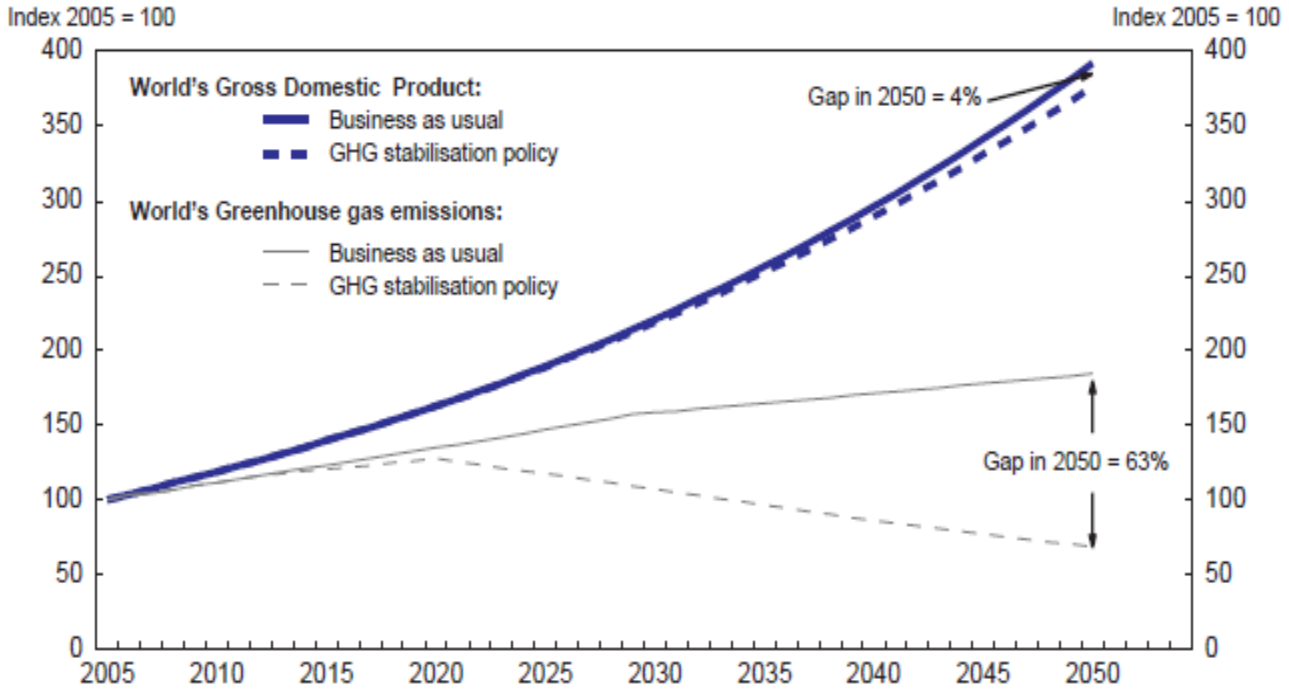
Source: IPCC, Renewable Energy Sources and Climate Change Mitigation, 2011

Range in recent levelized cost of energy for selected commercially available RE technologies



Source: IPCC, Renewable Energy Sources and Climate Change Mitigation, 2011

Economics of climate change mitigation



Source: OECD(2009), The Economics of Climate Change Mitigation.

GHGs emissions by region, 1990-2003

Emissions, population and GDP by region, 1990-2003

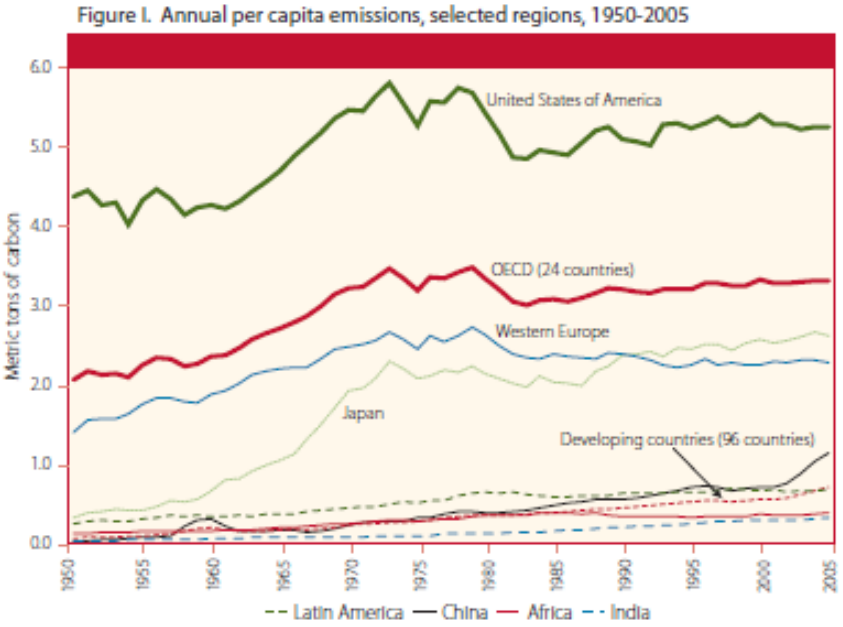
Region	*GtCO2 emissions 1990*	*GtCO2 emissions 2003*	*Population (millions) 1990*	*Population (millions) 2003*	*GDP (1990$ billions) 1990*	*GDP (1990$ billions) 2000*
Africa	0.6	0.9	636	868	425	645
Asia & Pacific	6.4	9.7	3,041	3641	6,119	9,154
Europe	8.2	6.8	800	823	7,814	9,904
Latin America & Caribbean	1.1	1.3	444	546	1,458	2,066
North America	5.5	6.4	283	325	7,591	11,097
Polar	-	-	-	-		
West Asia	0.4	0.8	75	111	(264)	440
Global	22.2	26.0	5,280	6,314	23,671	33,305

Source: Geodata, UNEP (http://geodata.grid.unep.ch)

- CO2 emissions per unit of GDP globally dropped by 15.9 per cent; in North America 19.5 per cent, and Western Europe 20 per cent. Among developing countries, Asia registered an increase of 1 per cent, and Latin America almost 17 per cent, while Africa dropped by 1.5%.
- Per capita emissions in 2003 were: North America 19.8 tCO2, Western Europe 9 tCO2, South Asia 1.2 tCO2, Central Asia 5.9 tCO2, and Central and Eastern Africa 1 tCO2.
- Equity is an essential factor in the global climate change regime, as reflected in the principle of “common but differentiated responsibilities and respective capabilities” in the UNFCCC.

Double inequity

- Even if the annual flow of carbon emissions could be stabilized at today's rate, the accumulated GHGs would double the pre-industrial level by 2050.
- This would cause a dangerous temperature rises, serious economic damage and destabilizing political consequences.
- The burden of projected damages will fall disproportionately on developing countries.
- Nicholas called this a "double inequity" because developing countries will be hit hard by global warming, while they are little responsible for the cause.



TRIPS agreement and transfer of climate-change-related technologies to developing countries

- The transfer of climate-change-related technologies to developing countries are not sufficient to aid these nations in mitigating and adapting to the effects of climate change.
- The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), in its current form, does not provide an appropriate environment for large-scale climate-change-related technology transfer to developing countries.
- Technologies that supply a “global public good” as climate-change-related technologies do, merit special treatment under TRIPS and other trade agreements.

Source: UN DESA Working paper No. 71.