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# Energy and climate: acting with urgency

Presentation in Buenos Aires

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# Main themes

- Challenge of moving to a low carbon economy, the urgency of action, and the reality of where we are now in political and energy terms.
- Slow progress. Vital to understand the convenience of fossil fuels and the inconvenience of renewable energies and nuclear, and inertia in energy use.
- Transport trauma. Solutions ranging from CNG, electric cars and biofuels.
- Policy options – persuasion, regulation, price penalties, subsidies. The best mix.
- Finance. Clean energy revolution puts more financial burden onus on consumers. So need for governments to help with subsidies/ tax credits as well as role in ensuring infrastructure and funding R & D.
- Parallel problems of economic competitiveness and energy security.
- The European example – what does it tell us about the difficulty of a mixed group of developed and developing countries coping with the energy/climate challenge?
- Climate justice and burden-sharing. Developed countries bear most responsibility for stock of old GHGs, but are proving incapable of united action or, in the US case, of any action. Developing countries increasingly account for the flow of new GHGs. They may not take responsibility for this, but some are acting responsibly.

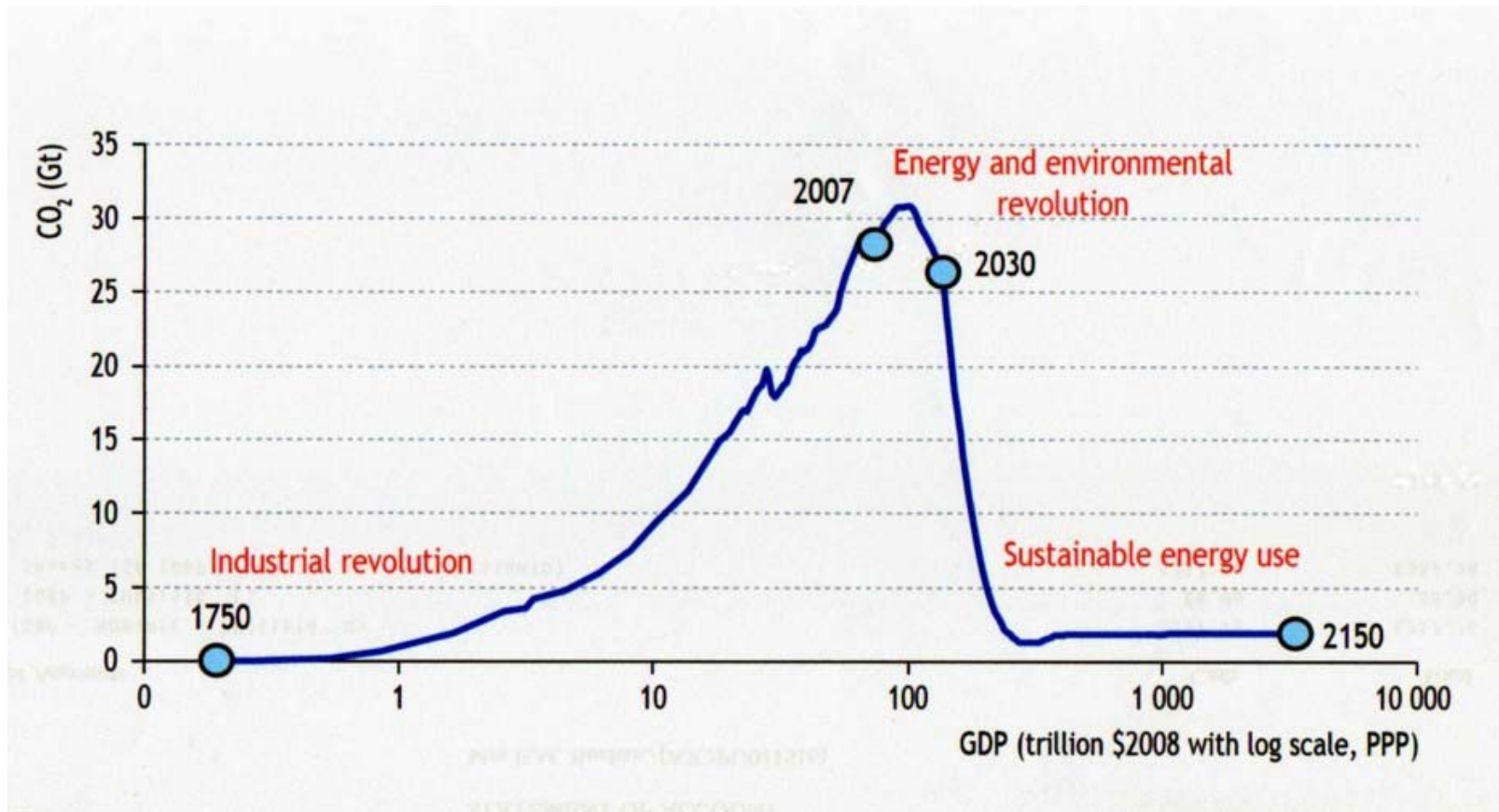


# The three drivers of energy use

- Population. Today 6.8 billion people, by 2050 9.2 billion. Two-way link between energy and population. Energy has helped increase population growth as well as other way around. Climate change could reduce the population violently, better to have responsible voluntary birth control policy.
- Wealth. Basically the richer you are, the more energy you use. Energy use stabilises at a certain (high) level of income, but this stabilisation point is above the level which China and India are expected to reach soon.
- Mobility. Defining feature of our globalised economy and way of life. But car sales in China have been increasing at over 30% a year. The \$1,000 car has been introduced in India. Air traffic has expanded with liberalisation and the creation of budget airlines. Aviation is the fastest growing source of GHGs of any sector.
- These factors make it hard to decouple the growth in energy consumption from growth in the economy.



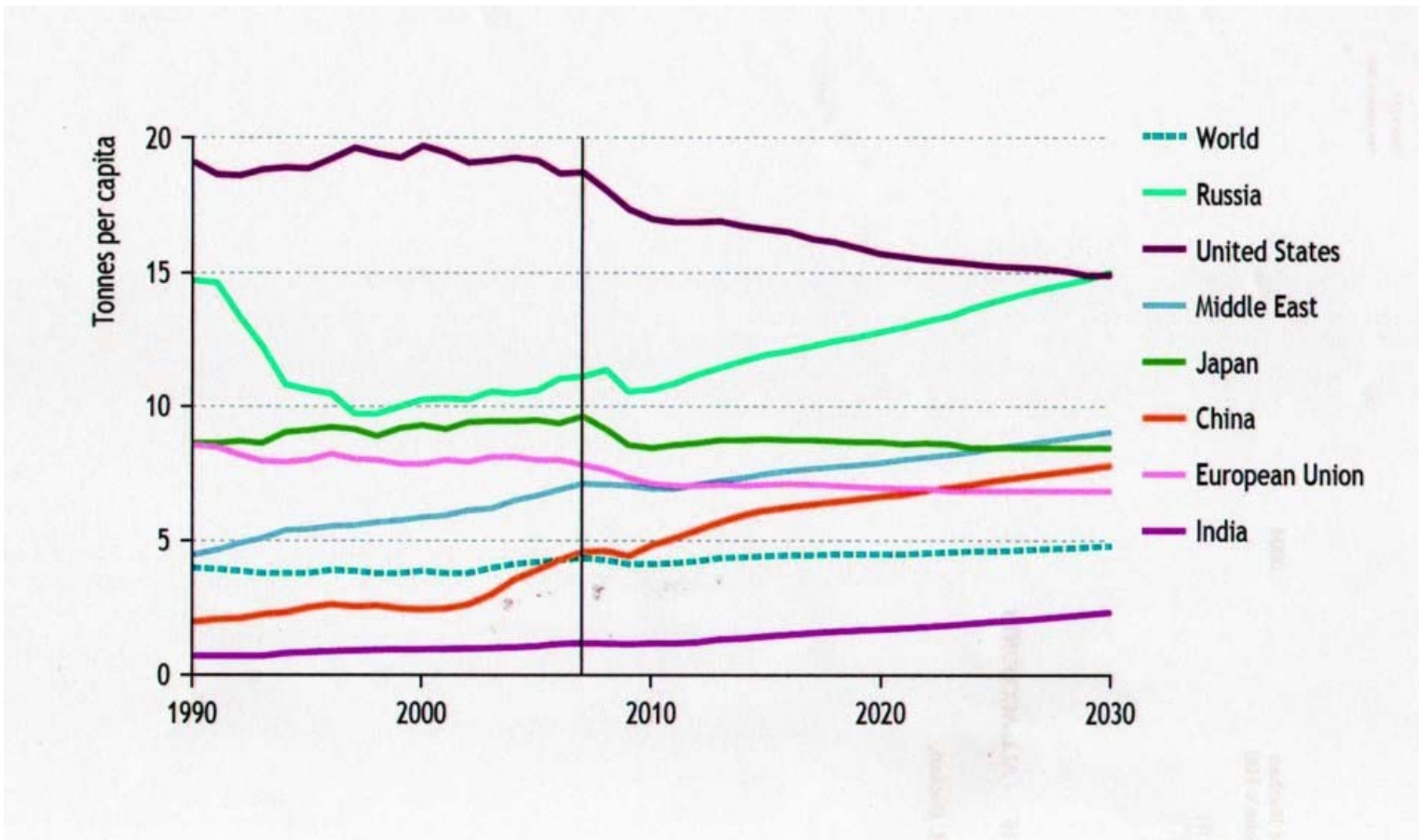
# Historic link between Co2 and economic output & future pathway to keeping within 2 degrees rise



Source: International Energy Agency, WEO 2009



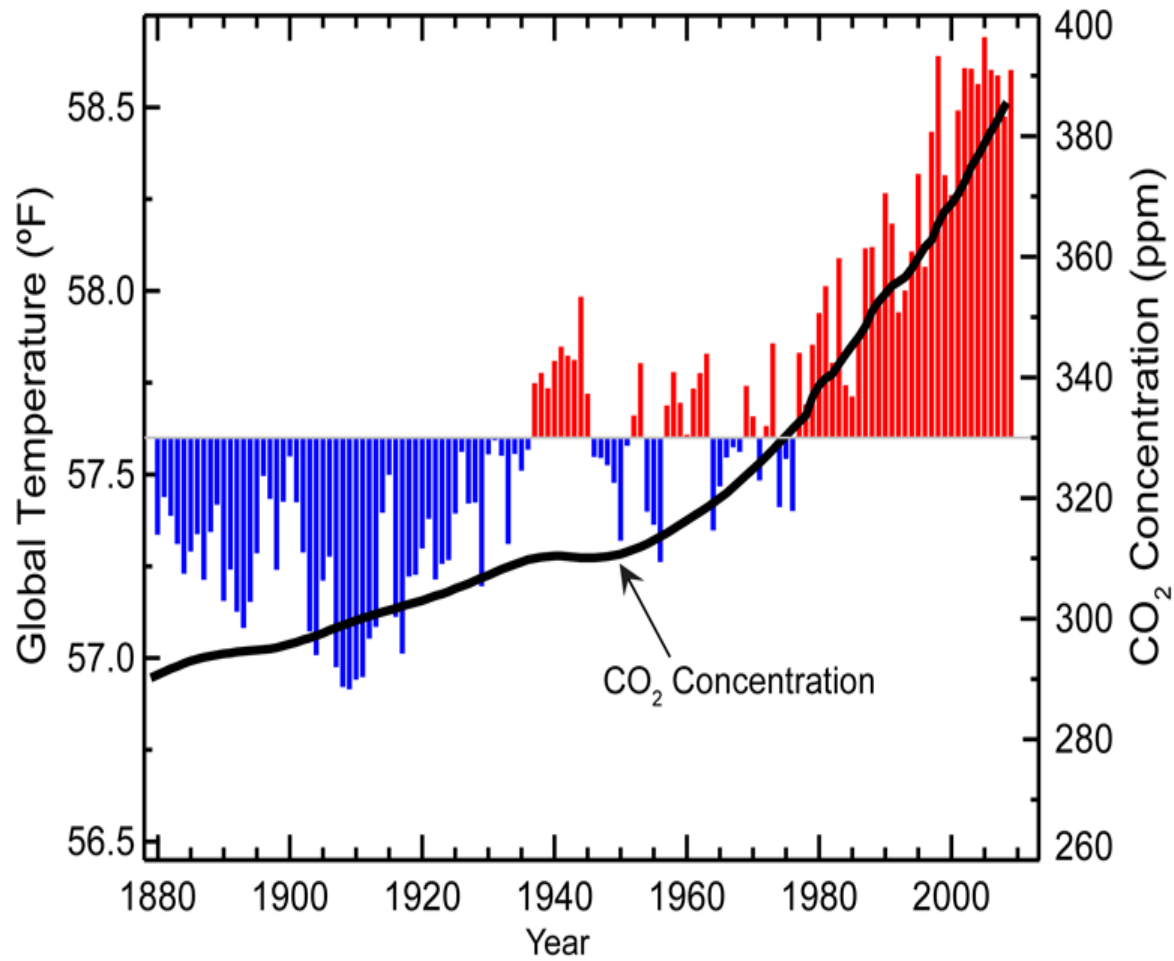
# Per capita energy-related Co2 emission levels and future trends on present policies



Source: International Energy Agency, WEO 2009



# Global Temperature and Carbon Dioxide



# Two reasons for urgent action

- Life of Co<sub>2</sub> in the atmosphere is long, at least 100 years. We generate around 30 gigatonnes of energy-related Co<sub>2</sub> a year, but natural capacity of earth's ecosystem to absorb Co<sub>2</sub> is about 5 gigatonnes a year. Every 10 year delay in stopping global emissions rising adds another 0.5 degree to probable world temperature rise.
- The financial cost of delay is very large. IEA estimates that each year of delay before adopting policies that would prevent GHGs rising above the level of 450ppm of Co<sub>2</sub>e adds an extra \$500bn to global bill of \$10.5 trillion for mitigating climate change. That is the price we have to pay for every year we have a do-nothing climate summit like Copenhagen !
- The reason for this is the very slow turnover of capital equipment in the energy sector. Country building a coal-fired power plant today will be locked in to producing carbon emissions for 60 years. Even if all new power stations were carbon-free, Co<sub>2</sub> emissions would only be 25% lower in 10 years time.



# Total war does not mean total sacrifice

- Cost of policies to stay within 450ppm of Co<sub>2</sub>e would not be punitive. IEA estimate is a cost by 2030 of 0.9-1.6% of world GDP (which is assumed to double by that date). A 1.6% of GDP cost in terms of 2030 = loss of a few months growth over two decades. Think of this as loss of sleep – you feel terrible if you miss a whole night's sleep, but you will not notice sleeping 10 minutes less a night over 20 years.
- Demand would increase for all fossil fuels except coal. Opec would have no real reason to complain, because it would be selling 11 million barrels a day more by 2030 than today, although fewer barrels than if there was no global climate regime. Oil-importing countries would save money. Gas would be more valuable. Biofuels production would increase.
- Essential part of policies aimed at 450ppm would be a re-balancing of the Chinese economy. This might reduce Chinese demand for commodities, viz. copper from Chile and soy from Argentina and Brazil.





# China's slower growth = much less energy

	<b>1996-2000 average</b>	<b>2001-2008 average</b>
<b>GDP % growth</b>	<b>8.63</b>	<b>10.2</b>
<b>Energy consumption % growth</b>	<b>1.10</b>	<b>9.4</b>
<b>Ratio of energy/ GDP growth</b>	<b>0.127</b>	<b>0.922</b>
<b>Electricity consumption % growth</b>	<b>6.11</b>	<b>12.5</b>
<b>Ratio of electricity/GDP growth</b>	<b>0.708</b>	<b>1.22</b>

Source: Professor Hu Angang, Tsinghua University, 2010



# What we need

- A carbon cap and trade market covering industry and the electricity sector in all industrialised countries in north America, Europe, Asia and Australasia.
- Strong national measures in all major emitting countries, above all in China.
- Sectoral agreements covering major energy-using industries, like steel, cement, even cars, across the globe.



# What we have

- A vague ‘Copenhagen accord’. This recognises the scientific advice to keep the temperature increase to within 2 degrees celsius, but decides nothing about how to achieve this.
- Europe has tightened and extended its emissions trading scheme until 2020, and added theoretically binding targets for renewables and biofuels. Taken as a whole, the 27 members of the EU have reduced emissions since 1990 (as required under Kyoto). But much of the EU’s emissions reduction is due to the post-communist slump of its east European members and the impact of the recent recession.
- Since Copenhagen, the US has proved itself incapable of following, let alone leading. The US sticks to its pledge of a 17% reduction by 2020 (on 2005), based on a 2009 bill passed by the House but the Senate has rendered the administration’s pledge and the House bill worthless by failing to pass a matching climate bill. Main climate hope is action by the Environmental Protection Agency to control emissions of new power plants.



# Nuclear – a second chance?

- Talk of a renaissance for nuclear as large-scale provider of low carbon power. Some 436 reactors in 30 countries produce 15% of world electricity (same % as hydroelectric), and 50 more being built. Revival in the US and Europe, and continued construction of reactors in Asia.
- Nuclear is the only energy source NOT to become cheaper over time. Planning and construction still take many years. There are still concerns about safety, although now less about reactor operation and more about waste fuel treatment. Electricity liberalisation has increased market uncertainty; investors in long-term projects like nuclear hate uncertainty.
- But South Korea's success in winning the contract to build 4 reactors for Abu Dhabi last year may herald a minor revolution. Koreans beat the leading US, French and Japanese companies by offering a less sophisticated but cheaper model. The competitive edge in reactor-building may be passing to countries like Korea, Russia, maybe China with active building programmes at home to give them economies of scale abroad.



# Renewables – some limits

- Traditional renewables still 10:1 more important than new renewables. Hydropower 16% of electricity, firewood perhaps 10% of total energy use.
- New renewables (wind,solar, biomass for heat/power, biofuels) tend to have limiting characteristics. Such as:
- Lower energy content and convenience. Most renewables (wind, solar) can only be turned into electricity which is transportable but not storable.
- Transmission. Infrastructure needs extension to remote mountains/deserts.
- Intermittency. Needs priority dispatch when wind blows and sun shines, and when they do not, need back-up generation (usually gas-fired power).
- Finance. High capital to operating cost ratio (because fuel cost can be zero). Long-term advantage - but in tight credit market, relative disadvantage in having to pay entire cost of new wind/solar plants upfront.
- BUT rising global investment: \$104bn 2007, \$130bn 2008, \$150bn 2009. Latin America low-carbon investment: \$4.6bn in 2004, \$11.6bn in 2009.



# Carbon capture and storage

- Already proven on limited scale. Used in making chemicals and fertiliser, and in north America to inject Co2 into oil fields for enhanced recovery.
- Can be used in any process, but most cost effective with coal. Requires suitable underground storage sites such as old oil/gas fields (not every country has this – Chile?). Retrofitting CCS requires extra space at power plants/factories to add capture and compressor equipment.
- Main economic obstacle is that the extra electricity required to run CCS equipment reduces the energy output of power plants. This can reduce energy efficiency ratio by up to 10 percentage points. Many developing countries will see ‘power penalty’ as a waste rather than a necessary cost that has to be paid for a cleaner climate.



# Transport

- Less fossil fuel used, so fewer emissions. US measures this in more miles to the gallon in Café standards; the EU in fewer grams of Co2 per km.
- Cleaner fossil fuel. Argentina and Brazil are leaders in CNG vehicles, and US should follow to make use of rising unconventional gas production.
- Electricity – either made on board with hydrogen fuel cells or stored in batteries that can be replaced or recharged en route. Hydrogen fuel cells have fallen out of fashion (except for stationary use) in favour of battery-operated cars, because harder to create hydrogen network than electricity.
- Biofuels. Brazil is world leader in bio-ethanol, Argentina in bio-diesel, and other production around the world. Environment is key issue. Biofuels should only be grown if a) big GHG savings compared to oil, and b) not cultivated on carbon-rich land or displace food production to carbon-rich land like rain forests.
- Biofuel trade beneficial – but producers must realise consumers will want to see environmental safeguards observed.



# Saving and efficiency

- Balance of choice and compulsion. Two examples.
- Household appliances. Giving people more information about relative energy efficiencies of similarly-priced household appliances has led to voluntary saving. But energy-saving fluorescent light bulbs are much more expensive at present than traditional incandescent light bulbs. So governments (Cuba a leader, now the EU) are making consumers' decisions for them by banning sale of incandescent light bulbs.
- Transport. It is important to create and maintain good urban public transport so that travellers have a real alternative to use of their private cars. But the real advantage of good public transport and of travellers having a choice is that it provides governments with a reasonable opportunity to use some beneficial compulsion. Not only parking payments for private cars, but also congestion charging in cities like London and Stockholm. The aim is to reduce congestion, but the side-effect is to reduce emissions too.





# The policy role of government

- Setting a framework. Long-time horizon of energy projects creates uncertainty which business hates. So business wants government to set a framework (rules, subsidies, taxes, targets etc) and stick to it. Business does not care which tools are used, but part of the tension in climate negotiations is that US and European politicians have very different preferences.
- The price mechanism. There is political acceptance of heavy energy/petrol taxation in Europe. It has therefore found it easier to adopt a cap-and-trade system for Co<sub>2</sub> (something the US invented for much smaller problem of Sox and Nox). The traded price of Co<sub>2</sub> is the effective tax rate.
- Regulation. US legislators hate raising taxes on gasoline, so they let the executive set the so-called Café gasoline efficiency standards. Even though cap-and-trade is a US invention, Congress has so far refused to extend it to Co<sub>2</sub>. So the EPA is left to try to regulate power plants' carbon emissions.
- Both methods have their merits on a national scale, but carbon trading would be easier to negotiate internationally. That option looks dead for the moment because of US inaction.



# The financial role of government

- Annual global investment in low carbon technologies averaged \$165bn in 2007-2009. According to the IEA this would have to rise to \$750bn a year by 2030, and to an annual average of \$1.6 trillion in 2030-2050, in order to halve global emissions by 2050. Governments' share of this should go to:
- Energy infrastructure needed for smart grids able to incorporate more renewables, and to increase basic R&D in energy.
- Public-private partnerships, especially to help with the deployment and commercialisation of new technologies like CCS or electric cars which may involve establishing new business models.
- Subsidies and tax credits to help individuals pay for the upfront cost of energy efficiency measures like home insulation or better boilers.



# Parallel energy challenges

- Staying competitive. This has become more complicated because of the uneven progress, after Copenhagen, towards a global climate regime. This lack of progress postpones the day when there might be uniform carbon constraints on all countries. European companies in the emissions trading scheme have a particular fear that they will lose market share to rivals outside Europe which have no comparable constraints. If market share were to leak out of Europe, so would emissions – the ‘carbon leakage’ problem.
- Energy security. Governments’ traditional concern has been to ensure a reliable flow of (usually) fossil fuel imports from abroad. In other words, their task has been to maintain the status quo. But in the move to a low carbon energy system governments now have to deal with a dynamic situation. They have to think about the stability of a changing domestic energy mix, as they move to more intermittent wind and solar power.

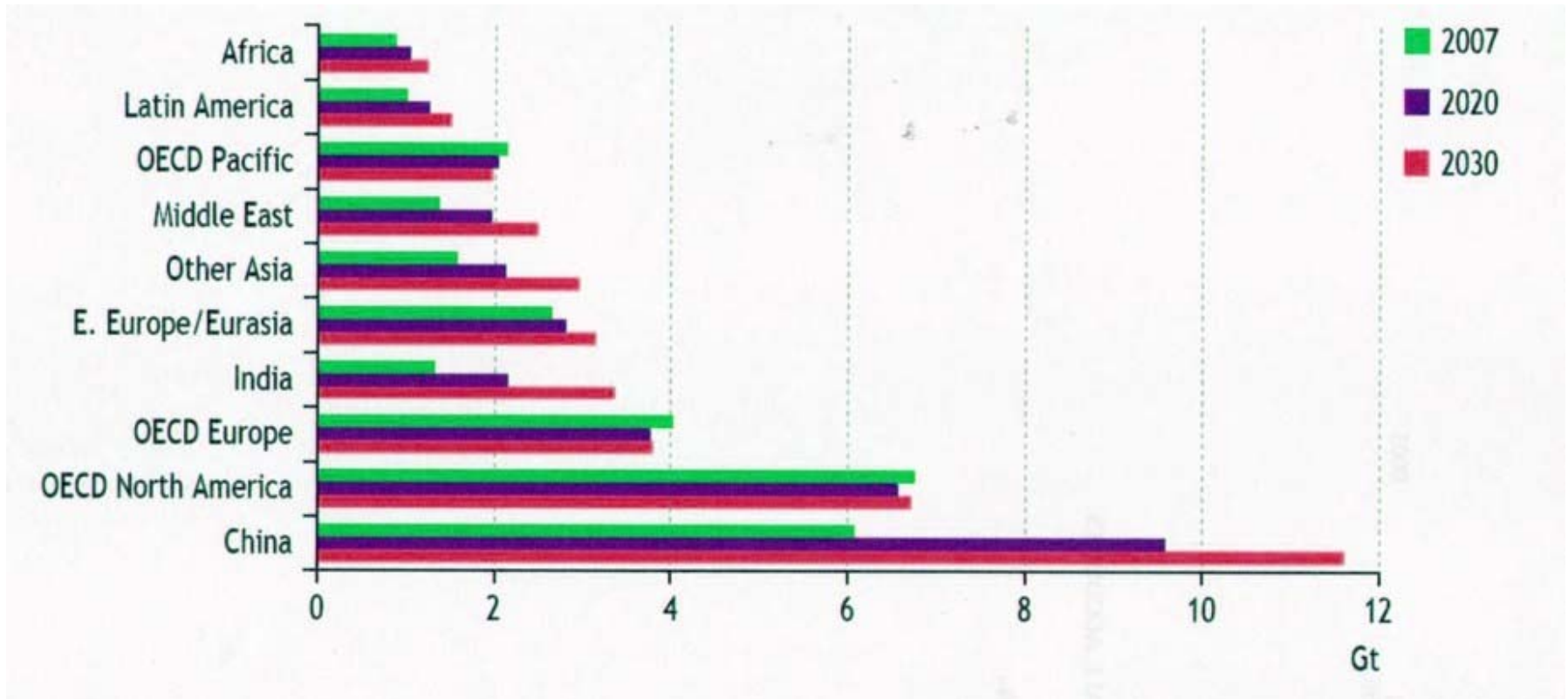


# The EU example – model or caution?

- Model. This group of 27 countries has a wider spread in wealth per capita between richest and poorest (Luxembourg and Bulgaria) than the income gap between the US and China. In its energy/climate programme, the EU has agreed differentiated responsibilities outside the cap-and-trade system that applies to all. This gives poorer states easier renewable energy targets, and permission to continue increasing emissions in agriculture, transport, services, while all the richer states have to cut emissions.
- Caution. But most of the poorer, new member states from central and east Europe still feel climate control is a rich man's game and a constraint on their development. They still worry more about their historic gas dependence on Russia. At best, energy security concerns have been a distraction from climate policies. At worse, energy security worries have run counter to climate policies, with countries like Poland and the Czech republic seeking to maximise use of their own dirty coal and lignite and to minimise (Russian) imports of relatively clean gas.



# Trends in energy-related Co2 emissions



Source: International Energy Agency, WEO 2009



# Climate justice and burden-sharing

- Some Latin American countries were vocal in their discontent with the Copenhagen accord. Andean Pact countries called the accord's negotiation "undemocratic and untransparent", and complain of imposed solutions (restrictions on rain forest use) to a climate problem not of their making.
- But some of the same countries are preparing a low-carbon future by investing in biofuels. Developing countries now make up 45 of the 85 countries with renewable policy targets, and 42 of the 83 countries with some kind of renewable energy promotion policy.
- Rich, industrialised countries are to blame for the stock of GHGs. But it is developing countries that increasingly account for the new flow of GHGs. They do not yet take overt responsibility for this, but they are beginning to act responsibly. Renewable investment and capacity is passing to emerging economies. In 2009 China produced 40% of solar PV material, 30% of wind turbines and 77% of solar thermal units. The last slide helps show why.



# Shares of annual & cumulative (since 1890) energy-related Co2 emissions on current policies

