Fatally Flawed Inequity

KYOTO'S UNFAIR BURDEN ON THE UNITED STATES & THE CHINESE CHALLENGE TO AMERICAN EMISSION DOMINANCE

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Introduction

From the very beginning, American policy debate on the Kyoto Protocol has been dominated by persistent accusations of unfairness to the United States and its citizens. In his opening statement of a hearing by the US House of Representatives Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs[1] – "The Kyoto Protocol: Is the Clinton-Gore Administration Selling Out Americans? Part III", 20 May 1998 – Chairman David M. McIntosh, for example, declared with firm moral certitude that the Kyoto Protocol

> is also patently unfair because it exempts 77 percent of all countries from any obligations. China, India, Mexico, and Brazil, just to name a few, are completely unfettered by the Treaty – these countries already have the competitive advantages of cheap labor, lower production costs, and lower environmental, health, and safety standards. If President Clinton has his way, now these countries will be free to develop and pollute all they want, while the U.S. economy goes into a deep freeze.

Exactly a year later, before the same body, a fellow Michigan Republican House member – Rep. Joe Knollenberg, by then well-known in climate change circles for 'the amendment'[2] – reiterated this sentiment:

> This fatally-flawed agreement [the Kyoto Protocol] is blatantly unfair because it exempts developing nations from making any commitment to reduce their emissions of greenhouse gases. As a result, nations like China, India, Mexico, and Brazil, [...] will be given a free pass while the United States is forced to struggle with the Kyoto treaty's stringent mandates.

There is arguably nothing quite like an accusation of unfairness as justification for scuppering an agreement, in particular if it is an international one. If evidence of this

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[1] http://www.house.gov/reform/neg/hearings/

[2] Popularly referred to as "the Knollenberg Amendment," this provision in the 1999 VA-HUD Appropriations Bill prohibits the appropriation of funds 'for the purpose of implementation, or in preparation for implementation, of the Kyoto Protocol.'

is required, we need not look further than the well-publicised reply to US Senators Hagel, Helms, Craig, and Roberts by President Bush:

> As you know, I oppose the Kyoto Protocol because it exempts 80 percent of the world, including major population centers such as China and India, from compliance, and would cause serious harm to the U.S. economy. The Senate's vote, 95-0, shows that there is a clear consensus that the Kyoto Protocol is an unfair and ineffective means of addressing global climate change concerns.[3]

By now, anyone only slightly familiar with climate change issues will be aware of what this passage did indeed herald: the withdrawal of the US from the Kyoto Protocol.

A Variety of Arguments

Various arguments have been advanced why the Kyoto Protocol is to be branded as 'unfair' towards the US – some arguably more serious than others[4] – but, as witnessed above, they all seem to reduce to what in American political jargon has become known as 'the lack of meaningful participation' of developing countries – their not being subject to emission reduction targets. This note is about two of the cornerstones in the arguments as to why this 'lack' is meant to lead to the alleged unfairness, namely the claims that (loosely put):

Claim I. In the near future, main developing countries are going to be worse emitters than the US.

Claim II. Under the Protocol, the US will be ruined while developing countries get away scot-free, if not better off.

Indeed, in some circles of the American policy debate, these positions have practically become a matter of orthodoxy. As indicated by the wording,[5] the injustice is taken to arise from the lack of 'meaningful participation' because America is being punished while others, who it is claimed will be much worse offenders are not – indeed, may even benefit. Or, paraphrased from the US perspective, 'we are going to be punished for becoming more virtuous.' The inequity felt will be particularly strong if, as implied by the second claim, the punishment is seen to be disproportionately large. But are these two key premises of the US Kyoto rejection actually defensible or do they belong to the realm of politicised myth?

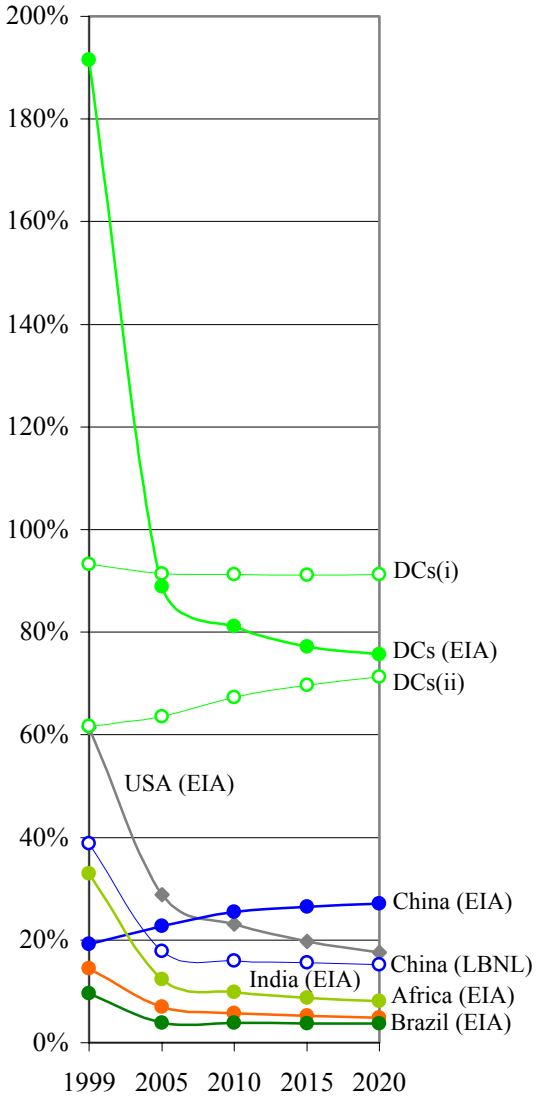
The differentiation between countries with and those without Kyoto targets essentially reflects the 'Annex I' classification of the Framework Convention which, in turn, relies on the principles of *historic responsibility* and *ability to pay.* The two orthodox claims put into question these very principles. Part of the orthodox argument from 'lack of meaningful participation' to inequity is the presupposition that – in assigning emission caps (= potential economic burdens) – it is unfair to differentiate between past and future responsibilities for the problem. Indeed, in light of past ignorance concerning the adverse effects of the emissions in question, the orthodox line can even go as far as demanding that, in fairness, *only* future performance should be taken into consideration. While fundamentally disagreeing with this view, let me for argument's sake suggest we concede the point and analyse the two claims from within

[3] 13 March 2001; http://www.whitehouse.gov/news/releases/2001/03/20010314.html

[4] Chairman McIntosh's reproach to developing countries for already having an unfair competitive advantage because of being poor is unlikely to pass the 'guffaw-test' in any halfway serious analysis.

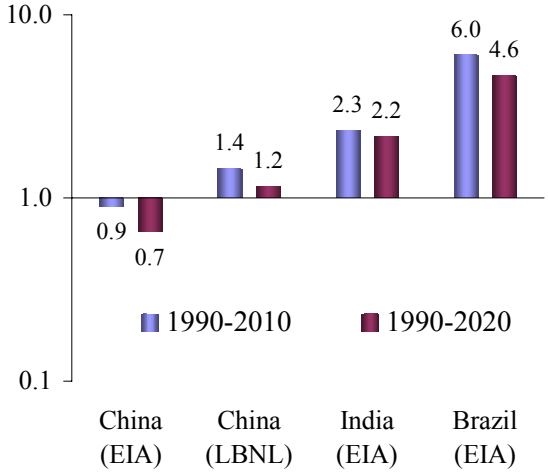
[5] 'Scot free = Free from payment of 'scot', tavern score, fine, etc.; exempt from injury, punishment, etc.; scatheless.'[OED]

Box 1: Judging Emission Behaviour

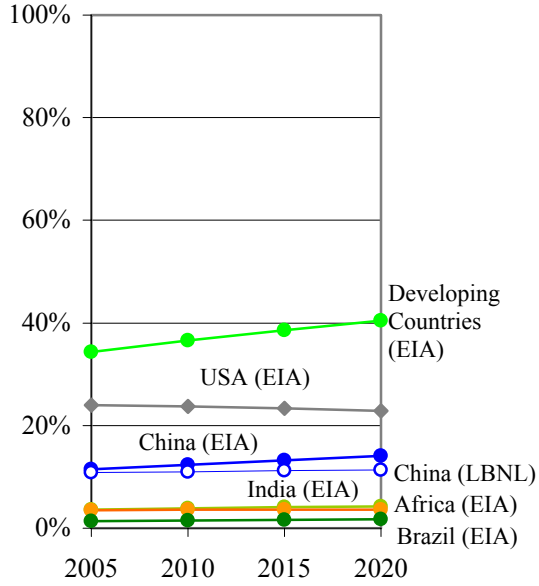


Sources: EIA = *IEO*01, LBNL = Sinton and Fridley, 2001

(a) *Emission Increments since 1990*



(c) *Ratios of Emission Increments. US : X*



(b) *Cumulative Emission Shares since 1990*

(i) One way in which one might try to rectify some of the problems associated with negative increments is by switching the percentage base from the sum total of the countries' increments to, say, their geometric mean.

(ii) Or one could opt for the sum of just the positive increments as percentage base.

Either choice can significantly alter the percentage figures associated with countries' increments, as illustrated in Figure (a) for the case of developing country increments.

their own framework, as it were. In other words, let us for argument's sake disregard the past and begin by comparing projected American and developing country behaviour as carbon emitters, in order to see for ourselves who is actually going to be worse than who.

The veracity of Claim I –indeed the strength of the sensed inequity– depends on how the comparison of someone being 'a much worse emitter' than someone else is interpreted ('operationalised'). Not surprisingly, there are different ways of measuring

emission behaviour for the purpose of such evaluative comparisons. The *International Energy Outlook 2001* of the Energy Information Administration (EIA) – a subsidiary of the US Department of Energy – for example, states that:

> Much of the projected increase in carbon dioxide emissions is expected to occur in the developing world, where emerging economies are expected to produce the largest increases in energy consumption. Developing countries alone account for 81 percent of the projected increment in carbon dioxide emissions between 1990 and 2010 and 76 percent between 1990 and 2020. Continued heavy reliance on coal and other fossil fuels, as projected for the developing countries, would ensure that even if the industrialized world undertook efforts to reduce carbon dioxide emissions, worldwide carbon dioxide emissions would still grow substantially over the forecast horizon.[6]

Responsibility for 81 percent of anything would indeed seem to be substantial, in particular if one infers, not unreasonably, that developed countries would hence have to be responsible for the remaining 19 percent. But caution is advised in interpreting the EIA's figure in this manner. Otherwise one might be rather surprised to find the percentage figures of the US and the developing country increment 'shares' adding up to 104 percent. Even more perplexing might be that, according to EIA methodology, developing countries account for 191 percent and economies in transition for –160 percent of the 1990 to 1999 carbon emission increment, to paraphrase the EIA passage (see Box 1).

How can anyone's 'share' in something be bigger than the 'whole' or how can it be negative? The answer, of course, is that –contrary to appearance– the percentage figures used do *not* refer 'shares' of some 'whole.' Their only meaningful use for comparative purposes is in explicit relational statements such as 'the ratio between developing country and industrialised country increments is 81 percent to 39 percent,'[7] a statement which can obviously be rephrased without reference to percentages as 'the developing country increment is roughly twice as large as the industrialised one.' The EIA's use of a percent figure on its own is akin to saying something like 'the developing country increment is roughly twice', although potentially rather more misleading.

Making developing countries 'twice as responsible' than industrialised ones would seem to recommend this 'increment measure' as ideal for justifying the first orthodox claim. Yet – taking into account certain recent developments (as discussed in the next section) – the US increment is projected to dominate all other developing country increments (Figure (c), Box 1), rendering the measure rather ineffectual in the defence of orthodoxy.

Instead of judging emission behaviour in terms of increment percentages, Claim I advocates could try to find support in percentages of cumulative amounts. After all, countries cumulative emissions *can* legitimately be interpreted as 'shares' of the global 'whole' (= cumulative global emissions),[8] thus avoiding the danger of a misleading use of percentage figures. However – as is readily apparent from Figure (b) in Box 1 – the problem with this sort of 'emission share' measure for justifying the first claim is, quite simply, its 'failure to deliver': In trying to use cumulative emission shares as a measure for judging emission behaviour, the maxim 'the larger the share,

[6] IEO01 *Highlights*:p.6.
[7] EIA figures and classification, excluding economies in transition.
[8] Strictly speaking, this is only true for gross-emissions, but as it is unlikely for any of the key Parties to be a net cumulative absorber of greenhouse gases, there is little need to worry about this issue.

the worse the behaviour' would seem to be not an unreasonable one. Yet, under this operationalisation, we find not only that

- the projected emission behaviour of the US and the key developing countries does not significantly change over the time-horizon, but, more importantly, that
- the US continues to behave, as it were, 'more than twice as badly' than its nearest developing country 'competitor', namely China.

Indeed, on average, developing countries as a whole account for only slightly more than a third of the global cumulative emissions over the time horizon, thus putting them in a slightly different light than what the EIA's 81 and 76 percent figures might (wrongly) have suggested.

The Chinese Challenge to American Emission Dominance

So where are advocates of Claim I to turn for a suitable operationalisation of 'being a worse emitter than someone else'? Given that shares – and percentage figures in general – don't seem work, an interpretation in terms of absolute emission levels might be more promising. In other words, they might try to justify this claim by interpreting it in terms of main developing countries surpassing absolute US emission levels in the near future. As this is unlikely to be the case for India, Brazil or any other developing country bar one this brings us to the one country which has indeed been singled out as 'chief (developing country) villain' in the US debate: China.

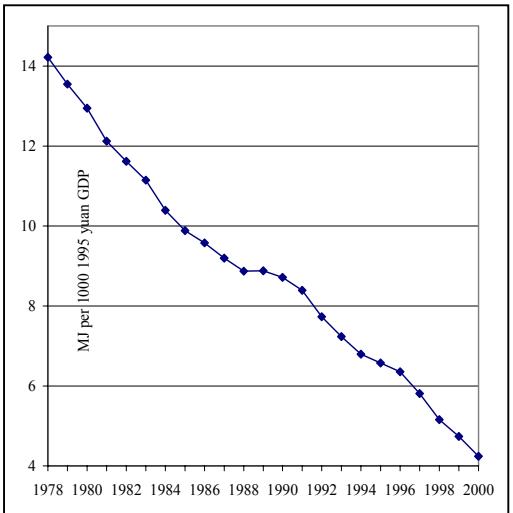


Figure 1: China. Energy Intensity of GDP.

Source: LBNL 2001

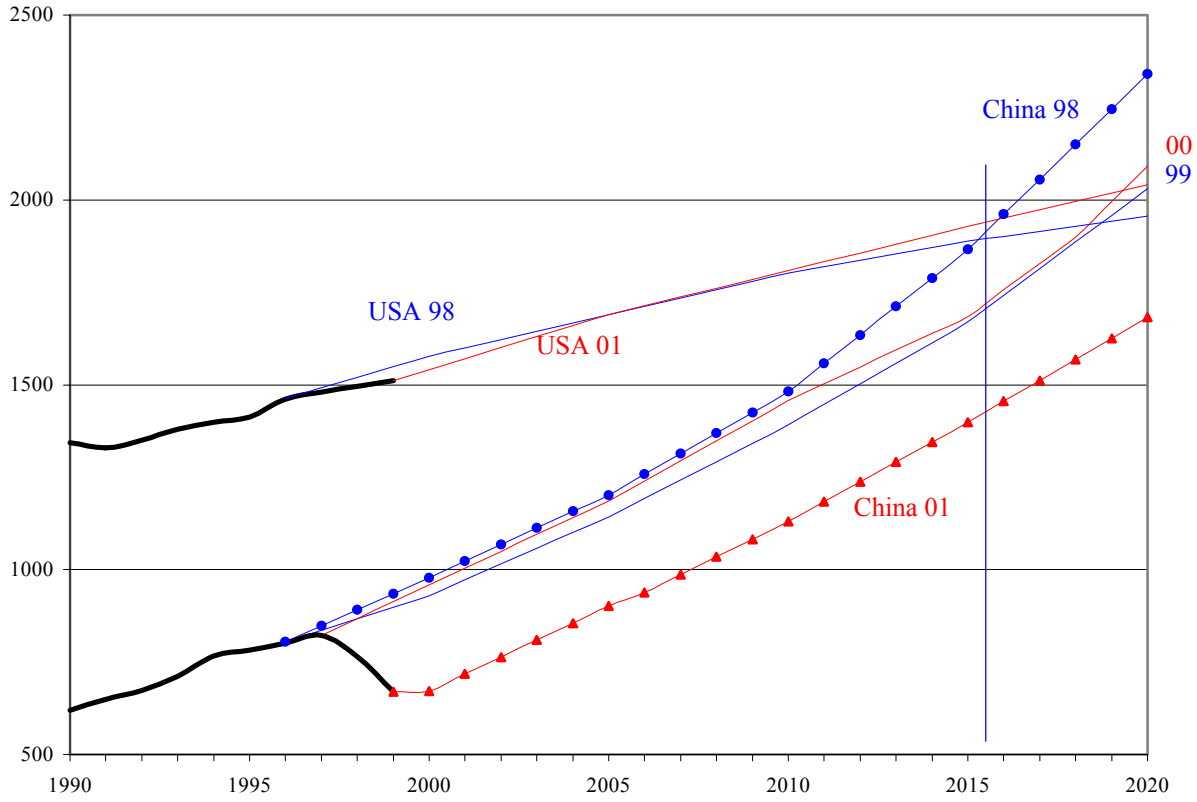
'China will surpass the United States in carbon emissions by the year 2015. … if current proposals are adopted, under which we would reduce our carbon emissions to 1990 levels while imposing no requirements upon the developing world and China, China, all by itself, will greatly exceed the United States in metric tons of carbon emitted.' Senator Robert C. Byrd, 19 June 1997 US *Senate Report* 105-54, Page 18 (US Senate Foreign Relations Committee Hearing on 'Byrd-Hagel Resolution')

'However, it should also be noted that China will soon surpass us as the largest emitter of greenhouse gases. The Chinese Government must stop blocking all forward movement on the question of developing country participation. The developing world is poorly served by the current level of Chinese intransigence.' Senator Byrd, 4 May 2001. US *Congressional Record,* Page: S4394

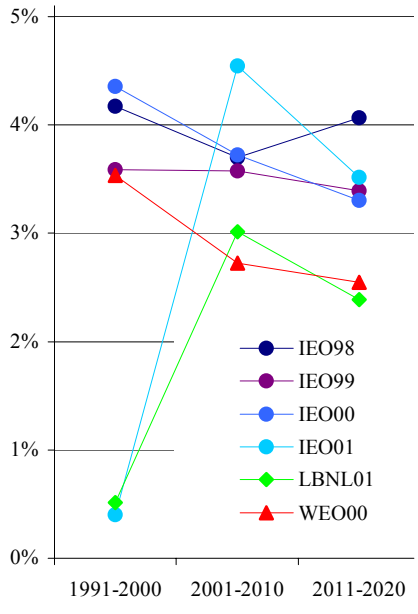
It appears that Senator Byrd was, and still is, an avid consumer of the emission projections regularly produced by the EIA. After all, until its most recent issue, the EIA's annual *International Energy Outlook* has without fail predicted that Chinese carbon dioxide emissions will surpass the American ones within the next two decades. Indeed EIA projections at the time of Sen. Byrd's first statement were that, as he claimed, US emissions would be surpassed by China in 2015 (Box 2). The aim of this section is to shed some light on the plausibility of the alleged Chinese threat to the US role as the world's largest carbon dioxide emitter. Is it reality of myth?

The Past and the Present. It has been well-established for some time that in the past two decades Chinese energy intensity has fallen dramatically (Fig. 1). According to Richard Garbaccio (US Environmental Protection Agency), Mun Ho (Harvard) and Dale Jorgensen (Harvard) 'reported energy use per yuan of GDP fell by 55%'[3:63]

Box 2. EIA *International Energy Outlook* 1998-2001. CO_2 Emission Projections (MtC)



China. CO_2 Emissions. Annual Growth Rates



Each of the four most recent editions of the *IEO* has a 1990 estimate for Chinese CO_2 emissions (620MtC) and an estimate for a base-year: 1996 for both *IEO*98 and *IEO*99, 1997 for *IEO*00, and 1999 for *IEO*01 (together with an estimate for the preceding year). Projections are in five yearly intervals. The '99 projections involved a significant reduction in projected 2020 emission levels from their *IEO*98 predecessor (reflected in a reduction of annual growth rates from 4.2 to 3.6, and from 4.1 to 3.4 percent for 1991–2000, and 2011-20, respectively), leading to a postponement of the projected China-US cross-over from 2015 to 2019 (US projections themselves remaining almost identical in *IEO*98-00). The projections published in 2000 were rather uneventful, the only difference to the preceding year being a reversal of the 1991-2000 growth reduction. The dramatic changes only occur in *IEO*01, where the 1991-2000 growth rates had to be slashed to less than one tenth from 4.4 to 0.4 percentage points. Yet this merely reflects an acknowledgement of empirical fact and not a change in exogenous modelling assumptions. The truly remarkable feature of the *IEO*01 projection is rather that, in light of this empirically imposed revision, growth rates for the subsequent decade are projected to be higher than ever before (4.5 percent). Simple extrapolation then leads to a projected cross-over in 2027.

between 1978 and 1995 (4.7 percent annually).[9] While there has been some disagreement about the causes for this decline (Appendix 1), it is difficult to argue with their claim that 'given the importance of fossil fuel use in the generation of local and regional air pollution, this fall in the energy-output ratio has considerable importance for both China and the global environment'[*ibid.*] And yet, one has to be careful not to misread this statement.

The fact is according to the IMF (*IMF*01), that between 1978 and 1995 Chinese GDP increased by a staggering 1500 percent (measured in yuan – 220 percent when measured in exchange rate US dollars). Now it may well be that this sort of sustained robust growth (annually 16 percent in yuan, 7 percent in dollars) would have been economically impossible without the concomitant drastic energy intensity reduction. But there is nothing in this sort of intensity reduction guaranteeing an improvement of the local or global environment.[10] Chinese CO_2 emissions, for example, more than doubled over the period in question (Figure 2). Intensity reductions may be necessary for sustained economic growth, but they are not sufficient for environmentally sustainable development.

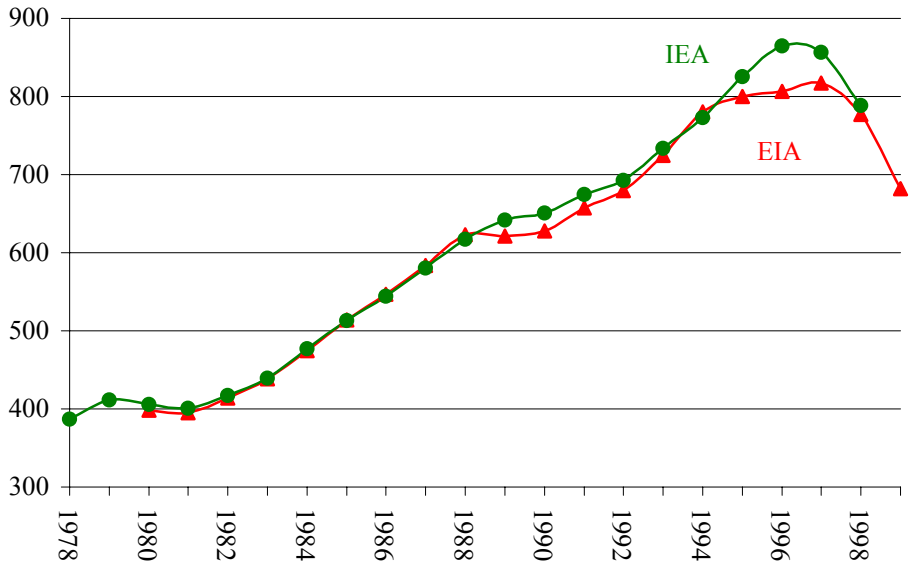


Figure 2: China. Historic CO_2 Emissions (MtC)

Sources: EIA = *ICDE*, IEA = *EFC*00.

In light of the fact that between 1996 and 1999, Chinese GDP continued to grow at similar robust rates, and given the lag in obtaining actual emission data, forecasts during this period – e.g. *IEO*98-00 (Box 2) and *WEO*00 (Figure 3) – can be forgiven for having estimated emission levels which grew at rates similar to the preceding two decades. However, towards the end of last year at least it became clear that something rather remarkable had happened in around 1997: Chinese CO_2 emissions, it turned out, had not only slowed down but peaked. Indeed, it emerged 'that – taking into account underreported coal use – between 1996 (when energy use peaked) and 1999,

[9] Indeed, according to Jonathan Sinton (personal communication, June 2001), more recent data shows that Chinese energy use per unit of GDP fell by 70 percent between 1978 and 2000, amounting to an annual reduction rate of 5.3 percent. (See also Appendix 1.)

[10] All that can be said is that without the reduction, the situation would have been even worse.

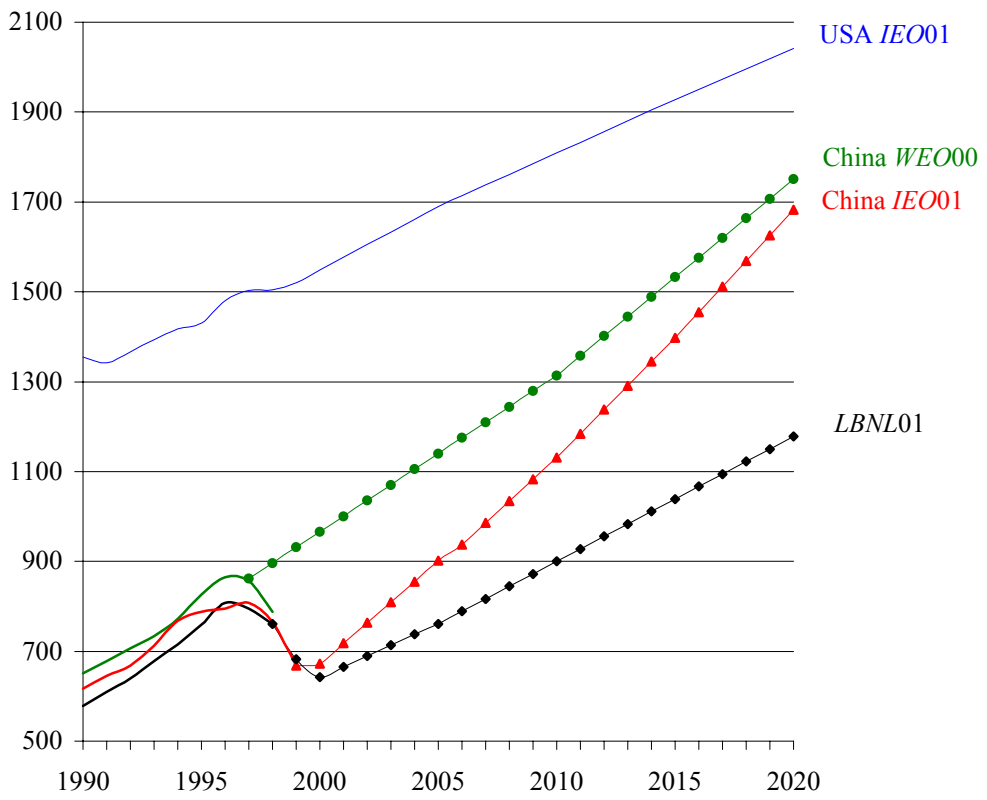


Figure 3. China. CO_2 Emissions. Recent Projections

China's emissions of carbon dioxide fell by 11 percent, to 1994 levels. Between 1996 and 2000, emissions fell by 14 percent, nearly to 1993 levels.'[11]

The Future. While no-one can be blamed for disregarding something they are unaware of, questions can and must be asked if disregard becomes denial, i.e. if facts are known and yet ignored as to their implications. Take the most recent EIA projection (*IEO*01), which – in contrast to that of the International Energy Agency (*WEO*00) – is clearly cognizant of the '97 reversal, yet seems to refuse to acknowledge any structural changes associated with it. As shown by the graphs in Box 2, the emission profile projected in *IEO*01 is practically parallel to the one generated the year before in ignorance of the reversal. Looking at these graphs, one could indeed be forgiven for taking the reversal to reflect merely a measurement error or a change in statistics. The key consequence in the present context is that – while having already been postponed in *IEO*99 from 2015 to 2019 (Box 2) – the *IEO*01 China-US cross-over point (interpolated at around 2027) can arguably still be referred to as occurring, if not 'soon', then at least 'in the near future.'

However, not everyone shares the views and assumptions which in the last couple of years have consistently led the EIA to predict Chinese emission growth rates for the next two decades of significantly more than 3 percent annually. The most recent IEA projection (*WEO*00), for one, is growing at rates a whole percentage point less than those implied in *IEO*01. This is all the more remarkable for two reasons: first of all because of the fact that for the period immediately preceding the reversal, the IEA estimates have been considerably less conservative than those of the EIA (Figure 2),

[11] Jonathan Sinton, personal communication, June 2001.

and second, possibly more remarkably, since *WEO*00 was in effect created in ignorance of (the full extent of) the '97 reversal.

Perhaps more significantly, Jonathan Sinton and David Fridley of the Energy Analysis Department at the US Lawrence Berkeley National Laboratory (LBNL) have recently made a projection actually based on a detailed analysis [2] of why Chinese emissions have undergone this quite unexpected reversal (Appendix 2). They conclude, in particular, that 'even if energy use rises at the same rate that prevailed in the early 1990s, i.e., at half the speed of economic expansion, carbon dioxide emissions will not reach 1996 levels until after 2005'. And Figure 3 clearly shows that under the LBNL projection, Chinese and American emissions virtually run along parallel tracks, which – if Euclid is to be trusted – implies that we may have to wait rather longer than the near future before the former actually surpass the latter, if at all. One might be tempted to deride these projections as hopelessly optimistic, yet before choosing this route, one might wish to take into consideration the close similarity between their projected emission growth rates and the those of the IEA (Box 2).[12] In light of this similarity, it would not be surprising if – having taken on board the reversal – next year's IEA projection of Chinese CO_2 emissions were to find itself at, if not below LBNL levels.

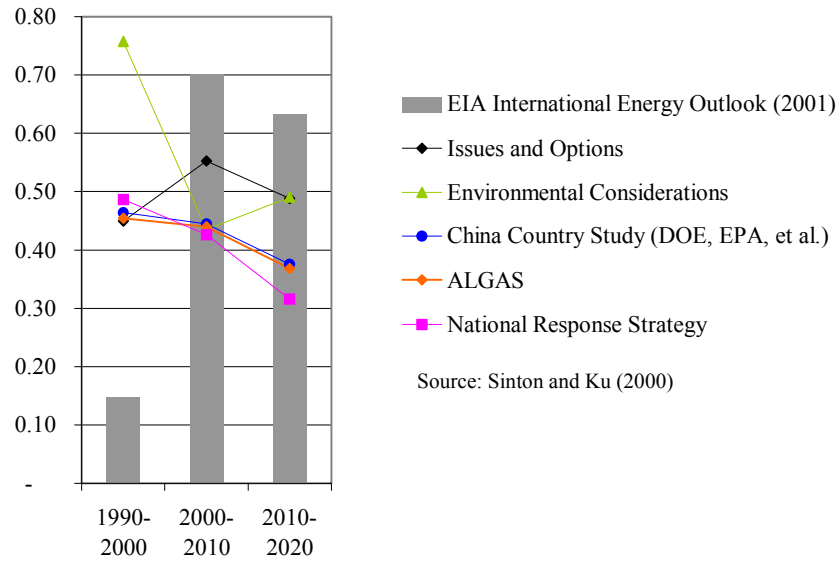


Figure .4: China. Energy Elasticities of GDP

* Only one of the studies listed prepared recently enough to account for the '96 drop in energy use.

To be sure, the growth differences discussed are themselves determined by certain underlying ('exogenous') assumptions of the models used in generating the projections. In the course of their analysis, Sinton and Fridley have carried out a comparative study of these exogenous assumptions. What sets EIA apart from all the other studies considered is that – by showing a projected rise in elasticity (Figure 4) – it assumes a significant deterioration in China's energy efficiency gains which have kept Chinese energy elasticity so low for the past 20 years. The other studies all

[12] Moreover, as Sinton pointed out to me, the annual growth rates in energy use in the LBNL baseline projection are actually above the rates found in baseline projections in some other widely circulated studies (e.g., the ADB-supported National Response Strategy), and are only slightly below the rates found in the China Country Study baseline.

acknowledge the effectiveness of the Chinese programs and project continued success (particularly given the burst of activity driven by the Energy Conservation Law of 1998). The balance of evidence thus suggests that events of the past couple of years have put a near future surpassing of US emissions by China squarely in the realm of politicised myth.

Per Capita Methodologies

The use of per capita figures has led to some controversy in the climate change debate, but there seems to be little doubt that national wealth or welfare comparisons ought to be carried out in per capita terms: No one in their right mind would argue that Switzerland is a much poorer nation than the US because of the fact that American GDP is almost fifty times larger than the Swiss one. And it is difficult to see how any comparison other than in per capita terms could be appropriate in this context.

Many developing countries are currently experiencing – and are projected to experience – GDP growth rates significantly higher than those of the industrialised world. Does this mean that over the time horizon, it would be unfair if they were not to carry an increasing share of some 'common but differentiated' burden? To give a reasoned answer we need to consider not only the size of burdens relative to the wealth levels, but also the proportions of the latter to one another.

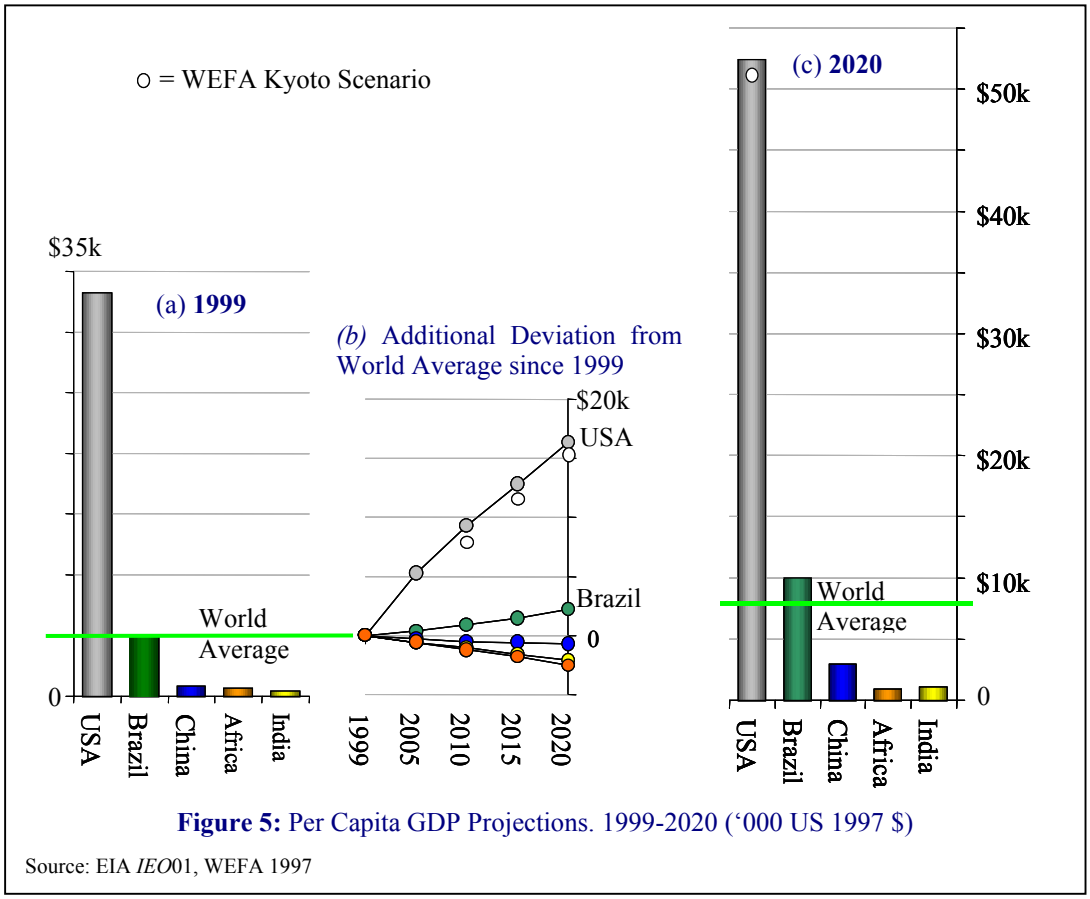


Figure 5: Per Capita GDP Projections. 1999-2020 ('000 US 1997 $)

Source: EIA *IEO*01, WEFA 1997

Consider, again, the US and the main developing countries (with Africa representing least developed nations). Given the current wealth polarisation – reflected in Figure 5.a – it would be difficult to argue for a 'North-South transfer' of anything but a truly

crippling American burden, even if the relative difference in GDP growth rates would imply that developing countries are 'catching up' with the US.

And yet, to be quite sure: no such catching up is projected to happen. Figure 5.b depicts the evolution of the wealth-gap between the US and the key developing countries/regions over the next two decades – as projected by the EIA.[13] Industrialised countries are projected to become much wealthier, not merely in absolute terms (57 per cent increase in real GDP/cap), but in terms relative to the rest of the world. In light of this projection, the only hope for the orthodox view that developing countries are not carrying their fair share of the burden under the Kyoto Protocol must be the claim that somehow they better themselves unfairly because 'the U.S. economy goes into a deep freeze.' But what could that possibly mean?

Given the existing wealth differences, it is difficult to see how any of the main developing countries could actually surpass the US in GDP/capita terms within the next twenty years, Kyoto or no Kyoto. The orthodox argument may thus have to rely on the rather dubious premise that the burden distribution of Kyoto would be unfair if Kyoto were to allow developing countries to gain on the US. Unfortunately for the orthodox view, not even this can be upheld.

Box 3: The WEFA Kyoto Scenario

Very soon after the third session of the Conference of the Parties at Kyoto in December 1997, the American Petroleum Institute (API) financed a study by WEFA, formerly Wharton Econometric Forecasting Associates, 'of the national economic and energy sector consequences the U.S. faces if the Kyoto Protocol is implemented.' When in Spring of 1998 it appeared as 'Global Warming: The High Cost of the Kyoto Protocol,' headlines such as 'FAMILIES WOULD SUFFER AS THE LOSS IN AGGREGATE INCOME PER HOUSEHOLD EXCEEDS $2700' had an immediate and disproportionate impact, in particular on the US Congress, where it has arguably been the single most important factor in the perception about the 'ruinous costs' of the Kyoto Protocol.

However, regardless of the initial characterisation of the intended scope of the study, the scenario modelled has very little to do with the Kyoto Protocol, apart from a reference to a target figure of '7 per cent below 1990 emissions'. For one, the study is focused exclusively on carbon dioxide emissions, thus ignoring the cost-saving potential inherent in the basket of greenhouse gases adopted (on US insistence) at Kyoto. Indeed, the implementation scenario studiously avoids any of the flexibilities inherent in the Kyoto Protocol (sinks, sequestration, trading etc.), opting instead for a purely domestic gross CO_2 emission reduction of 7 per cent below 1990 levels for the period between 2010 and 2020. The study concludes that 'the level of real gross domestic product is 3.2% lower than the base case in 2010. By about 2020, the economy has adjusted to the pattern of rising energy prices and is somewhat able to compensate for the mini-shocks of rising prices. Consequently, the percentage reduction in GDP falls to 2.0%.'[WEFA 1998:p.35] It should not be surprising that these figures are far higher than any realistic evaluation of what the Kyoto Protocol actually entails would be.

The fact is that even under the highest cost estimates – such as the ones of the 1998 'WEFA Kyoto Scenario' (Box 3) – US per capita welfare is still projected to grow at significantly above-average rates (Figure 5) without a reversal in widening welfare

[13] It must be emphasised that the numbers represented in Figure 5.b exclude current inequalities, they merely reflect future projected increments on top of them. For example, in 2020, the USA is projected to have a per capita GDP $44.5k above the 2020 world average of $7.8k – $28k (current difference, Fig. 3.a) + $16.5k (projected increment, Fig. 3.b) – while Africa is projected to slip further from its current $4.5k to $7k below average. Indeed not even China, with its very impressive aggregate growth rates will be able to keep pace with world average wealth: it is estimated to slip a further $680 from its current $4,200 below global average by 2020.

gap. What is more, the projected 'deep freeze'[14] amounts *at worst* to nothing more than to forego about a year's economic growth. This, it seems, does make it rather difficult to feel sympathetic with the orthodox claims of immanent economic doom. Moreover, given all the 'flexibilities' – built into the Protocol at the insistence of the US (albeit an earlier administration) – the cost of implementing Kyoto to the US would likely be much lower than these inflexible predictions would have it:

> The reality is that, if it becomes the foundation for effective global action, the Kyoto Protocol appears cheap at the price. The IPCC reviewed results from global modelling studies, and found that the costs of complying with Kyoto for different OECD regions was estimated to be in the range 0.1 to 1.1% GDP by 2010; these results were from models that assume full emissions trading but without other Kyoto flexibilities (multiple gases, sinks or CDM), which would further lower costs. This equates to between 0.01 and 0.1% reduced annual GDP growth rate in the richest countries of the world, far smaller than the standard uncertainties in economic growth projections that governments routinely use as the basis for policy-making. The IPCC also notes that poor climate change policies to implement the Protocol's targets could raise costs, whilst smart implementation (e.g. that harnesses cost-effective efficiency improvements, co-benefits, and 'double dividends' from shifting taxation) would lower them; some European studies even show net economic benefits.[6]

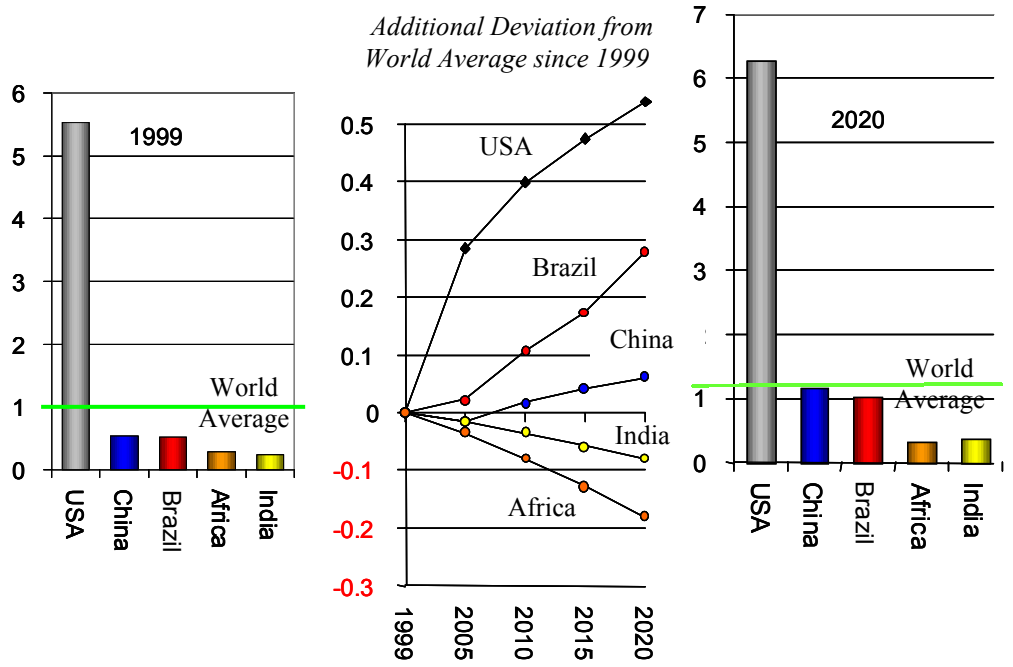


Figure 6: Per Capita Carbon Emission Projections. 1999-2020 (tCe)

Sources: China = Sinton and Fridley 2001, Others = *IEO*01

Interestingly, this line of argument has a lesser-known 'cousin'[15] concerning CO_2 emission, bringing us back to the orthodox emissions claim (Claim I), which we have so-far considered in national aggregate terms.[16]

[14] Rep. McIntosh was indeed referring to the WEFA figures.
[15] Related by way of energy use in fossil fuel economies.
[16] 'Aggregate' is used here to refer to measures pertaining to countries as a whole, as opposed to per capita measures which pertain, as it were, to their average citizen. Naturally, all the distinctions made

Figure 6 shows US *per capita* emissions continue their substantial rise relative to the global average by adding on an increment of almost half a ton of carbon equivalent, rising from 4.5tCe (1999) to 5tCe (2020) above average. It is difficult to see how, in this sort of emission behaviour could possibly be described as 'restrained' in comparison with developing countries, in order to justify the orthodox emission claim.

If anyone can be said to have 'restrained' relative emission trends it would have to be India and the least developed countries of Africa with per capita emissions which continue to fall further and further below the global average. The CO_2 emission gap between least developed countries and Annex I Parties in general, and the US in particular, is not only projected to grow considerably over the time horizon, but the growth is in opposite directions from the world average.

The point of this description is not to argue that the projected business-as-usual world averages are somehow setting a standard which is to be aspired. Far from it, as they are clearly not sustainable and have to be revised downwards. The point is simply to highlight the fact that there is a natural criterion as to who ought to take precedence in bringing about such a revision,– namely whoever displays more profligacy in their projected emission pattern – which makes the American claim for simultaneous developing country mitigation commitments indefensible even if one chooses to ignore historic responsibilities.[17]

Conclusions

No developing country will surpass American carbon emissions in the next 20 years. As a matter of fact the average American's emissions are projected to continue growing at a rate significantly above average, while those of the average Chinese and Indian will grow at the world average, if not substantially below it. Indeed, no traditional emission measure substantiates the claim that main developing countries are going to be worse – let alone much worse – emitters than the United States by the time of the Kyoto Protocol commitment period (2010), or for that matter by 2020. This is not to say that developing country emissions will not have to be addressed at some point not too long from now. But it clearly exposes the fallacy in the orthodox argument for a rejection of the Kyoto Protocol according to which the US is unfairly being singled for reform (or even punishment) while other offenders – who are as bad if not much worse – are let off the hook. This argument is plainly and simply no longer tenable, assuming it ever was in the first place.

The costs of implementing the Kyoto Protocol in the US might be considered politically inopportune, but no-one can seriously claim that they are unfair, be it because of their magnitude or because of a lack of 'meaningful developing country participation'. In short, even if we disregard the past, it still not feasible to justify the claim that America would be unfairly treated by the Kyoto Protocol 'because it exempts 80 percent of the world.' Developing country emissions will have to be addressed at some point in the not too distant future, but it is unfair and morally wrong to use them as a scapegoat at the here and now.

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in the context of aggregate measures (absolute, relative, increment, and cumulative) can equally be applied to per capita measures.

[17] Chinese per capita emission levels, it is true, are edging themselves upwards toward US levels, while Brazil's mirror them from below at a fairly constant difference. But the fact remains, quite apart from the vastly different starting points in 1999, that US levels still dominate both of them.

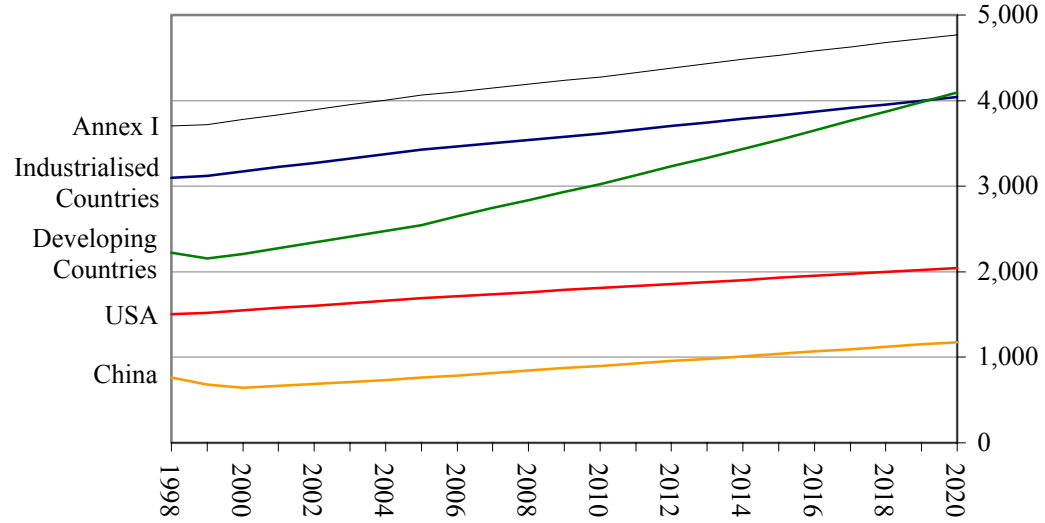

Figure 7: Regional CO_2 Emission Projections 1998-2020 (MtC)

Sources: China = *LNBL*01; DCs = *IEO*01 with *LBNL* China Projection, Rest = *IEO*01

Postscript: The US Cabinet-level Analysis of the Kyoto Protocol

In his announcement of the Cabinet-level Review of US Climate Change Policy on 11 June 2001,[18] President Bush reminded his audience in the Rose Garden of the White House that 'the Kyoto Protocol was fatally flawed in fundamental ways,' and went on to point out that 'the world's second-largest emitter of greenhouse gases is China. Yet, China was entirely exempted from the requirements of the Kyoto Protocol.' Admittedly, this time President Bush had his focus not on the 'inequity-' but on the 'ineffectiveness-because-of-lack-of-meaningful-participation'-accusation, which is why it may be helpful to have Grubb and Depledge remind us that:

> The reality is that the Kyoto Protocol provides the potential for a dynamic, evolving regime, with the current set of emission targets for the first commitment period being only the first step in a much longer-term process of tackling climate change. The Protocol establishes a structure of rolling commitment periods, with negotiations on second period commitments … to start by 2005. The current first period emission targets are intended to meet the Convention requirement that industrialised countries should take the lead in tackling climate change by modifying their emission trends; they were never intended to provide the definitive solution to climate change. … The Protocol is based on the premise that the second and subsequent periods are likely to require more stringent emission commitments, and for a wider group of parties, thus gradually "ratcheting up" the Protocol and its resulting environmental effectiveness.[6]

However, the figures referred to in the *Initial Report*[19] of the Climate change Review in support of alleged ineffective nature of the Protocol are precisely of the type discussed here in the context of the orthodox emissions claim (Claim I):

> **The Kyoto Protocol is ineffective in addressing climate change because it excludes developing countries.** The Kyoto Protocol's emission reduction requirements apply only to industrialized countries. Developing countries can continue business as usual under the Kyoto Protocol, despite their rapidly growing emissions:

[18] http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html
[19] http://www.whitehouse.gov/news/releases/climatechange.pdf

> - Current data indicate that developing countries' net emissions (including emissions and uptake from land use activities) have *already* exceeded those of the developed world.[Sources: IPCC Special Report on Emission Scenarios, International Energy Agency data (www.iea.org) and Land-use data from Oak Ridge Laboratory Carbon Dioxide Information Analysis Center (cdiac.esd.ornl.gov).]
> - Moreover, annual developing country emissions of CO2 will double between 1990 and 2010 – an increase that represents over twice as many tons as all of the reductions the United States would be required to take under the Kyoto Protocol.[Source: *IEO*01]

Limitations of time do not permit me to comment in any depth on the absolute aggregate level claim that developing country net-emissions have already surpassed those of the industrialised world. But it may nonetheless be illuminating to compare it with the relevant estimates and projections of CO_2 emissions on their own (i.e. in the absence of land use change effects). As it happens, the latest EIA estimates and projections – adapted to the LBNL China projections – tell us (Figure 7) that in 1999, the CO_2-emission level of the developing world was at 70 percent (960MtC below) of the industrialised emissions, and is not projected to surpass them before the end of the next decade. Accordingly one cannot but marvel at the level of uptake from land-use activities in industrialised countries which must have been required to equalize the greenhouse gas emission levels of the two blocs.

As concerns the relative increment claim (the doubling of developing country CO_2 emissions), it cannot be denied even with the revised China projections discussed earlier, that while industrialised emissions are projected to increase by 30 percent developing country emissions will increase by 80 percent. Yet if one is determined to establish the priority of who is to act, one might also want to take into consideration two other facts (*IEO*01 + *LNBL* China):

- In 2010, the industrialised country CO_2-emissions will still be around 20 percent higher than industrialised ones
- Starting at 3200kgC, the average industrialised person is projected over the time period to increase their emissions by 450kg, more than three times the 130kg increment of the average developing country inhabitant, who started at 310kg.

While the *Initial Report* does not contain any concrete proposals as to how the US Administration wishes to overcome this 'lack of meaningful participation' (beyond references to selling more technology and enhancing measurement), there is no doubt that, given the prominence attached to it in their Kyoto Protocol critique, it remains one of their key strategic climate change objectives.

Appendix 1: The Fall in Chinese Energy Intensity

In economic literature energy intensity changes are often classified as being due to *technical* changes (also known as *physica*l- or *real*-intensity changes) or *structural* changes. Technical changes are defined in terms of energy used in the production of a particular product or by a particular economic sector. Structural changes, by contrast, are defined as shifts in the shares of total outputs between sectors which may be more or less energy intensive (often also including shifts in import and export patterns). In evaluating empirical studies of these two types of causes for energy intensity changes in a national economy, it is important to keep in mind the strong context dependence of these concepts: asking for the main cause of certain observed intensity changes occurred without specifying the level of sectoral aggregation is at best confusing and at worst meaningless. The fact that the answer can change depending on kind and level of aggregation involved becomes clear just by keeping in mind that at the top-level of aggregation, all changes are *by definition* 'technical' ones.

Thus Garbaccio *et al.* rightly point out that since the level of aggregation of their study is not as detailed as that used in a series of World Bank studies, it would be wrong to infer that their conclusion – 'between 1997 and 1992, technical change accounted for most of the fall in the energy-GDP ratio'[1:89] – is not necessarily inconsistent with the World Bank assertion that structural change 'was the most important factor.'[1:89] However, at their 2-digit sectoral classification level, Garbaccio *et al.*'s finding have been supported by a number of other studies, not least the very recent working paper of Zhong Xiang Zhang, according to whom '93.2% of the cumulative energy savings in the industrial sector for the period 1990-6 were attributed to real intensity change, with about three quarters of such savings from the four chief energy using sub-sectors (i.e. chemicals, ferrous metals, non-metal mineral products and machinery).'

Appendix 2: The Fall in Chinese Energy Consumption

(Source: Sinton and Fridley, 2001)

- Between 1996 and 1999, China's … primary energy use declined by 12 percent, mainly due to falling coal use. … This remarkable reversal of the long-term expansion of energy use has occurred even as the economy has continued to grow, albeit more slowly than in the early 1990s. … The decline in primary energy use has occurred despite robust, though slowing, GDP growth of nearly 8 percent between 1996 and 1999.[20]

- The heart of this story is the country's single largest fuel source—coal. … On the supply side, the reasons for this phenomenon are straightforward. A strong, centrally mandated campaign to improve the profitability of big state-owned mines and to close small mines has helped to push down output. …On the demand side, the picture is more complicated. Most evidence points to continued rise in demand for

[20] According to Jonathan Sinton (personal communication, June 2001) 'Recent evidence suggests that coal production (and use) was significantly understated in 1999 and 2000. The National Bureau of Statistics is planning to release a revised figure for coal production for 2000, raising the currently released figure of 957 Mt by 90 Mt. In fact, actual output may have been up to 150 Mt higher than the current official figure, or about 1,100 Mt. Even assuming this latter figure to be correct, primary energy use would still have fallen by 9% between 1996 and 2000, mainly due to a nearly 300 Mt drop in coal use.'

transformation, i.e., to electricity, heat, gas, and coke. Virtually all of the decline has thus been in direct uses of coal, such as boilers for industry and buildings, kilns, and stoves.

- The current energy mix and trends will be greatly altered if the Chinese government continues its planned reductions in coal dependence. … It is clear that the decline in energy consumption is, in essence, a decline in coal consumption. … The decline in direct coal use reflects the convergence of a number of trends, both short- and long-term. Among the short-term trends, the economic downturn beginning in 1998 appears to have had a significant impact on coal use,

- Another short-term trend with longer-term implications is the emergence of a buyer's market in coal.

- At the same time that slower economic growth, industrial reform, and higher coal quality have resulted in a substantial reduction in coal consumption, other longer-term trends are also having a continued impact. The shift from state-owned to collective, private and foreign-invested ownership of production is widely seen as a shift to greater efficiency, particularly since the productive assets of the non-state sector are often newer and better operated, even in some rural township enterprises. The product mix is also improving, providing greater quality and value of output per unit of energy input. Although industry remains the leading sector of the economy, within the industrial sector certain energy-intensive subsectors have declined while others of lower energy intensity have gained in importance.

- Sustained support for environmental and energy-efficiency policies is a factor in the continuing decline of coal use by households. Residential coal use is being aggressively replaced by cleaner forms of energy such as LPG, natural gas, town gas, and electricity. Planned expansion of natural gas use from 20 bcm today to 100 bcm in 2010 will benefit millions of residential users and further displace coal. Long-term implementation of policies to promote energy conservation has helped to accelerate improvements in end-use efficiency in most sectors, and will continue to be key as China's market orientation deepens.

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References

[1] Garbaccio, Richard F., Mun S. Ho and Dale W. Jorgenson (1999), 'Why Has the Energy-Output Ratio Fallen in China?', *The Energy Journal*, Vol.20, No.3:63-91.
[2] Sinton, Jonathan and David Fridley (2001), 'Hot Air and Cold Water: The Unexpected Fall in China's Energy Use,' *China Environmental Series*, Issue 4. Washington DC: Woodrow Wilson Center, (in press).
[3] Sinton, Jonathan E., and Jean Y. Ku. Energy and Carbon Scenarios for China: Review of Previous Studies and Issues for Future Work. Report no.LBL-47116. Berkeley: Lawrence Berkeley National Laboratory. November 2000.
[4] Zhang, Zhong Xiang (2001), 'Why Had the Energy Intensity Fallen in China's Industrial Sector in the 1990s? The Relative Importance of Structural Change and Intensity Change', http://papers.ssrn.com/sol3/papers.cfm?abstract_id=267993
[5] WEFA (1998), *Global Warming: The High Cost of the Kyoto Protocol, National and State Impacts*
[6] Grubb, Michael and Joanna Depledge, 'The Seven Myths of Kyoto: A Viewpoint,' *Climate Policy* No.2, 2001 (forthcoming)

Figure 4 References

- Asian Development Bank, Global Environment Facility, United Nations Development Programme. 1998. Asia Least-cost Greenhouse Gas Abatement Strategy: People's Republic of China. Manila: Asian Development Bank. October.
- East-West Center, Argonne National Laboratory, and Tsinghua University. 1994. National Response Strategy to Global Climate Change: People's Republic of China. Final Report of the Technical Assistance Project (TA 1690-PRC). Manila, Philippines: Asian Development Bank. September.
- National Environmental Protection Agency of China, State Planning Commission of China, United Nations Development Programme, and the World Bank. 1994. China: Issues and Options in Greenhouse Gas Emissions Control. Washington, DC: World Bank. December.
- Research Team of China Climate Change Study. 1999. China Climate Change Country Study. Beijing: Tsinghua University Press.
- United Nations Environment Programme, and National Environmental Protection Agency of China. 1996. Incorporation of Environmental Considerations in Energy Planning in the People's Republic of China. Beijing: China Environmental Science Press. November.

Data Sources

Energy Information Agency (US Dept of Energy)

ICDE *International Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels Information*, http://www.eia.doe.gov/emeu/international/environm.html#IntlCarbon
*IEO*98 *International Energy Outlook* 1998, http://www.eia.doe.gov/oiaf/archive/ieo98/
*IEO*99 *International Energy Outlook* 1999, http://www.eia.doe.gov/oiaf/archive/ieo99/
*IEO*00 *International Energy Outlook* 2000, http://www.eia.doe.gov/oiaf/archive/ieo00/
*IEO*01 *International Energy Outlook* 2001, http://www.eia.doe.gov/oiaf/ieo/

International Energy Agency (OECD)

*EFC*00 *CO_2 Emission from Fuel Combustion 1971 – 1998* (2000 edition), OECD/IEA 2000
*WEO*00 *World Energy Outlook 2000*, OECD/IEA 2000.

International Monetary Fund

*IMF*01 *World Economic Outlook 2001*,
http://www.imf.org/external/pubs/ft/weo/2001/01/data/index.htm