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The Fallacies of Concurrent Climate Policy Efforts

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Abstract Climate policy has assumed an extreme degree of urgency in the international debate in recent years. This article begins by taking a critical look at the scientific underpinnings of the efforts to stabilize the climate. It points to several serious question marks on the purported relationship between greenhouse gas emissions and global warming, and expresses distrust about claims of impending catastrophes related to rising sea levels, hurricanes, and spread of infectious disease. It then reviews the concurrent climate policy efforts and concludes that they are incoherent, misguided and unduly costly, and that they have so far had no perceptible impact on anthropogenic greenhouse gas emissions. The exceedingly ambitious policy plans currently under preparation suffer from similar fallacies. For these reasons, but also because of the remaining scientific doubts and the exorbitant costs that have to be incurred, skepticism is expressed about the preparedness to implement the climate policy plans currently on the table.

Keywords Climate policy costs · Climate policy achievements · Climate policy fallacies

INTRODUCTION

The world is engulfed in a hurricane of pleas for deep and costly action to stabilize climate. Politicians are outdoing each other at international meetings with commitments to act. Media are painting ever more scaring stories of impending catastrophes that can only be avoided by immediate and energetic measures to cut greenhouse gas emissions. Even school children around the world are enticed by teachers about the urgent need to convince their families that sustenance of the human habitat requires a profound change in life styles. Divergent views are not allowed, and in any case cannot be heard in the ongoing uproar. Skeptics of the prevalent credo are subjected to an intellectual, if not yet a physical, fatwa for their errant beliefs. Humanity has been gripped by a profound moral panic whose end is not in sight. And yet, as will be demonstrated on the following pages, those who assert that we are near some kind of catastrophic tipping point, have no unambiguous scientific support for their claims.

What follows is a skeptic's confessions. The main purpose of the article is to scrutinize the ongoing policy efforts aimed at stabilizing climate. It is also to look into the agenda of policy plans in the area, to clarify the relevance, efficiency and political practicability of the emerging policy brew. However, an extended preamble that looks at the scientific foundations of climate fear is needed before the climate policy issues can be intelligently tackled.

The rest of the article is therefore structured as follows. The "Immediate deep action to stabilize the climate, or else…" section tracks the antecedents of the policy frenzy. In "Questionable scientific and observational support for the perils of global warming" section, doubts are formulated about the validity of some of the scientific and observational assertions and of their purported implications for human societies, which form the basis for the policy urge. "An overview of the ongoing and planned policy efforts to stabilize climate" section provides an overview of the ongoing and impending policy efforts, scrutinizes their shortcomings and fallacies, and tries to explain their unwieldy nature by the political processes through which they came into being. Last section provides a set of conclusions.

IMMEDIATE DEEP ACTION TO STABILIZE THE CLIMATE, OR ELSE…

A wider public debate on the climate impact from human greenhouse gas emissions emerged only in the early 1980s. It gained speed after 1988 when the Intergovernmental Panel on Climate Change (IPCC) was established and started engaging natural and social scientists to produce a strident flow of studies on the subject. A central issue in many of these studies has been to determine the annual cost of a deep policy to stabilize climate and the annual benefits that would follow from a more stable climate, compared to the global warming that would occur from a business as usual scenario in a 50–100 year perspective. A deep policy was regularly defined as one assuring that CO_2e-concentrations[1] in the atmosphere did not exceed a doubling (from pre-industrial 280 to 560 ppm, believed to involve a global warming of some 2°C). Since the early 1990s and at least until 2004, most studies concurred that the undiscounted annual costs and benefits were of roughly equal magnitude, in the range of 2 ± 1% of global GDP over the twenty first century (Cline 1992, 2004; IPCC 1996, 2001; Pearce 2003). Given that the costs would have to be incurred in the near future while the benefits would emerge with several decades delay, a deep climate policy was hard to motivate economically even when very low discount rates were employed to assess the present values of costs and benefits. This may explain the shallow nature of the Kyoto agreement entered into in 1997.

By 2006 and 2007, however, three events brought about a dramatic change. The first was the publication of the Stern Review, commissioned by the government of the UK (Stern 2006), where the author claims (Executive Summary, p. X) that the undiscounted annual benefit of a policy that prevents global warming from exceeding 2°C will be at least 5% of global GDP, and may amount to as much as 20%, for that is the magnitude of the damage caused by climate change, not the 2 ± 1% of global GDP suggested by earlier studies. In the absence of urgent and deep stabilization action, Stern envisages "risks of major disruptions to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the twentieth century." Then, in 2007, the IPCCs Fourth Assessment Report was published (IPCC 2007), in which it is asserted (Working Group III, Summary for Policymakers, p. 15, repeated on p. 26) that the annual undiscounted cost of a climate policy to prevent the atmosphere's CO_2e from exceeding a doubling will amount to 0.1% of global GDP or less. Neither of the studies makes an effort to explain the sudden and extraordinary shift from the positions established in preceding research. The third event was the release of the film "An Inconvenient Truth" followed by the joint award of the 2007 Nobel Peace Prize to Al Gore, the film's creator, and to the IPCC.

The new numbers provided by the two studies have suddenly made a deep climate policy economically highly worthwhile, while Al Gore's film had a great influence by focusing the politicians', the media's, and the general public's attention on the scary perils likely to follow in the absence of immediate and deep policy action.

The aggregate of the three events brought about the frenzy that has raged since then. The political reactions were not late to follow, even though tangible action remains to be taken. Thus, climate issues dominated the agenda of the G8 meeting in 2007 and 2008, at which the members agreed on the urgent need to reduce global emissions by 50% in 2050 (IEA 2008a). Meanwhile, in January 2007, the EU Commission published a communication titled "Limiting Global Climate to 2 degrees Celsius—The Way Ahead for 2020 and beyond" (EU 2007), which identifies Europe's desire to implement a deep climate policy with global ambitions. The Lieberman/Warner Bill of 2007 (described in EIA 2008), proposing a far-reaching US federal climate stabilization program, and the many state level initiatives in the US represent further reactions to the emerging mood, as do the numerous overt and covert threats to apply protectionist measures against nations that fail to follow the climate stabilization mainstream.

QUESTIONABLE SCIENTIFIC AND OBSERVATIONAL SUPPORT FOR THE PERILS OF GLOBAL WARMING

Climate science is relatively novel, characterized by unsettled issues and extreme levels of uncertainty. Yet, in the ongoing pitch, heavily biased and weakly substantiated claims about the need for immediate deep action to avert impending catastrophes are frequently made by the official lobby, comprising the IPCC and Nicholas Stern, that wishes to promote a deep climate policy. Typically, these claims are then further exaggerated by media and environmental NGOs. The truth of these assertions is widely taken as given. In what follows, I review a selected set of such claims to demonstrate the weak scientific or observational foundation on which they are based. Given the infected nature of the debate, I take considerable care to reference the scientific literature in support of what is said. There are few references to *Nature* and *Science*. This is the unfortunate result of the biased position taken in recent years by the editors of these two journals when it comes to climate issues, expressed by their reluctance to publish

[1] CO_2-equivalent, taking other greenhouse gases into account.

views that question the predominant credo (Michaels 2008). At the same time, I frequently refer to *Energy & Environment*, a refereed journal that came into being to give a voice to the critics, precisely because of the bias exhibited by the two leading journals.

Anthropogenic Warming

Although the existing 150 years of global surface temperature measurements suffer from a variety of deficiencies, there appears to be a fairly general agreement that warming has occurred, and that current levels are some 0.7°C higher than at the onset of the twentieth century. The agreement is much less complete about the role of greenhouse gases and of the human influence on the temperature rise.

Anthropogenic warming constitutes the very basis for the urge to arrest the human emissions of greenhouse gases that are seen as its cause. Thus, the IPCC's 4th Assessment Report (IPCC 2007) asserts that "Most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic GHG concentrations" (Synthesis Report, Summary for Policy Makers, p. 5). But is there scientific evidence or positive proof that the recent warming is anthropogenic?

The physics of climate models employed by the IPCC indicate unambiguously that most greenhouse warming must occur in the tropical mid-troposphere. This is counter to balloon and satellite observations since the 1960s, which show very small temperature increases in the tropical mid-troposphere, compared to those from surface observations (Lindzen 2007, 2008; Singer 2008). The physics subsumed in the IPCC models also see a uniform positive relationship between greenhouse gas concentrations in the atmosphere and warming. But while concentrations have been rising steadily, from pre-industrial 280 ppm CO_2e to 455 late in the 2000s decade (IEA 2008a), the rising global surface temperatures since 1900 exhibit a distinct irregularity, with warming between 1900 and 1940, and again between 1975 and 2000, with a distinct cooling in between (Fig. 1). Satellite data for the lower troposphere, depict a complete absence of warming in the course of the present century (Fig. 2).

Pathetic attempts employing aerosols and wind data to reconcile the observations with the greenhouse warming theory, reminding of the efforts to deny the Copernican revolution, are unconvincing. Longer as well as shorter run solar variability along with ocean fluctuations, neither of which are well handled by the climate models currently in use, provide more straightforward explanations to the observational record (Lindzen 2007, 2008; Singer 2008). On a more speculative note, results from NASA probes suggest that the polar ice caps on Mars are shrinking, and that the planet's climate is the warmest in decades (Nasa 2003), also points to solar activity as the main cause to observed changes both on Mars and the earth. Policies to reduce greenhouse gas emissions might prove ineffectual, if solar activity is in fact the main explanation to global warming.

The infamous hockey stick (average reconstructed global temperature data as a function of time), has related antecedents in that it purported to demonstrate how anthropogenic greenhouse gas emissions over that past 100 years had driven global temperatures with exceptional speed to unprecedented levels in a 1,000-year perspective, in contrast to the relatively stable temperatures characterizing the preceding 900 years (Mann et al. 1998, 1999). The hockey stick was given great prominence in IPCCs 2001 publications and was reproduced widely in the media, as it appeared to vindicate the Panel's central thesis about anthropogenic greenhouse warming.

The hockey stick analysis was beset with methodological errors as has been demonstrated by McIntyre and McKitrick (2003, 2005). Mann's statistical methodology

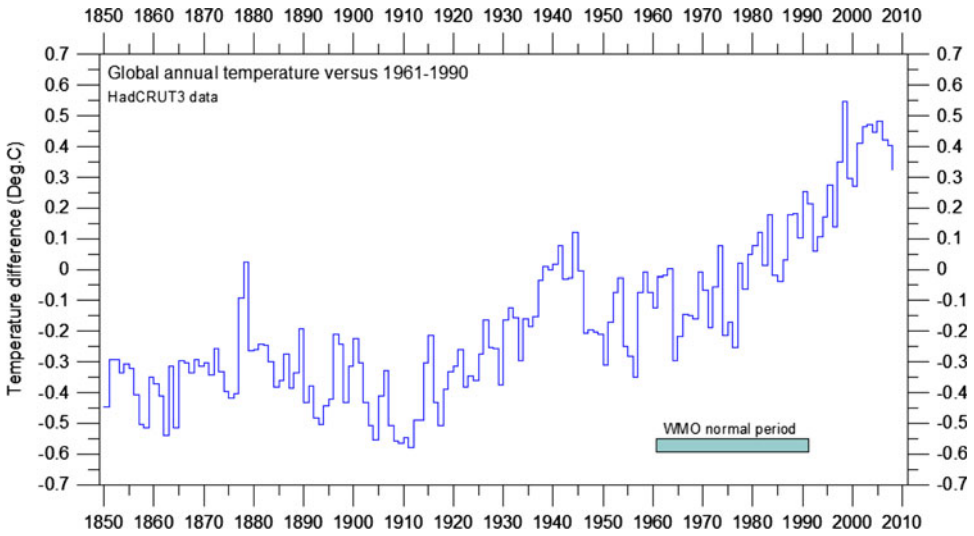

Fig. 1 Global surface temperature: deviations from the average for 1961–1990, degrees C, *Source*: Climatic Research Unit, University of East Anglia, 2009

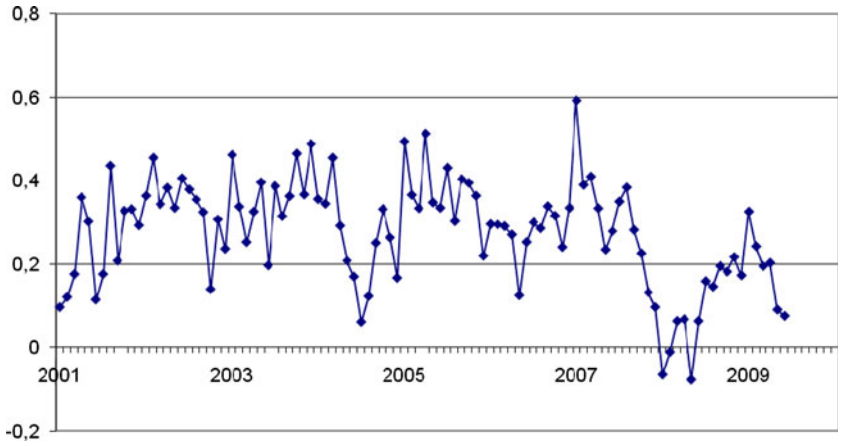

Fig. 2 Global monthly lower troposphere temperature. Deviations from 1979 to 2008 average degrees C according to Remote Sensing Systems, using data obtained by the National Oceanographic and Atmospheric Administration (NOAA) TIROS-N satellite, and interpreted by Dr. Carl Mears., *Source*: http://www.climate4you.com/

was so flawed that it was seen to produce a hockey stick shape with vastly different data sets. In 10,000 simulations applying Mann's algorithm on random numbers, a hockey stick emerged 99% of the time. The importance of the subject and the acrimonious debate that followed prompted the US House of Representatives to appoint a committee, led by Edward Wegman, a prominent statistician, to settle the issue. Wegman (2006) reaffirmed the deficiencies in Mann's methodology and asserted the absence of support for the claim that the 1990s decade was the hottest in a millennium. The hockey stick no longer appears in IPCCs more recent publications.

Assessments of global temperature change pose challenging problems, especially for periods prior to the mid-1800s when thermometers started to be employed. Mann made heavy use of tree ring data, raising an additional problem with his analysis, given that tree rings reflect not only temperature, but importantly also precipitation. More recent reconstructions of millennial temperature change, employing a variety of proxies show the temperature run-up to the medieval warm period maximum to have been equally strong and fast as that experienced over the past century, and the peak temperatures 1,000 years or so ago at least equal, and according to some scientists, significantly exceeding those of the most recent decades (Loehle 2007).

The demise of the hockey stick throws light on two deplorable circumstances surrounding the scientific process of the IPCC. The first is the extreme difficulty experienced by critics in accessing the data and computer code used in the original work. Michael Mann arrogantly claimed that this material was proprietary and would not be made available to outsiders (Holland 2007). The second is the peer review process to which Mann's work was subjected before being employed in support of IPCCs greenhouse warming claims. Wegman asserts that any reasonably qualified statistician would have detected the methodological deficiencies, and the reason this did not occur is due to the weak statistical background of the small paleoclimatological community to which Mann belongs and from which the referees of his work were recruited. The two circumstances certainly weaken the confidence in IPCCs scientific assertions.

Warming and Sea Level Change

There are many scaremongers asserting that an extraordinarily strong sea level rise will occur over the present century, with catastrophic consequences for human habitat. Quoting the IPCC, senator Joe Liberman referred to "2500 UN scientists who tell us that unless we stop global warming, sea levels could swell up to 35 feet (almost 11 m) submerging millions of homes" (press report Aug 30, 2001). Hansen (2006) claims that sea levels may rise by 6 m by the end of the present century, while Al Gore's documentary states, similarly, that a sea-level rise of 20 feet (6 m) is a realistic short-term prospect.

A sea level rise of several meters would indeed be dire, but all three statements reproduced above have been made by outliers, and outside a scientific context.[2] The IPCC, in fact, has developed an increasingly moderate view over time on sea level rising, and Lieberman's reference to its 2,500 scientists is fallacious. The four successive Assessment Reports issued by IPCC have gradually reduced their estimates of sea level rise, with the maximum figure projected for 2,100 coming down from 3.7 m in 1990 to 1.2 m in 1995, 0.8 m in 2001 and 0.6 m in 2007 (Singer 2008). Even the moderate 2007 prediction has to be put into a context.

First, according to abundant geological records (e.g., Fairbanks 1989), sea level has risen by about 120 m since the last glacial maximum, about 18,000 years ago, or 0.7 m per century, quite in line with the IPCCs more recent maximum projections, and yet, adjustments by humans and other species have averted any tendencies to catastrophe.

[2] James Hansen is indeed a scientist, but the claim attributed to him has been made in a non-scientific context.

Furthermore, a deceleration appears to be occurring. Thus, in the first half of the twentieth century, the measured rise was 2 mm per annum, while in the second half it was 1.5 mm, making a total of 35 cm for the entire century (Holgate 2007). *Second*, short run changes in sea level are extremely difficult to measure (Douglas and Peltier 2002), providing scope for a wide range of views. For instance, contrary to IPCC fears, Mörner (2004) found the sea level around the Maldive Islands to fall by 20–30 cm over the preceding 30 years, but this result is subject to alternative interpretations. Eschenbach (2004) suggests that it could be a result of rising land due to coral growth. And *third*, the relationship between global warming and sea level predominantly runs through the expansion of a warmer ocean, and the melting of the Greenland and Antarctic ice caps. Recent data suggest no statistically significant ocean warming (Gouretski and Koltermann 2007). And according to IPCCs Fourth Assessment Report from 2007 (Working Group I, Summary for Policy Makers), melting of the Greenland and Antarctic ice are phenomena that require thousands of years at the least, so their impact lies far beyond the concurrent concerns with global warming. The melting of Greenland's ice cap could possibly accelerate with global warming, given this island's southerly position, and the decreasing altitude of the ice cover as its thickness is reduced. But before jumping to hasty conclusions, it is worth to note a recent study of Greenland which found the 1930s and 1940s to be the warmest decades for more than a century, while the 1980s and 1990s were relatively cool (Vinther 2006). At the same time, increasing precipitation over the Antarctica, also plausibly due to global warming, has been observed to increase its ice cap by 5 mm per year, making it a sink, not a source of ocean water (Wingham et al. 2006).

Warming and Tropical Hurricanes

The Stern Review (2006) claims that global warming will result in more frequent extreme weather events including a rising intensity of storms. In the same vein, IPCCs (2007) most recent Assessment Report (Working Group II, Technical Summary, p. 64) asserts that "confidence has increased that some weather events and extremes will become more frequent, more widespread and/or more intense during the twenty first century." Media have jumped upon and exaggerated these asserions. Violent and frequent hurricanes are widely seen as a compelling consequence of warming. Yet, there is neither observational nor scientific support for this relationship. In fact Christopher Landsea of the Atlantic Oceanographic & Meteorological Laboratory, a leading contributor to IPCCs Second and Third Assessment Reports on the subject of hurricanes, resigned in disgust from the same assignment for the Fourth Assessment Report, precisely because he felt that IPCCs leadership insisted on a politically correct statement which was not affirmed by science.[3]

Recent work by Vecchi and Soden (2007) support Landsea's scientific position as does the straightforward statement by eminent atmospheric scientist Richard Lindzen (2005) that all models of global warming envisage a reduction of temperature differences between the polar and tropical regions, thereby reducing the tendency for hurricanes to form. Statistics for hurricanes that have landed on the US coast over two consecutive 50-year periods confirm this view. Between 1900 and 1949, there was a total of 101 such hurricanes, of which 39 were classed as particularly intense. Between 1956 and 2005, the corresponding numbers were 83 and 34 (Solomon 2008). Based on IPCC material, the Pew Center reports the absence of any increasing trend in the number of global tropical cyclones (http://www.pewclimate.org/hurricanes.cfm).

Warming, Mortality and Infectious Disease

Europe experienced an unusual heat wave in 2003, causing many deaths. In his evidence to the House of Lords in the UK, Sir John Houghton claimed that some 20,000 Europeans died in 2003 due to exposure and dehydration, and that with ongoing warming, that sort of summer will be the average in Europe by the mid-twenty first century (Lawson 2008). Nicholas Stern makes a very similar statement, but with the annual number of deaths raised to 35,000 (Stern 2006). Though this case refers specifically to Europe, similar alarmism has also been expressed about the global conditions.

Two comments will put the above example into a proper context. *First*, humans thrive in varied climatic circumstances, ranging from Finland to Singapore. They thrive because they have adapted to the respective climates, and successful adaptation is plausible within an even wider climate range. Suffering and mortality will rise in consequence of sudden unusual weather events such as the 2003 European summer. The *second* comment is that several scientific studies point to cold as a much bigger cause to mortality than heat. Keatinge et al. (2000) and Laaidi (2006) vindicate this view in relation to European conditions, while Lomborg (2007) draws upon global data to conclude that "the warming of 0.36°C since the 1970s has averted 620,000 deaths due to cold and added 130,000 due to heat." These studies then suggest that despite the human ability to adapt, the concurrent global climate is not the best possible for humans, and that a bit of further warming

[3] "I personally cannot in good faith continue to contribute to a process that I view as both being motivated by preconceived agendas and being scientifically unsound" (Landsea 2005).

would move the global, but not necessarily all local circumstances closer to human optimality.

The scare stories about global warming leading to a proliferation of infectious diseases, often focus on malaria and envisage that it will spread beyond the present tropical zone, were proffered by IPCCs Second Assessment Report (1996), which claimed that global warming could lead to 80 million additional cases of malaria per year worldwide. Such scares have been repeated and amplified by climatically oriented NGOs and in Al Gore's film *An Inconvenient Truth*.

Paul Reiter (2000), a leading global authority on insects and the spread of infectious disease, himself a contributor to more recent IPCC Assessment Reports, has effectively countered such scares. In the midst of the Little Ice Age, in the eighteenth and nineteenth centuries, when temperatures were significantly lower than in recent decades, malaria was endemic in cool regions like northern North America, France, England and Scandinavia. As recently as 1926–1927, 1,000 malarial deaths were reported in Greece. The most catastrophic known malarial epidemic occurred in the Soviet Union in the 1920s, resulting in more than ½ million deaths, of which 10,000 in Archangel, close to the Polar Circle (Reiter 1998). Only in the latter half of the twentieth century has the pestilence been effectively eradicated in virtually all temperate regions and many tropical ones like Malaysia and Singapore, primarily in consequence of emerging prosperity which permitted the launch of nationwide public health programs that included specific anti-malarial measures. A recent study (Tol and Dowlatabadi 2001) suggests that malaria can be eliminated once a nation has exceeded a GDP/capita level of some $3100, for only then will it be possible to afford the necessary measures. Malaria is far more correlated with poverty than with climate. Resources expended on climate stabilization will be largely wasted insofar as malaria is concerned, especially so because climate change is generally claimed to have an insignificant impact on temperatures in the tropics where the pestilence is still common.

AN OVERVIEW OF THE ONGOING AND PLANNED POLICY EFFORTS TO STABILIZE CLIMATE

On the preceding pages a number of doubts have been expressed about the prevailing greenhouse credo and its implications: (a) The laws of physics along with observed warming make it unlikely that greenhouse gases are the main cause of the rising temperatures recorded in the past 100 years. (b) The demise of the hockey stick has obliterated the assertion that the ongoing warming is unique in terms of speed, extent and level. The integrity and credibility of the IPCC process has been hurt by the way the demise took place. (c) The likely increases in sea level over the next century are not catastrophic and do not significantly deviate from the trend recorded since the last glaciation. (d) Continued warming is expected to even out polar and equatorial temperatures. This should result in reduced hurricane strength and frequency, contrary to the alarming assertions that are expressed by climate activists. (e) Prosperity, not climate, determines the spread of infectious diseases like malaria. Even with rising global temperatures, the geographical spread of this pestilence will continue to shrink, provided that wealth and prosperity improve.

I have limited my skeptical deliberations to these five, even though similar doubts can be expressed about many more of the assertions about impending catastrophes, e.g., the melting of Arctic sea ice, the extinction threat faced by Polar bears, or the deteriorating conditions for global agriculture.

The arguments and positions outlined in "Questionable scientific and observational support for the perils of global warming" section may be true or false. Given the recency of climate science, the final verdict is certainly not yet out. Nevertheless, one could reasonably expect that the aggregate of the doubts would impose some afterthought and restraint on the policy efforts. After all, even if only some of the alarming assertions turn out to be false, they will substantially reduce the potential damage of climate change, and so weaken the motivation to stabilize. And all the policies can be straightforwardly discarded if the climate science and the implications for climate change are wrong. For instance, to the extent that warming has causes other than greenhouse gas emissions, the efforts to reduce these emissions may prove irrelevant. However, in the current mood of self-righteous frenzy, questioning of the climate credo is not permitted, and trillion dollar policies are being launched with the many serious skeptics not allowed a voice.

The rest of the article leaves science aside and focuses entirely on policy. The key question to be addressed can be formulated as follows: Are the existing and emergent policy measures appropriate and cost effective for significantly reducing anthropogenic greenhouse gas emissions? My critique is intended to demonstrate the many fallacies that afflict policy and that make whatever reduction much more expensive than it need have been. The account is chronological, starting with what has already taken place, and concluding with the plans currently in the pipeline. A strong emphasis is given to the political economy process underlying policy evolution.

Excessive greenhouse gas emissions is a global issue whose handling requires a global approach if economic efficiency is to be assured. To an economist, the nature of

the solution is pretty straightforward. It could either have the form of a uniform global carbon tax or be implemented through a universal global system of trade in emission rights that are distributed through auctions. Both approaches would involve an equal charge imposed on all carbon emitters. There may be two reasons why such a system has not already been introduced. The *first* is that the costs of the scheme are deemed to be higher than the perceived benefit of a more stable climate, and the perception of the size of that benefit is bound to be suppressed by the scientific doubts expressed above. The *second* reason has a political economy character, in turn comprising three parts. (a) Politicians have a preference for national measures, for which they can take full credit. (b) Some nations, particularly the poor ones are less convinced about the priority to be given to climate policy and less able to afford the policy costs. Income transfers are needed to get them aboard a global scheme. (c) Climate policy can be pursued with a variety of instruments, some of which will benefit vested interests, so these instruments will be pushed in the seeking of rent, often resulting in costly regulatory capture and government failure.

The Kyoto Protocol

International climate negotiations have been conducted at a series of Conferences of the Parties (COPs). The Kyoto Protocol was adopted at COP3, convened in Kyoto in December 1997. The Protocol commits the Annex I countries (Russia, Ukraine, a group of former communist countries of Eastern Europe, and members of the OECD, excluding Mexico and South Korea), to reduce their CO_2e emissions by 2008–2012, the end of the first commitment period, to an average level 5.2% below actual emissions in 1990. Commitments by single nations were individually negotiated. For major countries they varied between −8% for EU15, and +8% for Australia. Bubbles, comprising the aggregate efforts of several countries, were allowed under the Protocol, and the European Commission redistributed its overall commitment among its then 15 members. The former communist members of the Annex I group were awarded non-binding commitments, given the implosions of their macroeconomies and greenhouse gas emissions after 1990.

Each participating country could determine its own policies to reduce domestic emissions, but the Protocol also identified three *flexible mechanisms* designed to help participants reduce their compliance costs, on the assumption that emission reductions abroad would be cheaper to accomplish than at home. Thus, an Annex I country could initiate and finance projects to reduce emissions in a former communist member of the Annex I group (*Joint Implementation*, JI), or in a country outside the Annex I group (*Clean Development Mechanism*, CDM), and take credit for the ensuing reductions. A participating country could also employ *emission trading* with other Annex I countries to attain its commitments.

Many of the Protocol's articles left the door open to widely differing interpretations. Contentious issues were left for negotiation in subsequent meetings. For example, the three flexible mechanisms were subjected to the rule of *supplementarity*, implying that they could supplement, but not entirely replace, domestic efforts to cut emissions. However, no quantitative dimension to supplementarity was determined at Kyoto.

The COP6 meeting in the Hague in November 2000 was inconclusively suspended due to the tensions between the EU which pleaded for rigid restrictions on trading and supplementarity, with no allowance for forest sinks, and the US which interpreted the 1997 Kyoto agreement in more liberal terms. Early in 2001, the US administration announced its unwillingness to continue negotiations on the basis of Kyoto. The Europeans responded by drastically changing their negotiating stance. In an effort to induce Canada, Japan and Russia to ratify Kyoto, all requirements of supplementarity were dropped and lavish allowances for forest sinks were reintroduced in an extra meeting convened in Bonn in July 2001.[4] These relaxations were all codified at the COP7 meeting in Marrakech in November 2001. Ironically, the deals struck in Marrakech basically reflected policies that the US had long favored.

Russia was the last country to ratify (Nov 2004), and the agreement entered into force early in 2005. In the same year, the EU-wide Emissions Trading Scheme (ETS) took over the national schemes that a number of EU member countries had launched in the preceding years.

Even as originally conceived, Kyoto was an extremely shallow climate policy. If continued until the end of the present century, anthropogenic warming analysis suggests the measures might have dampened temperatures by a hardly observable 0.1°C. The reformed Kyoto without the US will accomplish even less (Helm 2008). The title of Christoph Böhringer's (2002) opus, "Climate Politics from Kyoto to Bonn: From Little to Nothing?", catches the gist of what had transpired, and the question mark in his title appears to be redundant.

The Kyoto Instruments in Use

The EU ETS is undoubtedly the most important policy measure applied so far. It has received wide attention in media. Its first trading period was concluded in December 2007, and the second period stretches until the end of 2012.

[4] The EU, of course, remained at liberty to determine its own more restrictive policy of implementation.

Trading under the scheme is restricted to the expanded EU, comprising 27 members. In 2007, the trade volume involved more than 2,000 million tons CO_2e (representing some 40% of total emissions in EU27, and 4.5% of global emissions), and the transacted value reached $50 billion. Emission rights were distributed for free to the industries covered by the scheme, with units whose emissions exceeded allocations, obliged to buy additional permits. Trading prices were initially in a range of €15–30/ton CO_2e, but then fell drastically when it was discovered that allocated rights exceeded actual emissions by the participating industries (Damsgaard 2008), a result of industrial lobbying and national political pressures on the European Commission. The first trading period, then, did not reduce emissions, and merely led to a sizable income transfer, predominantly burdening electricity consumers. To come to grips with these fallacies, the Commission has reduced the volume of permits available during the second trading period, and replaced some of the free allocations by auctioning. In response, the 2008 price for emission rights initially recovered to a range of €20–30, but in 2009 it has remained below €15 most of the time.

The optimal emissions trading scheme should have an extended geographical reach, for then it will catch and even out a wide variety of compliance costs. For the same reason, it should ideally cover all emissions, for then trading will suffice for attaining whatever emissions goal, and there will be no need to impose distorting emissions taxes. The ETS complies reasonably with the first criterion but not with the second. In principle, it should be possible to cover virtually all emissions by moving the emission control upstream (production and imports of crude oil) in order to extend the burden of trading to, e.g., individual automobiles, but there is no indication that policy is in the process of change in this direction.

The ETS was launched to operate in parallel with a plethora of national tax measures with a direct or indirect aim of cutting emissions. The taxes and their combination with emission trading result in serious inefficiencies, mainly by exposing emitters to different carbon prices. Several issues are involved: (a) The taxes are national and not coordinated across the EU. This results in geographical differences in the level of impositions. (b) Taxes on activities not subject to trading are bound to differ from the impositions due to the purchase of emission rights. (c) Activities covered by trading are erratically subjected to taxes on top of the cost incurred by trading. While this double coverage raises the compliance costs, the practice has been shown to be environmentally inconsequential (Böhringer et al. 2002).

Damsgaard (2008) lists emissions trading initiatives being launched outside Europe, notably the *Western Climate Initiative* comprising seven states in the US and four Canadian provinces, operating since 2007, and the *Regional Greenhouse Gas Initiative* involving 10 states in Eastern US, to be launched in 2009. At the end of 2008, no trading scheme has been implemented at the federal level in the US, though many proposals have been presented to Congress. In New South Wales, Australia and in New Zealand at the national level, trading schemes are also under development, the latter with very limited geographical reach, but intended to have a universal coverage.

The Clean Development Mechanism (CDM) provided for 550 million tons CO_2e credits valued at $7.5 billion in 2007, with China accounting for more than half of total sales, and the Europeans being completely dominant buyers (Damsgaard 2008). Because of the way it is structured, this scheme has been marred by bureaucratic intricacies in demonstrating that the projects yield true emission cuts compared to what would occur in the absence of support from the credit buyers. It is sometimes described as a huge scam (Lawson 2008) in which European buyers are offered the same credits several times over, or credits from projects that would have been developed in any case. In the most conspicuous cases, heavily emitting installations have been established for the sole purpose of deriving income from the credits that are issued when these installations are eliminated (Economist Debate on Carbon Offsets, Dec 4–16, 2008, http://www.economist.com/debate/days/view/254; Harvey 2007). Joint Implementation (JI) has so far not developed on a significant scale, possibly due to Russian lethargy. This instrument is bound to suffer from the same deficiencies as the CDM.

The Dash for Biofuels

The present decade has seen an extraordinary expansion of biofuels production in the US and Europe. Even though security of supply has figured as an argument in favor of biofuels in the political debate, the reduction of greenhouse gas emissions has been the main motivation for the biofuels support on both sides of the North Atlantic. Table 1 demonstrates the 7.5-fold increase of output between 2001 and 2007, and almost a doubling anticipated till 2013.

Biofuels are not competitive with gasoline and diesel at oil prices between $50–100 per barrel (Brazil is an exception). Massive subsidies have therefore had to be expended to secure the recorded production growth, and

Table 1 Biofuels production in the US and EU, 000 barrels per day

	2001	2007	2013
USA	60	450	770
EU	20	150	280

Source: IEA (2008b)

Table 2 The Kyoto agreement: achieved versus committed CO_2e-emissions

	1990, m tons	2006, m tons	Achievement, %	Commitment 2008–2012, %
EU15	4,240	4,150	−2	−8
EU15 ex (Germ + UK)	2,250	2,490	+11	±0
Canada	590	720	+22	−5
Japan	1,270	1,340	+5	−6
Australia	420	540	+29	(+8)
USA	6,140	7,020	+14	(−7)
Total of above	12,660	13,770	+9	

Source: UN Framework Convention on Climate Change Home Page, http://unfccc.int/2860.php

even more subsidization will be needed to fulfill the projections. Around 2005, total subsidies amounted to $1.00–1.40/l ethanol in the US, and to $1.60–5.00 in Europe (OECD 2007). In comparison, pretax gasoline prices work out at about $0.55/l with crude oil prices at $53/bl, and at $0.85/l with crude oil at $108. In 2008, total biofuel subsidization can be assessed to absorb some $55 billion, more than half as much as the overall international aid flows.

With concurrent technology, ethanol and biodiesel usage in Europe and the US yield very limited reductions in greenhouse gas emissions. Even disregarding the moral issues of rising food prices as biomass extraction proliferates, it is clear that biofuels represent an extremely expensive climate policy tool. The subsidies currently expended on ethanol in the US amount to $400–550 per ton CO_2 emission reduction. In Europe, the range starts at $590 and goes up to an incredible extreme of $4500. The inefficiency in using biofuels for emission abatement emerges starkly when these subsidy numbers are compared with the price of EUs ETS emission rights, which has never exceeded $50/ton CO_2e. A more efficient second generation technology to produce biofuels may or may not emerge in the next decade.

The suspicion cannot be avoided that the rich countries' farm lobbies have succeeded in co-opting the green mafia and that they both are taking the media, the politicians and the taxpaying public for a great ride. Biofuels produced with the current technology represent a tremendous waste for insignificant benefits in terms of reduced emissions. They cannot be taken seriously as an instrument in the fight for climate stabilization.

Achievements

Table 2 reflects on the meager climate policy achievements attained until the end of 2006, the period for which emissions data are available. It covers only the countries that were to have binding constraints, though in the end Australia and the US opted out. The 2006 emissions, amounting to 13,770 million tons for the countries listed (excluding forest sinks), accounted for just above 30% of the global total.

Despite the high-sounding declarations and the intensive political manifestations, the countries in aggregate had increased their emissions by 9% since 1990. The EU15 (the EU group that signed the 1997 accord) is the only entry in the table that noted a small reduction. The possible attainment by EU15 of its Kyoto commitment will hinge not so much on climate policy but importantly on declining energy use due to a deep and extended recession at the end of the 2000s decade. The recorded European decline is not so much a result of climate policy as of (a) West Germany's absorption of East Germany and the ensuing modernization of the latter's power sector; and (b) the UK's dash for gas in consequence of this country's electricity deregulation. The achievement in the remaining 13 EU members cannot be called impressive. Canada and Japan will clearly not manage their Kyoto goals. Australia ratified the accord only at the end of 2007, and the US not at all, so these two countries cannot be bound by their 1997 commitments.

The Future

Even with full acceptance of the concurrent scientific alarmism on the damage of climate change, it is clear that the Stern Review assessments of that damage at more than 5%, and possibly 20% of global GDP is a gross exaggeration in that it disregards or seriously underplays both adaptive behavior and technical progress, an unacceptable approach to defining "business as usual" (Byatt et al. 2006). And IPCC's assertion, quoted above, that a deep mitigation policy will carry annual costs of 0.1% of global GDP, is so completely out of line with other assessments that one may suspect a typo. Even Stern's cost assessment of an annual 1% of global GDP is likely to be a serious underestimate (Byatt et al. 2006), not the least because the number emerges from model exercises that assume a friction-less economy in which adjustments are always economically optimal (Helm 2008). Yet, it is these extreme

figures of "benefit" and cost that have prompted the climate rhetoric pitch of the past 2 years, and brought about the plethora of unwieldy plans for future action. The EU has assumed a vanguard role in this context.

In a series of documents issued since early 2007, the EU Commission has made clear the position on the longer run European climate policy stance.[5] These documents clarified the European resolve to prevent global temperatures from rising more than 2°C above the pre-industrial level, with the eye-catching shorter run (2020) 20-20-20 policy goals: (a) European emissions to be cut by 20% from their 1990 level, importantly through expanded emissions trading; (b) a renewables share of 20% in total energy use; and (c) a 20% improvement in energy efficiency. Additional 2020 objectives in the package envisage raising the European emission cuts to 30%, provided a broad climate agreement involving China and the US is reached, and ensuring that biofuels attain a 10% share of total energy use in the transport sector. By 2050, European emissions should be 50% below their 1990 level.

The great ambition of this package can be gauged by comparing with the forecast outcomes for 2020 from a business as usual scenario in which no new climate policies are instituted over and above those in force at the end of 2006 (EU 2008). CO_2e-emissions are then anticipated to be 5% above the 1990 levels, renewables are expected to attain 10% of gross inland energy consumption, while biofuels are seen to equal 7.4% of transport fuel use.

The package has been criticized on a number of grounds. *First*, the envisaged emissions trading, though expanded in scope and coverage, will retain most of the shortcomings from which the present scheme is suffering. Limitations on trading to the EU area are envisaged to remain. No coordination with existing carbon taxation is planned. Free allocation of permits will be reduced, but will retain an important role. No reform of the fraud-prone Clean Development Mechanism is being considered. For all these reasons, the economically inefficient differences in the impositions on various emitters will continue. *Second*, the energy efficiency gains are importantly based on the belief that markets fail to take advantage of potential economic opportunity, a highly doubtful proposition. *Third*, the extreme waste involved in the existing support to biofuels will be further magnified as the role of these fuels is expanded. *Fourth*, it is hard to see the logic of the renewables goal per se in a climate policy. Not all renewables are climate neutral. In the presence of emissions trading and/or carbon taxes, a goal for renewables involves an inefficient policy over-determination.

Further questions arise on closer examination of the EU scheme. With Tol (2007) one may ask what is so special about the 2°C target, and wonder about the EUs pretensions to make it a global target. The policy is likely to prove quite expensive, though the politicians don't know for sure since they have decided to ignore existing benefit-cost analyses and to pay no heed to indirect costs, e.g., the cost of system wide changes in transmission and distribution and essential back-up installations as wind becomes an important electricity source. If indeed the policy is costly, will it prove politically executable, or will it follow other grand EU schemes like the Stability and Growth Pact and the Lisbon Agenda, into oblivion? One interpretation to the setting of the 2°C target is that the European governments have been convinced by concurrent rhetoric that abatement is not costly. Or the target may have been set not to be met but to make the public feel good about their government, or alternatively as an opening bid for international climate negotiations. Finally, the target can be seen as setting an example for the rest of the world to follow, but that purpose would have been better served by greater attention to the design of a cost effective policy, for reduced costs would make it more palatable for others to adopt.

To have a global impact of significance on emissions and on the greenhouse gas content in the atmosphere, the European policy must be widely adopted. A political decision by the Obama administration will determine the extent to which that country will follow suit. The same goes for Australia, Canada and Japan whose policies up to now have not carried very far (Table 2). For the rest of the world, which now accounts for half of global emissions, the decision is not so much political as economic. For both historical and equity reasons, the third world can make a strong legitimate claim that it must be paid for its contribution to climate stabilization, if it is to get on board. This will substantially raise the rich world's stakes.

In its policy documents, the EU has adopted the goal of a 50% emission cut by 2050. The G8 meeting in 2007 "agreed to seriously consider" a goal of reducing emissions by 50% in 2050, while in the following year's meeting the members "agreed to consider and adopt" the same goal (IEA 2008a). Against the background of this concurrence, it may be appropriate to present some results from exercises with a general equilibrium model of the world economy showing the order of magnitude of the required dollar flows if the world is to attain the above emissions goal, with the developing world's participation paid for in full by financial transfers from the Annex I group (Jacoby et al. 2008). By 2020, the net annual transfers are assessed at $500 billion, of which $200 billion from the US. By 2050, the required annual transfers would exceed $3000 billion, with the US contribution rising to $1000 billion. Note that this is on top of the cost of climate policy within the Annex I group. To put these sums in perspective, it may be noted that the total global foreign aid

[5] One of the first documents was EU (2007).

flows have amounted to some $100 billion in recent years. Given the relative size of these numbers and also the substantial dilution of EU's stance from its 2007 package at the Brussels Climate summit in December 2008, the failure of the COP15 meeting in Copenhagen in December 2009 is easy to understand. The gulf between the alarmist rhetoric and the political preparedness to incur costs appears impossible to bridge.

CONCLUSIONS

The world is in the midst of a frantic effort to institute policies that aim at stabilizing climate. This effort suffers from a number of fallacies related both to science and policy design:

- The contours of the scientific problem to be addressed by policy are far from clear;
- The frequent assertions that humanity is approaching some kind of catastrophic tipping point have a very weak and ambiguous scientific support;
- The reach of climate change is truly global, but there is a strong political preference for action at the national level, resulting in an uncoordinated, economically inefficient global policy stance;
- Measures with an international reach, where they are applied, are marred by bureaucracy and procedural complications that make them virtually impracticable and that foster graft;
- Cost efficient global action to reduce greenhouse gas emissions requires that all emitters face the same carbon price. The policy efforts introduced so far are economically inefficient in that the carbon price they impose varies widely across sectors and nations;
- The use of a plethora of uncoordinated instruments with overlapping reach results in further inefficiency and augmented policy costs;
- The purported urgency leads to policies whose effects have not been properly analyzed, and whose impact on emissions may prove counterproductive;
- The policy effort needed to impact significantly on emissions is deep and costly, and likely to require substantial income transfers. Unwillingness to face the costs results in a wide gap between political rhetoric and true preparedness to implement.

For all these reasons, purposeful and significant global action is unlikely within the foreseeable future.

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