North American versus European Global Warming Policies: Same Constraints, Different Objectives*

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Abstract

For most of the past decade the US and Europe have followed different paths on climate change policy, at least in regards to their stated objectives. The EU adopted mandatory emission cuts under Kyoto, while the US adopted a business-as-usual stance. However, both regions face the same economic and technical constraints. I argue that these have turned out to be so stringent that, despite having different objectives, the outcome in the two regions regarding greenhouse gas emissions has been nearly the same, namely business-as-usual.

1 Introduction

The European Union signed and ratified the Kyoto Protocol in 2002, promising to cut greenhouse gas emissions by 8% below 1990 levels by 2008. The USA refused to do so, and has not adopted any binding

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emission reduction goals. Instead, in 2002, they adopted a rather leisurely and non-binding target of reducing emissions intensity by 18% below the 2002 level by 2012—something that continuation of the post-1980 business-as-usual trend would suffice to achieve. Consequently these two large players have, for most of the past decade, followed two very different objectives: in the case of the USA, business-as-usual; in the case of the EU, deep emission cuts.

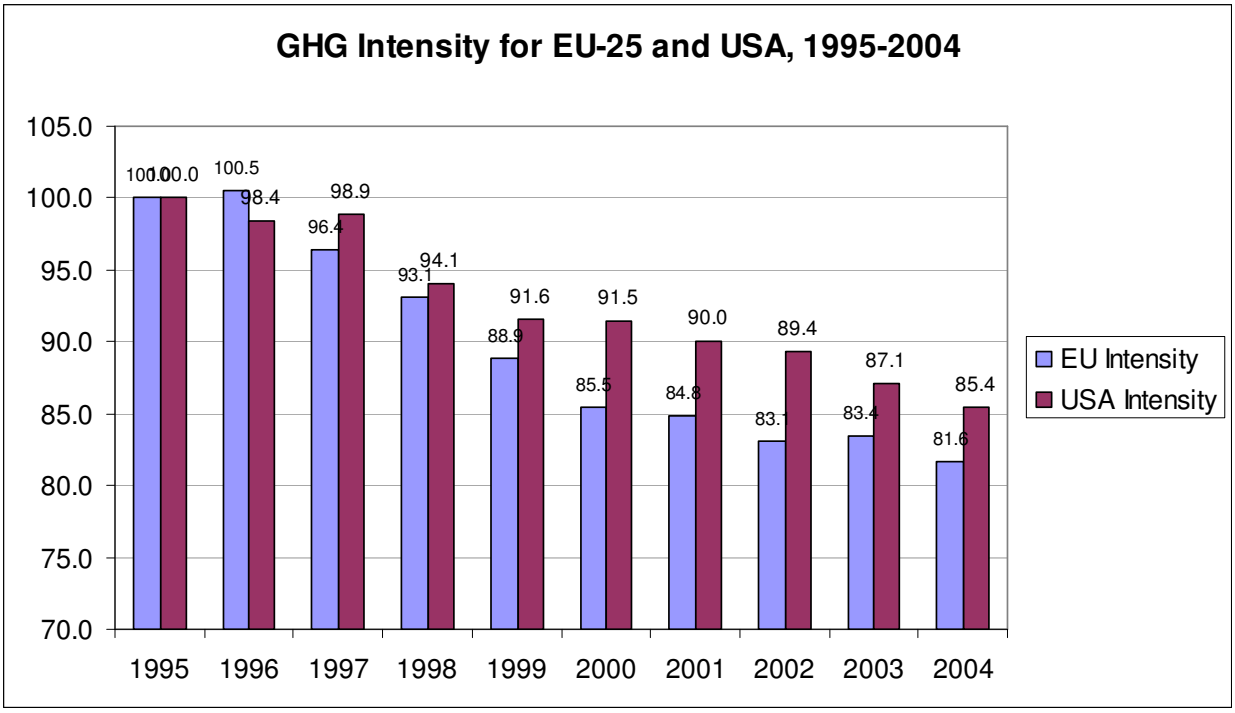

Figure 1: Greenhouse Gas Emissions Intensity, USA and Europe (EU-25). Data sources: http://epp.eurostat.ec.europa.eu/, http://www.gpoaccess.gov/eop/tables07.html and http://cdiac.esd.ornl.gov/ftp/trends/emissions/usa.dat; author calculations.

Yet a look at the data shows that the two regions have not differed all that much in terms of actual outcomes. From 1990 to 2004, total EU (including Germany) CO_2 emissions rose by about 5.5%.[1] Over the same interval they rose faster in the US, by about 13.8%. However, the US economy grew much more over that time span, in part because the EU data includes the collapse of Eastern Europe and east

[1] Marland, et al. (2007).

Germany after the fall of Communism. Emissions intensity (greenhouse gases per dollar of GDP) was very similar for the two regions. It fell by just over 18% in the EU and by just under 15% in the US. Consequently, without even trying, the US reduced its emissions intensity of production nearly as much as did Europe. Furthermore, the EU's reduction in emissions intensity mostly occurred between 1995 and 2000: since then it has fallen only a little, and the US is catching up (or "down"—see Figure 1).

In this paper I discuss possible reasons why the EU didn't achieve more. The main constraints they face are:

- Energy efficiency & emissions intensity are resilient to change
- Price paths favour coal over oil and natural gas in recent years
- No low-cost CO_2 abatement options appear to exist
- Energy is crucial for growth

I conclude that these constraints are so strong that international outcomes as regards greenhouse gas emissions are determined more by constraints rather than stated objectives.

2 US and EU CO_2 Emissions

2.1 US

Historical US CO_2 emissions are as follows

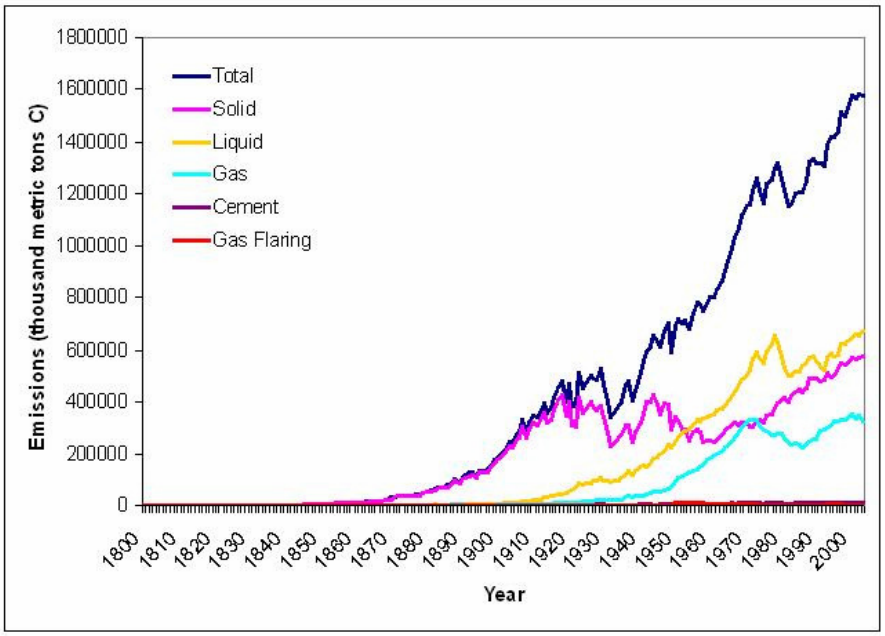

Figure 2. US Carbon Emissions, 1800-2004. Source: http://cdiac.esd.ornl.gov/trends/emis/usa.htm

Per capita emissions reached about 5.5 tonnes per capita in the early 1970s and have remained steady since then. There was a drop in total US emissions in the early 1980s, coinciding with a sharp recession, but since then they have moved steadily upward, with a slight leveling-off in recent years.

2.2 EU

Historical CO_2 emissions from Europe (not including Germany) are as follows:

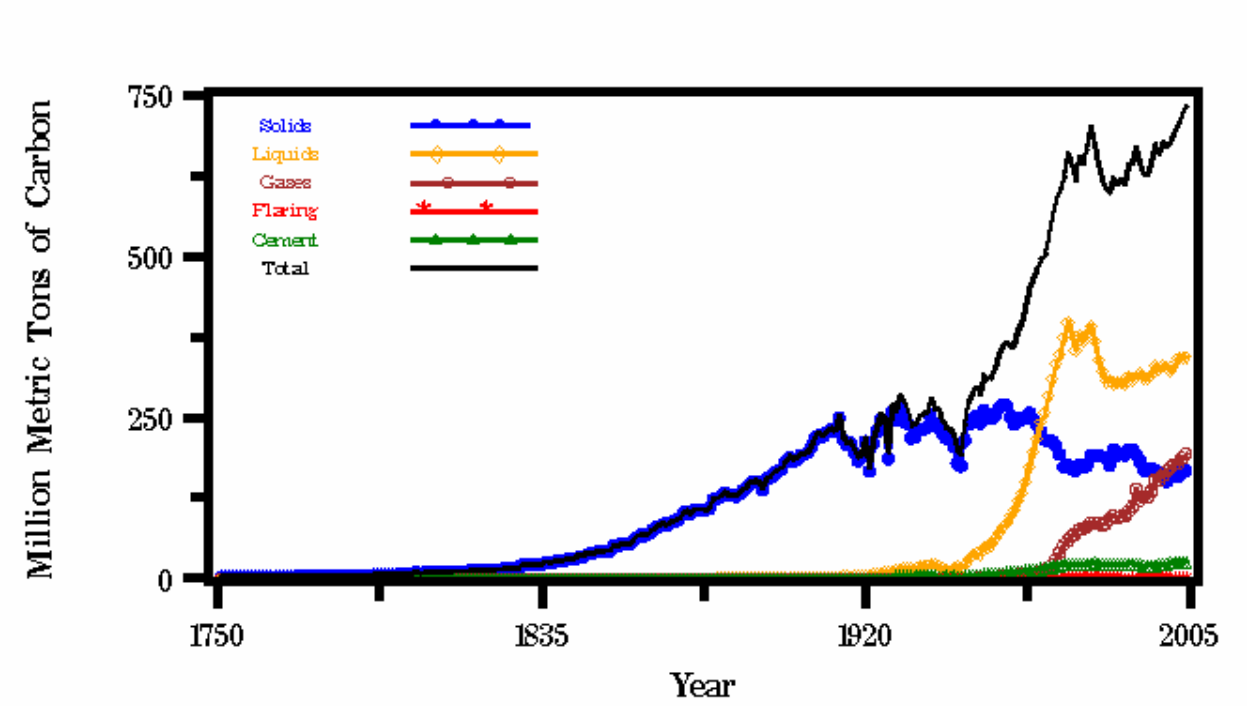

Figure 3. Western European Carbon Emissions 1750-2004 (Source: http://cdiac.esd.ornl.gov/trends/emis/weu.htm)

Since 1970, per capita emissions in Europe have been steady at about 2 tonnes. It is noteworthy that emissions fell sharply between 1992 and 1994, but have since been growing rapidly, reaching an all-time high as of 2002 and continuing beyond that ever since. The drop in the early 1990s created an impression that the EU was successfully reducing GHG emissions and could comply with Kyoto. However the post-1994 trend has been accelerating upwards, indicating that emission reduction policies in the Kyoto era have not had the intended effect.

The starting point of this analysis is that there are long-established upward trends in total CO_2 emissions in both the US and Europe. Emissions are strongly tied to population growth in both regions. Periods of decline are brief episodes among upward-trending segments.

3 Constraints on Emission Cuts

3.1 Energy efficiency and emissions intensity are resilient to change

A simplified version of what is commonly called the "Kaya Identity" decomposes annual emissions in the following form:

$$CO_2 = \frac{CO_2}{GDP} \times \frac{GDP}{Pop} \times Pop \qquad [1].$$

CO_2 denotes total emissions. The term $\frac{CO_2}{GDP}$ is total emissions per dollar of real GDP, or emissions intensity. *Pop* denotes population. The term $\frac{GDP}{Pop}$ is real GDP per capita, or average income.

In other words, total emissions is simply the product of emissions intensity, average income and population. This equation can be re-expressed in growth rate terms as:

$$\%\Delta CO_2 = \%\Delta Pop + \%\Delta \frac{CO_2}{GDP} + \%\Delta \frac{GDP}{Pop} \qquad [2].$$

In both Europe and the USA, public policy favours population growth and income growth. Consequently, future reductions in total emissions must come from reductions in emissions intensity. Intensity does trend downwards over time. Despite the absence of CO_2 control policy, since 1970, US emissions intensity has fallen by half, from 0.31 Kt emissions per $million dollar of real GDP, to 0.15, as of 2005 (for sources see notes to Figure 1). The total decline from 1960 to 2005 averaged 1.7% per year. However, during this time, US real income grew by 2.2% per year and population grew by 1.1%, on average, so the reduction in intensity was more than offset by the growth factors. If population and income growth continues to sum to 3.3% per year, emissions intensity will have to decline at twice its historical rate just to cap US CO_2 emissions.

Proposals to place a cap on emissions must therefore contend with factors that make it difficult to change emissions intensity.

3.2 No low-cost CO_2 abatement options exist

Proponents of deep cuts to greenhouse gas emissions sometimes point to the successful reduction in particulate and SO_2 emissions in Canada and the USA since the 1960s. These emissions have certainly been cut dramatically. However, there is a problem with this analogue. Table 1 outlines the main options used in the past for emission reductions, and their availability in the cases of CO_2 and SO_2.

The four main abatement options are: install scrubbers, switch to a cleaner version of the same fuel (e.g. from high-sulfur coal to low-sulfur coal), switch to a different fuel (e.g. from coal to natural gas) and reduce the scale of productive activity. The first two are the cheapest options. In the case of compliance with US sulfur emission reductions, installation of scrubbers and switching coal types accounted for, respectively, about 45 and 55 percent of the emission reductions achieved during Phase I of the 1990 Clean Air Act Amendments regime, particularly during the large 1994-1996 drop (Schmalensee et al. 1998). But these options—which accounted for all the SO_2 reductions during that time—are unavailable for CO_2 control:

TABLE 1

AIR POLLUTION ABATEMENT OPTIONS AND COSTS

Abatement Option	Relative Cost	Availability	
		SO_2	CO_2
Scrubbers	Low	Yes	No
Switch to cleaner version of same fuel	Low	Yes	No
Switch to different fuel	High	Yes	Yes
Reduce overall consumption	High	Yes	Yes

- While there is such a thing as low-sulfur coal, there is no such thing as low-carbon coal.
- There are no scrubbers for CO_2.

The latter point is well-known to power plant operators. In a recent study of air emission abatement options, the Ontario Power Authority (2007) noted that simulated CO_2 emission changes were entirely driven by estimated changes in output levels:

> "[Projected] Reductions in CO_2 emissions between 2010 and 2014 were driven by reductions in coal [-fired electricity] production rather than by emission controls. At present there is no viable control technology available to reduce CO_2 emissions from coal plants. Therefore CO_2 reductions under all alternatives are the same." (OPA 2007, p. 5)

Consequently the only available abatement options for CO_2 are the costlier ones, namely fuel-switching and reducing consumption. Power plants can replace boilers with gas-fired units, or they can reduce total fuel consumption, which in general requires a reduction in total energy output. Either of these options

involve considerably higher costs for the abating sector and for the economy as a whole, as well as more serious technical obstacles.

3.3 Recent price changes favour adoption of coal

Fuel-switching, away from coal, towards natural gas and oil, is another approach to cutting CO_2 emissions. However, in recent years, the real prices of oil and gas have gone up much faster than coal.

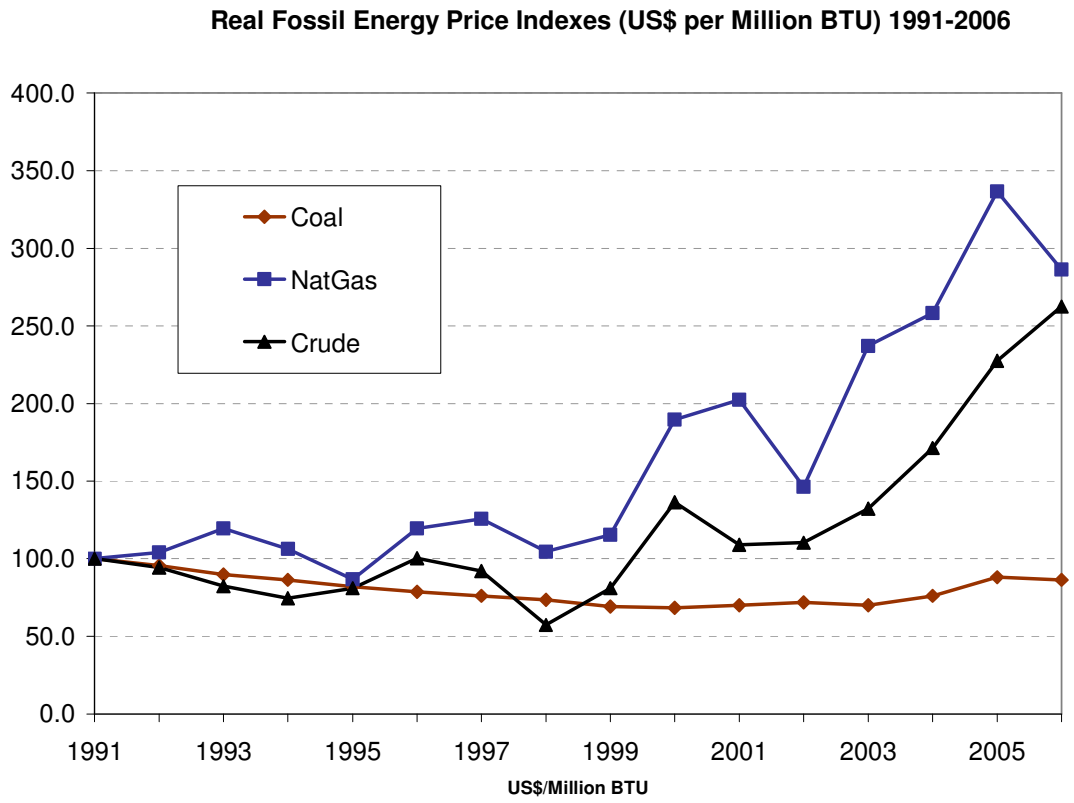

Figure 4. Real fossil energy prices (USA) indexed to1991=100. Source: http://www.eia.doe.gov/emeu/aer/finan.html

In fact, while coal has declined in price somewhat (relative to the GDP deflator), crude has gone up by 150% and natural gas nearly 200%. The price changes are inversely related to those that would most favour reducing GHG emissions.

Another factor that complicates the natural gas situation for Europe is the emergence of a near-monopoly supply situation controlled by Russia. This creates a vulnerability for Western Europe should the Kremlin decide to cut off gas supplies, as it has done to The Ukraine in other disputes.

3.4 Energy consumption is critical for growth

The proliferation of inexpensive electricity has been one of the truly miraculous engines of economic growth and social equality in the west. Greenwood et al. (2005) present data showing that the proliferation of household appliances, made possible by electricity, reduced required average housework time from 58 hours per week to 18 hours per week between 1900 and 1975 in American households. They find that adoption of durable goods in the home (major appliances like washing machines and stoves) accounts for over half the increase in US female labour force participation over the 20th century.

Perhaps more importantly for the study of future trends in the US and the EU is the question of whether increased energy consumption *causes* GDP growth, or is *caused by* GDP growth. The distinction is important. If increased energy consumption is merely a by-product of growth, it could potentially be capped and reduced without dampening economic growth. But if increased energy consumption is an input to growth, the two cannot be easily decoupled.

Detecting the direction of direction of causality (or "Granger-causality" as it is called) in time series data involves cointegration analysis and vector autoregression. These techniques have been applied to US data (Stern 2000), Canadian data (Ghali and El-Sakka 2004) and others. The results show that energy consumption *causes* economic growth, and in some cases the causality runs both ways. Stern (2000, p. 281) concludes as follows:

> The multivariate analysis shows that energy Granger causes GDP either unidirectionally as indicated by the first of the three models investigated or possibly through a mutually causative relationship… The results presented in this paper, strengthen my previous conclusions that energy is a limiting factor in economic growth. Shocks to energy supply will tend to reduce output.

The phrase "*energy is a limiting factor in economic growth*" is an important statement of conclusions. Energy consumption is not merely a by-product that can be decoupled from GDP growth. Deliberately reducing energy consumption will likely reduce economic growth, thereby increasing the reluctance of policy makers to attempt it.

In addition, electricity price increases are regressive. Some studies of carbon taxes have examined the regressivity issue (Jorgensen et al. 1992), and have found that whether a carbon tax is regressive depends heavily on how it is implemented (and how inequality is measured). Dinan and Rogers (2002) found that an economy-wide cap and trade system with grandfathered permits would be highly regressive, with the poorest households worse off by $500 per year and the richest households better off by $1,000 per year. The advantage accruing to the high income households arises because they own the companies that receive the grandfathered permits.

3.5 Rhetoric and reality in Europe

We are accustomed to the political declarations of intent from European politicians regarding climate change. With the exception of Czech President Vaclav Klaus, there is not a single mainstream European leader voicing opposition to climate policy objectives of ever-increasing stringency. In the UK, for instance, Labour's Tony Blair was outflanked on the climate change issue by Conservative David Cameron, leading to a competition for who could seem the most "green." This week, the UK

Conservative Party announced plans for a proposal to ban plasma-screen televisions as a way of protecting the environment (because of their energy consumption presumably).

In the US, by contrast, there are many members of Congress, as well as the Administration itself, who have publicly challenged claims that greenhouse gas emissions need to be capped and reduced, and have opposed policies to introduce anything like Kyoto-style targets or timetables. Only 10 years ago the US Senate voted unanimously to support the Byrd-Hagel resolution forbidding US participation in Kyoto-like treaties that harm the economy and exempt developing countries. All subsequent emission reduction proposals, including milder ones like the McCain-Lieberman bills, have failed to get Senate approval.

But the difference in positions may be more apparent than real. Leaving aside the stated views of European politicians regarding the desirability of setting emission reduction targets of ever-increasing depth, on deadlines ever farther into the future, it is instructive to examine how European politicians have responded to specific emission reduction initiatives that carry visible costs.

The overall performance of Europe is masked somewhat by the collapse of East Germany (and other post-communist countries, now that they are in the EU) and by the UK's transition from coal to gas in the early 1990s. These provided one-time reductions in the emission levels of European countries. But outside of these events, emissions have continued to rise, despite efforts to decouple emissions from economic growth. Diakoulaki and Madaraki (2007) analyse CO_2 emission growth figures for 14 EU countries over the 1990-2003 interval in light of CO_2 abatement policies implemented by all countries (except Spain). Emissions fell more than ten percent in the UK and Germany, but were either unchanged or increasing in all other countries. With regard to UK and German manufacturing, all the reductions occurred prior to 1997, and emissions since then have grown. Regarding emission reduction behaviour of the 14 countries they concluded "there are no systematic signals for distinguishing the behavior of the examined countries in the pre- and post-Kyoto period." (p. 655).

Because the EU entered the Kyoto Protocol as a single entity, Brussels must allocate emission allowances among countries. Under the new EU Emission Trading System, countries submit National

Allocation Plans in which they request permits, and Brussels makes the decision about the amounts they will be given. In its first year of operation, so many quotas were issued that the carbon price collapsed from €30 to nearly zero. In 2006, Germany filed its second NAP in which it sought a guarantee that new coal-fired power plants would have sufficient permits, free of charge, to continue conventional operating levels for 14 years (Heymann 2007). The German Environment Ministry soon revised this request down slightly, but the European Commission still rejected the NAP and demanded tighter targets. The GEM has agreed to them, prompting an ongoing confrontation between German industry and the government.

Meanwhile Latvia, Poland, Hungary, the Czech Republic, Slovakia and Estonia have all filed lawsuits against the EU over their emission allocations, alleging that they are being forced to bear an unfair burden of emission reductions.[2] These suits are in addition to earlier, separate ones launched by 13 Polish and one French steel companies, as well as the governments of the UK, Slovakia and Germany on behalf of domestic power and steel companies, all accusing the European Commission of not issuing adequate emission permits. All these lawsuits are pending before the Court of First Instance in Luxembourg, except for the French one which is before the European Court of Justice. Although decisions could be more than two years away, legal analysts note that EU losses in previous court decisions have resulted in countries being allowed to increase their emissions, which could result in another price collapse in the second allocation period running to 2012.

Former UK Prime Minister Tony Blair had already hinted that as of the end of the Kyoto implementation period in 2012, national leaders would be looking for an approach that did not involve legally-binding targets.[3] "The blunt truth about the politics of climate change is that no country will want to sacrifice its economy in order to meet this challenge," he was quoted as saying.

4 Conclusions

[2] http://www.bbj.hu/main/news_29532_eu+wrangling+on+carbon+emissions+moves+into+courts.html.
[3] "Blair Signals Shift Over Climate Change", *The UK Guardian* November 2, 2005.

Observers of international climate policy tend to view Europe and the US as representing diametrically-opposed approaches. It is true that they have embraced different goals. But a close look at the actual record shows that politicians in Europe are just as reluctant to impose costly emission control policies as are those in the USA, and the two regions are not very different in terms of actual outcomes. The serious constraints that limit options for reducing CO_2 emissions means that, despite differing objectives, both the US and the EU have more or less followed a business-as-usual path to date.

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