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KYOTO AND BEYOND: ECONOMIC IMPACT ON DEVELOPED ECONOMIES

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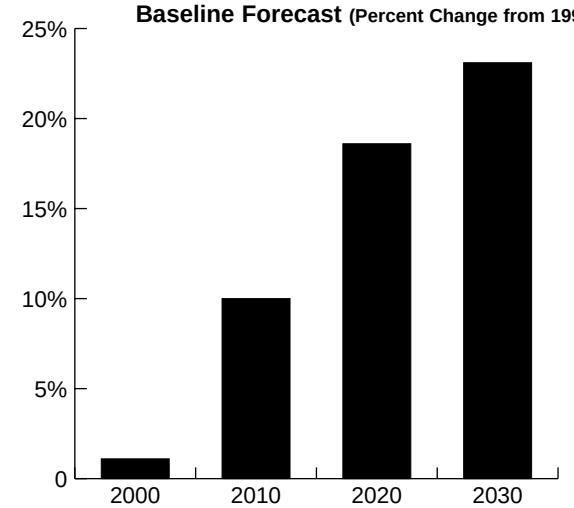
Introduction

Notwithstanding the European Union's ratification of the Kyoto Protocol on climate change, the world's second largest economy faces major challenges in meeting not only the Kyoto greenhouse gas (GHG) targets but also the more stringent emission reductions being debated for the post-Kyoto commitment period (after 2012). Data from the International Energy Agency (IEA) suggest that EU carbon emissions will continue to rise over the 2000-2030 period (see Figure 1). Even with strong new policies to reduce emissions, there are almost no changes from 1999 emissions levels, according to the IEA report. The cost for developed countries to meet the emission reduction goals of the Kyoto Protocol and the tighter targets that will be proposed for the second and subsequent commitment periods will be much higher than is generally understood. Policymakers need to have access to cost estimates based on appropriate climate policy models.

Figure: 1 **Growth In Carbon Emissions in the European Union: 2000-2030 Under the Baseline Forecast** (Percent Change from 1999)



Source: International Energy Agency, *World Energy Outlook 2002*, p. 437

Post-2012 Carbon Emission Targets

Despite the current lack of specificity regarding policies to prevent the projected growth in emissions between now and 2010, more stringent greenhouse gas emissions targets are being proposed for the years after the Kyoto Protocol's first compliance period (2008-2012).

For example, some EU officials are calling for a 60 percent reduction in carbon dioxide (CO_2) emissions by 2050. Others have suggested that we must stabilize CO_2 concentrations in the atmosphere at 550 ppm by 2100. Based on data from the Intergovernmental Panel on Climate Change,

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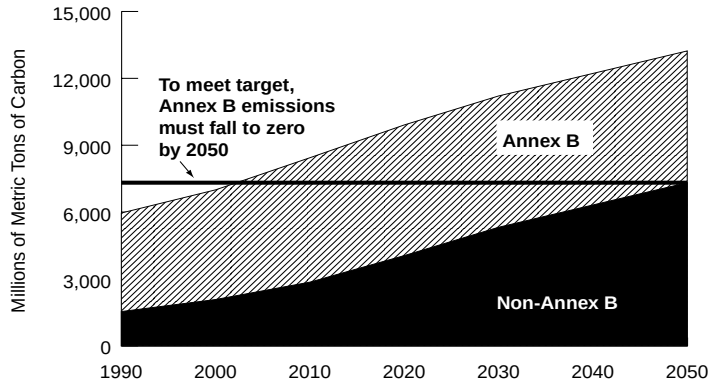
in order to put the world on that trajectory developed country emissions must fall to zero by 2050 in order to allow developing countries to continue to grow (see Figure 2). (The Kyoto Protocol does not require developing countries to reduce their emissions.)

In another example, the February 2002 report by the Interdepartmental Analysts Group (IAG) for the UK government considers the implications of a 60 percent reduction in CO_2 emissions from 1998 levels by 2050 in the UK. The report notes that aiming for stabilization at 550 ppm could imply even larger cuts against a 1998 base by Russia, Germany, Canada, and the USA. (See Figure 3.)

Figure: 2 **Carbon Emissions for Developed (Annex B) and Developing Countries: Business-as-Usual Case and Emissions Cuts Required to Meet Target of 550 PPM Using IPCC Data**



Source: DRI-WEFA, 2002.

■ Conflict Between Russian Economic Goals and Emission Reduction Targets

Policymakers in Russia are currently studying the costs and benefits of Russian ratification of the Kyoto Protocol—without Russia the Protocol cannot enter into force. While Russian carbon emissions fell by 30 percent from 1990 to 2000, they are now rising and will soon exceed the tighter post-Kyoto emission targets which will be proposed for the second and subsequent commitment periods (see Figure 4). At the recent World Climate Change Conference in Moscow, Dr. Andrei Illarionov, President Putin's Economic Adviser, noting the strong link between energy use and economic growth, stated that "if we are to double GDP within the next 10 years, this will require an average growth rate of 7.2 percent." He also observed that countries which had doubled their GDP within 10 years increased their CO_2 emissions by 7 percent or more every year. Illarionov went on to state that "the implementation of the Kyoto Protocol or even preparations for its implementation will curb economic growth considerably." Current prospects for Russian ratification seem doubtful.

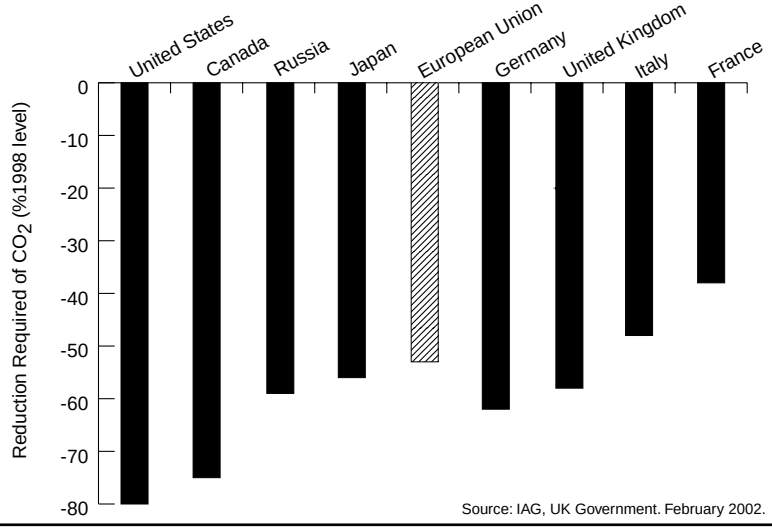
Does the Choice of Economic Models Matter?

Many experts believe the economic models currently employed by environmental policymakers throughout Europe provide an incomplete picture of the full economic costs of compliance with the Kyoto Protocol.

■ Measuring the Economic Impact of Kyoto

As a recent study by the International Council for Capital Formation (ICCF) illustrates, an accurate portrayal of the costs of complying with GHG emissions reduction targets depends largely on choosing an economic model that captures all the short- and medium-term costs of adjusting to higher energy prices or regulatory mandates on the economy as a whole. (See "Economic Modeling of Climate Change Policy" at www.iccfglobal.org.)

Figure: 3 CO_2 Reductions Required by 2050 Under 550ppm Scenario (1998 Base Year)



For example, some economic models such as the PRIMES model used by EU environmental agencies are designed only for measuring sectoral effects, not economy-wide effects. PRIMES is primarily designed to show the effect of policy changes on energy markets. It can calculate the direct cost implications of reduced energy use but not the economy-wide impact on gross domestic product (GDP), employment, investment, etc. Thus, the results of this model, which show a reduction of only 0.12% in GDP to the EU in 2010 from complying with the Kyoto Protocol, are not an accurate measure of the total costs to EU households, businesses, the economy, and government. (See Figure 5.) These sectoral models underestimate the negative economic effects by a factor of 10 to 15 times (0.12 vs. 1.5 to 2.0). Such reliance on results from PRIMES has led EU officials, industry, and households to believe that the costs of achieving the Kyoto Protocol's targets and the further cuts planned for the second and subsequent commitment periods will be relatively small.

Even general equilibrium models, which measure "big picture" impacts on an economy after it has had time to adjust (over 30 to 40 years) to higher energy prices, show GDP losses

Figure: 4 Russian Emissions: What Does the Future Hold?

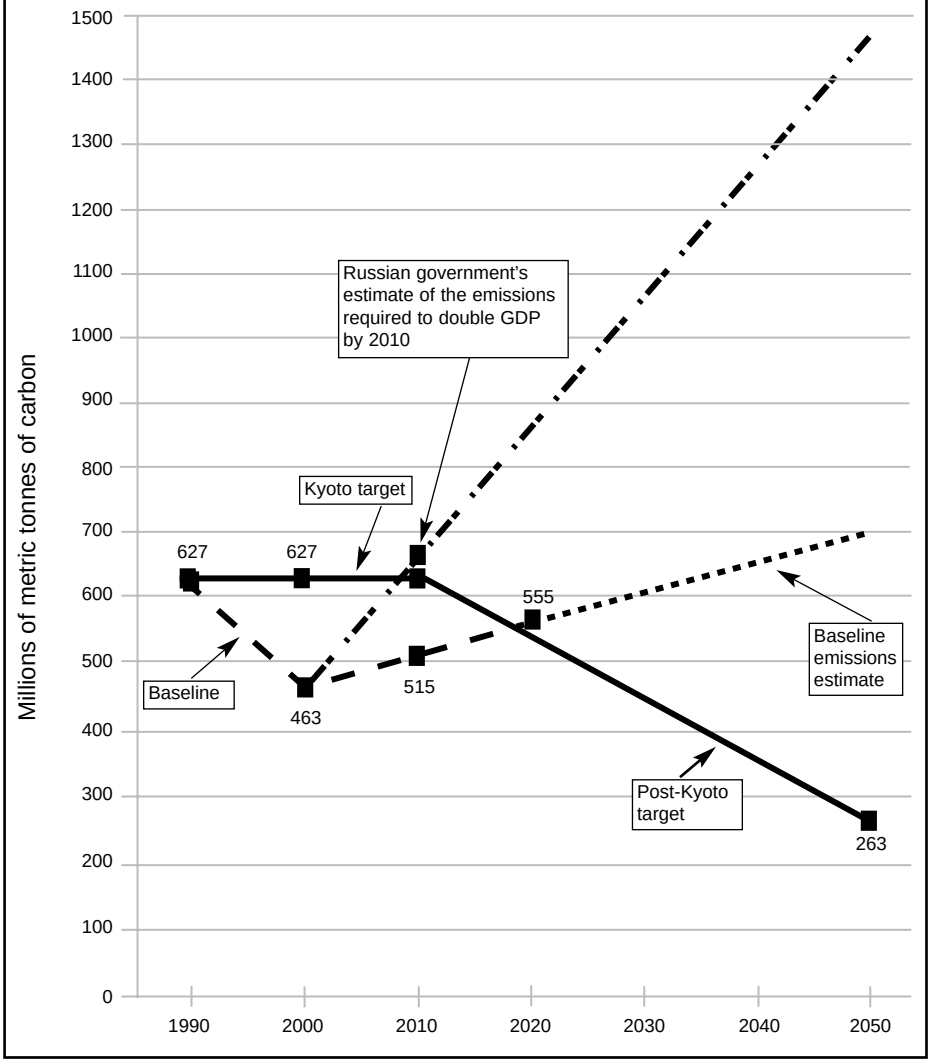
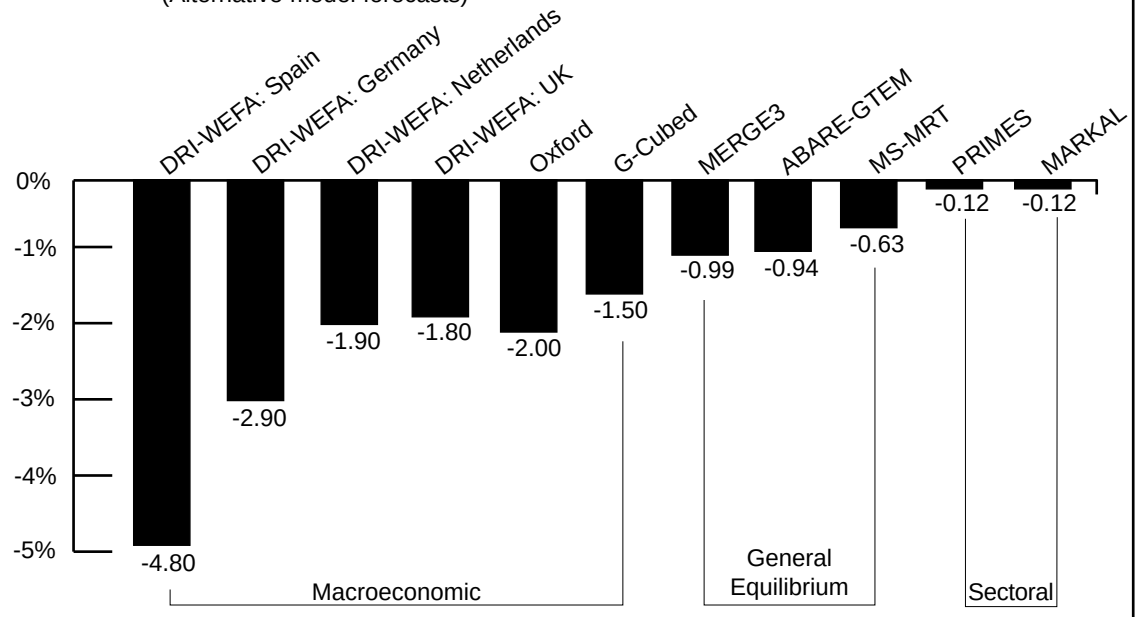


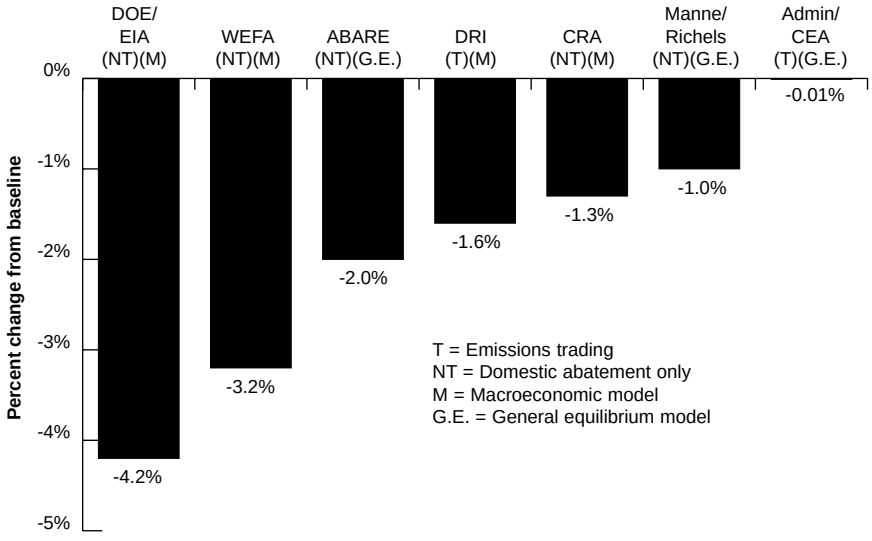
Figure: 5 Impact of Kyoto Protocol on GDP levels in the EU in 2010
(Alternative model forecasts)



Source: Canes, E., Michael. 2002 (Oct.). Economic Modeling of Climate Change Policy. www.iccfglobal.org

of about 1 percent per year under Kyoto, which are an order of magnitude greater than PRIMES. (See Figure 5.) Even though general equilibrium models look at a period of time much longer than the Kyoto timetable, their results more accurately reflect the consequences of curbing emissions than does a sectoral model like PRIMES. General equilibrium models reflect the full economic impact of reducing emissions, not just the impact on the energy sector. Given their long time frame, general equilibrium models are unable to capture short-term adjustment costs and therefore probably underestimate near-term impacts. Despite that fact, they still indicate that the economic impact of meeting Kyoto and post-Kyoto emissions targets will have an economic impact far greater than PRIMES.

Figure: 6 Annual Impact of Reducing Carbon Emissions to the Kyoto Target on U.S. GDP, 2008-2012 (Percent of GDP)



Source: Testimony by Margo Thorning before the Senate Governmental Affairs Committee, July 18, 2001.

Macroeconomic models provide an assessment of the overall economic costs of meeting emission targets where the short-term, frictional costs of adjustment are included. These models, which US scholars and climate policy modelers began using in the early 1990s to measure the impact of Kyoto on the US economy, quantify

Figure: 7 Impact of Purchasing Carbon Emissions Permits on GDP Levels Under the Kyoto Protocol and Under More Stringent Targets

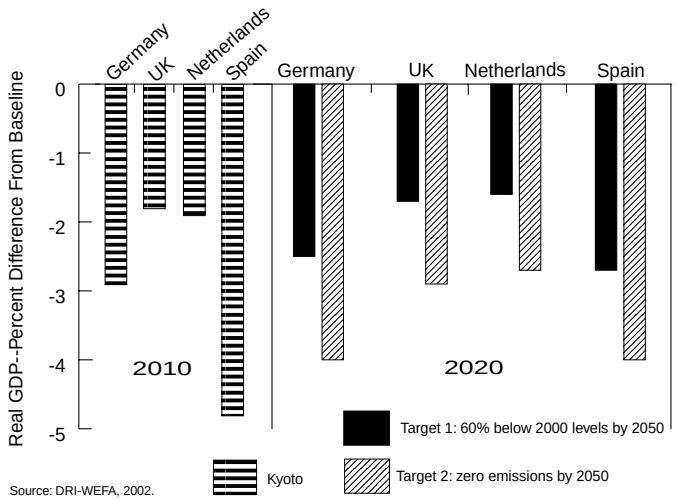
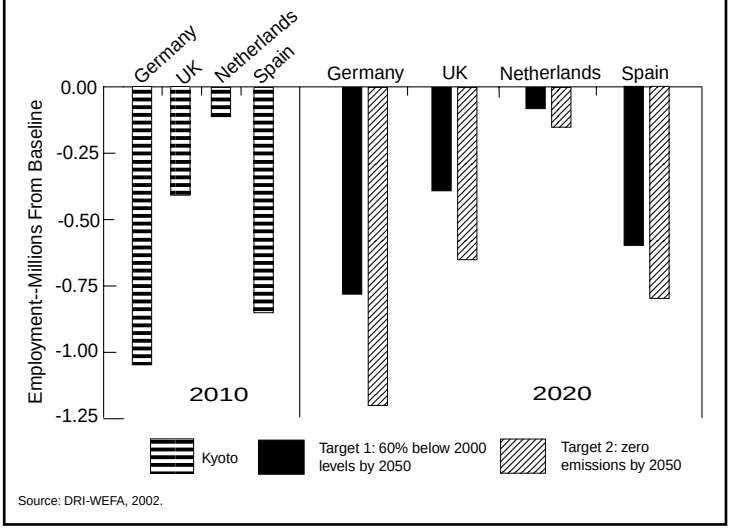


Figure: 8 Impact of Purchasing Carbon Emissions Permits on Jobs Under the Kyoto Protocol and Under More Stringent Targets



the impact on employment, investment, budget receipts, and GDP growth when an economy is "shocked" by having to make quick changes in its capital stock, production processes, lifestyles, etc. Results of macroeconomic models show that Kyoto would have negative effects on the US economy in the range of 1.5 percent to about 4 percent of GDP in 2010. (See Figure 6.)

■ Macroeconomic Model Estimates for the UK, Germany, the Netherlands and Spain

When macroeconomic models are used to measure Kyoto's effects on the EU, the impacts are greater—1.8 to 5 percent less GDP in 2010—than those derived from sectoral models like PRIMES. For some countries like Spain, the GDP loss due to reduced energy use will be severe—Spanish GDP in 2010 is estimated to be about 4.8 percent smaller.

Studies by the ICCF on the impact of reducing all six Kyoto gases on four major EU economies, UK, Germany, the Netherlands, and Spain, demonstrated the impact on GDP of carbon taxes (or tradable permits) large enough to actually force greenhouse gas emissions down to the Kyoto target. (See Figure 7.) The ICCF also measured the economic impact of two alternative emission targets being discussed by EU policymakers: (1) 60 percent below 2000 levels by 2050 and (2) zero emissions by 2050.

Getting on the path for these targets has significant impacts on GDP and employment because of the cost of the carbon permits by 2020. (See Figure 7 and Figure 8.)

The simulations for Germany, the Netherlands, the UK, and Spain assume that the United States does not participate in the Kyoto Protocol. The simulations do assume intra-country trading. The analysis assumes that emission permits would be auctioned to energy producers at the point of first sale.

This study assesses the marginal cost of CO_2 abatement accounting for projected changes in other GHGs, and the resulting economic cost. While the Kyoto Protocol established limits for participating countries' emissions from six GHGs, this analysis analyzes the cost of reducing CO_2 from energy use after taking into account reductions in the other GHGs that were projected by reliable sources. There was no attempt to quantify the cost of these reductions in the analysis.

Further, the so-called Kyoto mechanisms such as Joint Implementation (JI) (within Annex B) or the Clean Development Mechanism (CDM) (outside of Annex B) were not included in the analysis. These measures would allow countries to reduce carbon emissions in other countries through investments in capital or technology. However, as these analyses for the UK, Germany, Spain and the Netherlands were completed in 2002, the proposals under consideration by the EU government did not spell out how these credits would be implemented.

■ Macroeconomic Model Estimates for Italy

A new 2003 ICCF analysis of the impact of Kyoto and additional emission targets on Italy includes the purchase of emission credits from abroad and other features described in the December 2002 climate action plan released by the Italian government. The ICCF analyzed the impact on Italy's economic performance in meeting its Kyoto Protocol target during the first budget period (2008-2012) and further reductions over the post-2012 period through the purchase of approved credits. It was assumed that the target is the Kyoto-defined reduction for Italy for 2008-2012 followed by continuous reductions in the target to 70 percent below 1990 levels by 2050.

Further, it was assumed that current actions can meet 43 percent of the Kyoto target reductions by 2010, but all further reductions are met through the purchase of credits from either other countries or JI/CDM participants under three credit price assumptions (see Table 1).

(1) €20 per tonne of CO_2 (equivalent to €73 per tonne of carbon)

(2) €50 per tonne of CO_2 (equivalent to €183 per tonne of carbon)

(3) €100 per tonne of CO_2 (equivalent to €366 per tonne of carbon).

The range of price assumptions reflects the EU's expectation of a low price (€20) up to the maximum compliance penalty (€100) for countries that do not meet the specified target reduction.

For the three credit price scenarios, analysis by the macroeconomic forecasting firm, Global Insight, assessed the impact on Italy's economic performance and employment. The results of the analysis show that real GDP would fall 0.5% below Reference Case levels during the 2008-12 budget period and would

Table 1: The Economic Impact on Italy of Implementing the Kyoto Protocol and Additional Greenhouse Gas Reductions Planned for Post-2012

	2010			2020			2025		
Case (Constant Euros):	**€20**	**€50**	**€100**	**€20**	**€50**	**€100**	**€20**	**€50**	**€100**
Real GDP (% Difference from Reference Case)	-0.02	-0.09	-0.52	-0.42	-0.88	-1.92	-0.65	-1.46	-2.88
Employment Change (Thousands) (Difference from Reference Case)	-1.80	-10.3	-51.4	-52.1	-97.7	-189.5	-82.1	-152.2	-276.5

be 1.9 percent and 2.9 percent lower in 2020 and 2025 (see Table 1) respectively under the assumption that emission credits would cost 100 euros per tonne. The annual employment reductions from the Reference Case in Italy would be as high as 51,000 jobs in 2010, rising to 277,000 by 2025.

Planning for COP 9: Appropriate Climate Models Can Help Policymakers

The increased flexibility of the European Commission's emission trading proposal is due in part to the discussions and debate generated by the ICCF's analysis of the cost of carbon reductions for the member states. The Commission's willingness to allow the use of the Clean Development Mechanism and Joint Implementation to reduce the cost of cutting carbon emissions in member states is at least partly due to policymakers being provided with comprehensive reports that showed significant impacts on GDP, employment, and investment.

The challenge facing policymakers planning for further GHG emission reductions for the second commitment period at the Conference of the Parties in Italy in 2003 will be to shape policies that are cost effective and "sustainable" from the perspective of industry as well as households and other stakeholders. The fact that Russia may well not ratify the Kyoto Protocol will need to be factored into the discussion. Climate policy experts need to provide decisionmakers with the results from a range of macroeconomic models in which the underlying assumptions on the rate of capital stock turnover and technological change are clearly delineated and accurately reflect the short-term costs of adjusting the stock of capital and labor.

A Better Path Forward

Renewables have a role to play in the goal of reducing GHGs. However, as a November 2002 article in *Science Magazine* points out, developing renewables requires a major commitment to a long-term R&D program for alternative energy sources for electricity and transportation. Candidates include solar, wind, biomass, nuclear fission, fusion, and fossil fuels from which carbon has been sequestered. Efficiency improvements, hydrogen production, super-conducting global electric grids and geo-engineering also hold great promise for reducing the growth of CO_2 during the 21st century. Commercially viable technologies able to wean the world from fossil fuels are still a long way off. Achieving major advances in energy technology will require both serious government and private sector investment in R&D.

Transferring technology to the developing world, where most of the growth in emissions will occur over this century, can play a major role in emission reductions. It is essential to continue transferring existing technologies, such as clean coal, combined heat and power, and others, that will enable those countries to "grow" their economies without similarly growing their emissions. As plans for COP 9 proceed, it would be a positive step if both the developed countries could accelerate efforts to alleviate global poverty and increase the developing world's access to cleaner energy sources.

Adopting a thoughtfully timed climate change policy—one that is based on accurate science, improved climate models, and global participation—is essential to global economic growth and to the eventual stabilization of the carbon concentration in the atmosphere, if growing scientific understanding indicates such a policy is needed.