Technology Policy for Climate Change Mitigation:
A Transatlantic Perspective

Paris, 16-17 December 2004

SUMMARY PAPER

This workshop was the 2nd climate policy conference jointly organized by RFF and IFRI in Paris. (The first one, "How to Make Progress Post-Kyoto?", was held on March 19th, 2003[1].) This year, Lepii-EPE (a research group at the university of Grenoble) was also associated. The organizing team was composed of: Patrick Criqui (Lepii-EPE), Richard Newell (RFF), Pierre Noël (IFRI), Billy Pizer (RFF), and David Reiner (Cambridge & IFRI).

The workshop was made possible by a grant from the Ministry of Ecology and Sustainable Development (France). BP awarded additional financial support.

This Summary Paper is divided into two parts: The first part presents short summaries of all the presentations at the workshop; The second part, which is an edited version of the closing remarks by Pierre Noël (Ifri), highlights some of the policy lessons that emerged from the workshop.

1. SUMMARY OF PRESENTATIONS

SESSION 1. TECHNOLOGY POLICIES: RATIONALE AND PAST EXPERIENCE

The Rationale and Instruments of Climate Technology Policy

By Richard Newell, *Resources for the Future*

Technology change is a process of invention, innovation and finally adoption and diffusion. The supply of innovation is determined by the state of knowledge, research and development and learning by doing. The demand for technology is determined by cost, quality and learning by using. Within this context, however, there are market failures. Negative climate externalities and positive spillover

[1] Materials available on www.rff.org

effects of technology are not accounted for. Policies must respond to these problems by putting a price on carbon, subsidizing research and development and diffusing more information. Funding for technology development must be diversified but directed to improve effectiveness. .

European Experience with RDD Demonstration and Deployment Programme

By Michel Poireau, *European Commission, DG Research*

Research and development is one of many tools used in Europe to combat climate change, but it is less important than in the United States and more fragmented. Also, European RDD funding have been declining in recent years. Europe sees RDD as part of the solution, but also aims to curb demand and use existing technologies to reduce greenhouse gas emissions. It is difficult to say if RDD has contributed to the current mitigation policy because the results are more difficult to evaluate than other policy measures. For RDD to be effective, it must be supported by policy and seek to satisfy particular goals. There is also the possibility that RDD can bring the EU and USA closer together through cooperation.

Technology, Policy and Climate Change: A Retrospective on Selected RD&D Experiences

By Robert Marlay, *US DOE, Office of Policy & International Affairs*

Although uncertainties on the nature of climate change still remain, the United States has taken action on global warming through voluntary programs, investment incentives, various rules and regulations, and through significant investment in technology development. Case studies were presented involving major federal support for energy-related technologies including advanced drilling technologies, synthetic fuels, coal-bed methane, wind turbines, alcohol fuels, the Montreal Protocol, coal gasification (IGCC), advanced gas turbines, the Clinch River breeder reactor, solar power towers, and energy efficient windows. Some of these case studies were successes and others were failures. The presentation concludes that R&D can be a powerful policy tool, preferably with tailored policies.

Private Sector Responses to Technology Policy

By Gaëlle Monteiller & Ellis Gartner, *Lafarge Group*

Lafarge maintains that both the public and private sectors need to take responsibility for technology development. To do their part, Lafarge intends to reduce carbon dioxide emissions per mass of concrete by 20% and total CO2 emissions by 10% between 1990 and 2010. In this presentation, conditions specific to the cement industry and the cement production process were reviewed and possibilities for alternative cements analyzed. Strategies to limit CO2 emissions were discussed.

SESSION 2. CLIMATE-FRIENDLY TECHNOLOGIES: CHALLENGES AND POLICY RESPONSES

Nuclear Energy and Global Warming

By Sylvain David, *CNRS*

Nuclear energy can help to significantly reduce greenhouse gas emissions and may play a large role in future energy production. It would be fairly easy to reduce uranium consumption without major modifications and there are ample reserves worldwide. Different types of reactors were examined. Demand for nuclear energy is likely to increase over the next 50 years as fossil fuels become limited and there is a need to reduce greenhouse gas emissions.

Challenges and Policy Options: Renewable Energy

By Kornelis Blok, *Ecofys*

In order to drastically reduce greenhouse gas emissions by 2050 we will need to improve our energy efficiency and find non emissions-generating sources of energy. Energy production becomes more efficient and cheaper as the scale of energy production increases. There will need to be a policy combination of R&D funding, emission trading, standards, agreements, subsidies and taxes. The renewable electricity directive aims for 20% of energy to come from renewable sources by 2010. The most likely possibilities include wind, biomass, and biofuels, but the target is a challenging one. Questions include whether to use feed-in schemes or obligations to encourage change and whether to fund technology development of deployment.

Advanced Vehicles and Alternative Fuels: Past, Present, Future

By Dan Sperling, *Institute of Transportation Studies, UC Davis*

Current trends in transportation are unsustainable with public transportation decreasing, vehicle ownership and usage increasing, vehicles getting larger, fuel economy worsening, and greenhouse gas emissions from the transport sector increasing. Personal transport is even increasing in developing countries, putting pressure on oil supplies. At the same time, technology is leading to new cars that produce less air pollution. Fuel economy, stagnating since the mid 1980's, is the largest problem in the US. Japan and Europe are more concerned about this problem because the balance between public good and personal freedom is regarded differently. There are many possibilities for change in design, engineering and alternative fuels, but there are concerns that efficiency increases will translate into increased power rather than increased economy. Fuel cells were presented as the ultimate solution over the long term. The United States faces political problems in contemplating more stringent fuel economy standards because they would disadvantage American auto-makers at the expense of foreign, especially Japanese, competitors.

Energy Efficiency Opportunities and Challenges in a Technology Policy Context

By Paul Waide, *International Energy Agency*

In this presentation, changes in energy generated per unit of GDP were broken down into changes in energy service and the intensity effect. Declines in intensity have translated into substantial energy savings although they have been offset by growth in demand for energy services. Growth in energy demand from residential appliances is predicted. Current policies are expected to reduce CO_2 emissions by 9.9% in 2010 and 12.5% in 2020. The use of more efficient appliances can lead to reductions in energy demand of up to 50%. Investments in efficiency can be more than offset by lower investments in generation, transmission, and distribution of energy. Several reasons why the market cannot deliver cost-effective savings on its own were explored. Evidence was presented that demonstrated how labeling of energy efficient appliances affects purchase decisions.

Clean Coal: Oxymoron, or Bridge to a Sustainable (Low Carbon) Future?

By Edward Rubin, *Carnegie Mellon University*

Reducing CO_2 emissions is a goal that will require drastic changes in our energy systems. However, such a goal does not necessarily imply elimination of oil and coal. There may be “clean coal technologies” to capture and sequester CO_2 as well as other pollutants. Carbon dioxide can be captured through chemical or physical processes and stored in geological formations or ocean beds.

The current state of capture and storage technologies was reviewed. Policies and R&D funding were seen as necessary to encourage the development of clean coal and carbon capture technologies.

The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs

By Dan Sperling, *UC Davis* (on behalf of Mike Ramage, Chair of the National Research Council's 2004 *Hydrogen Economy* report)

Hydrogen is abundant in the world and offers the potential of pollution-free energy. For hydrogen to develop, however, there must be development and implementation of cost-effective and safe hydrogen production methods, hydrogen infrastructure and hydrogen storage systems. Prospects for future developments were explored as well as development and marketing strategies.

SESSION 3.

Technology Policies or/and Emission Caps: Insights from Energy Technology Modelling

By Patrick Criqui, *Lepii-EPE, University of Grenoble*

The EU has a goal of limiting the increase in global temperature to two degrees Celsius, but there are uncertainties as to how much CO2 emissions would need to be cut to achieve this goal. To achieve significant emission reductions, there will have to be increased efficiency in energy use, increased usage of renewable and nuclear energy and increased hydrogen and carbon capture. There are many possible technologies to reduce CO2 emissions, but it is difficult to predict their cost and their benefit and thus difficult to predict which technologies merit investment. It is best to maintain a diversified portfolio of technology investments. Any technology-based policies should be combined with environmental taxes and subsidies and quotas.

Public Attitudes, Energy Technologies & Climate Policy

By David Reiner, *Cambridge University & IFRI*

In both the United States and European Union, better understanding of science and technology leads to greater trust in science and technology and belief in the benefits of science and technology. A more informed public may also have a slight tendency to engage in more energy-friendly practices. Surveys of public attitudes on both sides of the Atlantic demonstrate the persistent misperception that nuclear power leads to global warming, finds strong support for renewables and similar priorities for research and development and in energy technology preferences to deal with global warming.

Balancing Climate in China: Mitigation, Diffusion, Invention

By Thomas Heller, *Stanford University*

There are several critiques of the architecture of the Kyoto treaty, including the non-guaranteed participation of developed and developing countries. Any effective treaty must take into account political economy and encourage economic growth. The presentation examines the sources of China's increased energy use. The nature of optimal government reforms is analyzed.

2. POLICY LESSONS

The goal of the meeting was to look at technology policy for climate change mitigation in the context of the current transatlantic disagreement. The organizers believe that debating technology policy is an important step in the process of (re)creating a common transatlantic language on international climate change policy.

A few lessons

Among the lessons that came out of the presentations and debates are the following ones:

- We do not exactly know what we can expect from public research, development and diffusion (RDD) policies;
- But we do know we need breakthroughs in almost every technologies surveyed and discussed in the workshop's second session – with the possible exception of nuclear power;
- There is a broad consensus among researchers that pricing carbon (either by taxing emissions or through a "cap-and-trade" system) increases the likelihood of technological breakthroughs;
- Hence combining public investment in RDD with economic instruments certainly makes sense; But the exact nature of the mix between the two is very likely to be determined by political factors and other contingencies.

Technology policy in a transatlantic context: does it divide or unite?

At the official level, there are both agreements and disagreements between the two sides of the Atlantic. One could defend the idea that both the EU and the US agree that stabilizing concentrations of GHGs in the atmosphere is probably impossible under current technological paradigms in the energy economy.

Each party puts the emphasis on a different side of a two-sided problem but in principle at least, the official US approach – "Technological breakthroughs will allow faster, cheaper reductions in the future" – and the official European approach – "Pricing carbon increases the likelihood that technological breakthroughs will actually happen" – do not define two mutually exclusive approaches to the problem of climate change mitigation.

At a practical level, however, there remains a great deal of disagreement about the proper role for technology policy in dealing with the climate risk:

- EU technology policies are fragmented and funding is decreasing; US efforts tend to be much more focused and they are intensifying.
- The EU is busy launching its market for carbon emission allowances and (for now) it does not include a mechanism for controlling costs of compliance (like a "safety valve"); In the US the enactment of such a scheme remains highly unlikely in the short term, as illustrated by the rejection of the McCain-Liberman bill – even though the rejected bill did include a "safety valve".

Hence agreement on the broad principles still does not turn into similar policy options and priorities. This reflects different political and institutional constraints, as well as more profound divergences in the status of technology policy in the climate change policy-mix.

Policy lessons for Europe and the United States

If one takes seriously both the necessity of technological breakthroughs and the important uncertainties associated with RDD policies, then a few policy lessons emerge from this workshop, that can be addressed to Europeans and Americans.

- European governments (and the European Commission) should take their relative weakness in public RDD investment as contradicting their firm commitment to the UNFCCC objective of stabilizing emissions at levels that prevent any dangerous threat to the climate;
- Europeans should refrain from portraying the US approach, centered on public support for RDD, as just another form of denial – such a characterization has sharply receded recently among policy makers but not disappeared;
- The US federal government, and the American public, should acknowledge that pricing carbon would increase the likelihood that, eventually, they will not have wasted their tax dollars invested in RDD policies;
- Moreover, there is a strong case for defending a “cap-and-trade” system as part of a technological approach to climate policy. Maybe US politicians and policy-oriented scholars could try and make this point as a way to garner support for capping emissions.

A common transatlantic language?

The preamble to the workshop stated that the organizers “*believe that debating technology policy is an important step in the process of (re)creating a common transatlantic language on international climate change policy.*” The workshop certainly contributed to uphold this belief. A common transatlantic language on climate change may eventually emerge provided (at least) two conditions are met:

- Both sides explicitly acknowledge that stabilizing concentrations (whatever the preferred level) is essentially a technological problem;
- Both sides explicitly acknowledge that regulating emissions (be it by prices or quantity or both) and public RDD support have to be combined in order to maximize the chance that we get the technological advances and breakthroughs we need – and we get them on time.

3. WEB SITES

All materials presented at the workshop as well as the program and this summary paper are available for free on IFRI’s and RFF’s web sites:

- www.ifri.org
- www.rff.org