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DIIS WORKING PAPER
CLIMATE CHANGE

"BRINGING IN THE AMERICANS?"

– ASSESSING EU AND U.S. POST-KYOTO POLICIES & OPTIONS TOWARDS A COPENHAGEN PROTOCOL IN 2009

Christian Hald-Mortensen

DIIS Working Paper no 2008/19

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Preface

This working paper aims to assist policy-makers and public officials in the Danish government in the run-up to COP-15, the UN climate treaty negotiations in Copenhagen in December 2009. COP-15 aims to finalize a successor to the Kyoto Protocol that will expire in 2012. The purpose of this paper and two policy briefs has been to generate advice for policy-makers in the Danish government, and to evaluate Post-Kyoto options already on the table – also those that are not found within the Kyoto Protocol framework today.

A draft version of the paper entitled "Transatlantic Climate Policy: Towards a Copenhagen Protocol in 2009" was presented at the 'University Association for Contemporary European Studies' (UACES) conference "Energizing Europe Climate Change, Energy Security and Europe's Next Big Project" in London, May 16-18, 2008. I thank Professor Martin Staniland, University of Pittsburgh, and Professor Alex Warweigh-Leigh, Brunel University for their comments.

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Abstract

Bringing in the Americans is the first task for the UN-COP-15 for the Danish government along with its EU partners. The key contents of the EU's climate leadership towards the climate conference are assessed, such as the -20% by 2020 reduction target, the effort sharing agreement and reforms of the European Trading Scheme. EU climate leadership is both based on strong public support and economic features such as a lower energy intensity of production than the U.S. The EU and Danish strategy converge in promoting the concept of a "low-carbon economy", based on first-mover advantage exports in renewables technology, such as wind power. The contents of the "Danish example" are assessed; decoupling economic growth and emissions within a "low-carbon economy"-storyline.

U.S. and EU policies diverged under the Bush administration that favored voluntary domestic measures towards industries and unilateral technology-based partnerships. The factors influencing the next President's climate policy such as increased support in public opinion, bottom-up developments among states, cities and in the business community are assessed, and so are factors that constrain a national climate policy, such as a high domestic reliance on coal. The dominant policy alternatives in the U.S. debate are evaluated. Ideas such as a carbon tax, emissions trading, a techno-optimist "Manhattan Project on Climate Change" and a 5-10x spending scenario in energy R&D are explored in terms of their political feasibility. The analysis indicates that a national cap-and-trade could emerge, but the legislative deliberations to establish such a policy could protract beyond COP-15. Transatlantic convergence in emissions trading is however very likely in the next Kyoto commitment period from 2012 to 2017.

The paper evaluates the work of Kyoto critics in terms of political feasibility and related Post-Kyoto proposals to empirical policy developments among the annex-I countries. Scholars have argued that an international framework for R&D in clean energy are needed, as past R&D efforts in clean energy has reduced the costs of electricity from solar panels. The section then discusses current energy R&D trends in the U.S. and in the OECD. Lowering the cost of key technologies could help to speed up diffusion of non-fossil-fuel sources, and would be a new form of directional leadership in climate policy, to be undertaken by the Annex-I countries.

Acronyms:

CO_2	Carbon dioxide
CH_4	Methane
EU-27	EU of 27 member states, per January 1, 2007
ETS	European Trading Scheme, the emissions trading scheme under which firms and power plants can trade emission permits among each other, so that if one plant reduces its emissions it can sell these permits to other plants.
PPM	Parts Per Million
R&D	Research & Development
UNFCCC	United Nations Framework Convention on Climate Change

Part I: Introduction

1.0 INTRODUCTION

For more than a decade the European Union member states have sought to persuade the U.S. to join the Kyoto protocol. Past attempts of bringing the U.S. into the Protocol have failed, leaving an emitter with 21% of global emissions with no emission reduction goal, and giving the major emerging economies China and India an excuse for not adopting reduction goals[1]. At the 2007 UN climate conference in Bali, the U.S. reiterated its unwillingness; the U.S. would sign no treaty without limits on the emissions from China and India[2]. China and India also will not join a global climate agreement, unless the U.S. is involved. For that reason, the central challenge for the Danish government as well as its twenty-six EU partners is to cut this knot of 'conditional cooperation' between China and the U.S[3]. The consistent message from the newly appointed Danish Minister on Climate & Energy has been that *"The U.S. is the key to a global agreement on climate change"* [4].

Any strategy by a small state such as Denmark to engage the U.S. takes place within the EU climate policy framework. This framework has evolved significantly since the Kyoto negotiations in 1997, and today comprises a common EU-27 reduction target, backed up by a burden-sharing agreement distributing the reductions, an emissions trading scheme and additional regulatory measures. Traditionally, the EU bloc has applied pressure on the U.S. at the COP's by adopting more ambitious reduction goals. Ahead of the 1997 negotiations the EU-15 adopted a target of -15% below 1990 levels, which affected the ultimate negotiation outcome for advanced countries. Annex-I countries agreed to reduce emission by -5.5% below 1990 levels by 2012. Such a "leadership by example" strategy implies that only by ambitious, credible action at home, can the Europeans persuade major emitters such as the U.S. to adopt similar policies. Since 1997, the EU bloc has stood up for the Kyoto protocol, and the member states have been the first to develop a trading scheme based on the Kyoto mechanism.

[1] http://www.mnp.nl/en/publications/2008/GlobalCO2emissionsthrough2007.html (Retrieved on June 18, 2008)

[2] Shamsuddoha, Md. & Chowdury, R.K. (2007), "Political Economy of Bali Climate Conference: A Roadmap of Climate Commercialization", A Policy Discussion Paper on the Key Elements of UNFCCC Climate Change Negotiation held in Bali, Indonesia, December 2007, PRDI

[3] Interview with Advisors to the Minister in the Ministry of Climate Change & Energy, Denmark

[4] Danish Minister of Climate Change & Energy, Information.dk, 11 september 2007, "Kina nødvendig for ny klimaaftale" (China necessary for new agreement on climate change")

The post-Kyoto negotiations are now in progress, and the objective of the 2009 UN Climate Conference (COP-15) is to establish a post-2012 regime for the commitment period 2013-2017. The other challenge is to include non-adherents such as the U.S., currently engaged in a non-binding "dialogue on long-term cooperative action" in the Copenhagen Protocol[5].

The Kyoto approach itself is heavily criticized - few scientists or policy analysts today dispute that climate change is real or accelerating, but alternative architectures are increasingly promoted by Kyoto critics. The critics' starting point is that Kyoto has had little "problem-effectiveness"; global CO_2 emissions are in fact steadily rising[6]. A range of scholars argue that the Kyoto architecture of emissions trading, joint implementation and the clean development mechanism may not be the only way forward[7].

The problem of global warming can be defined as both a market failure and a government failure. Global warming presents us with a market failure when excess carbon dioxide gases are exerted into the atmosphere during industrial production, and companies do not factor into the costs of their products the effects of greenhouse gases on the environment. As a result, no one pays for the excess greenhouse gases. Since market forces cannot solve the problem of greenhouse gas emissions that lead to global warming, this issue is also a government failure. Without international consensus on how to end global warming, participation in efforts to eliminate global warming are voluntary and non-binding. Some countries are aggressively attempting to end the growth of global warming, while others are further contributing to the problem. When governments do respond to climate change, they have three broad options: 1. *Mitigation*, meaning reducing CO_2 emissions away from the Business-As-Usual path, 2. *Research & Development* into new technologies that can lower mitigation costs, and 3. *Adaptation* to climate change, such as developing new crops that can produce yields in higher temperature environments or building sea walls against rising sea levels. This paper focuses on the first and second option.

[5] Barett, Scott (2007), "A Multitrack Climate Treaty System", in : "Architectures for Agreement", by Stavins, R. & Aldy, J. (2007), Cambridge University Press, p. 241

[6] Christoff, Peter (2006), "Post-Kyoto? Post-Bush? Towards an effective "climate coalition of the willing?", International Affairs 82, 5, pp. 831-860

[7] Victor, David & Cullenward, Danny (2007), "Making Global Carbon Markets Work" (Extended Version), Scientific American, September 24, 2007; Christoff, Peter (2006), "Post-Kyoto? Post-Bush? Towards an effective "climate coalition of the willing?", International Affairs 82, 5, pp. 831-860, Lomborg, Bjorn (2007), "Cool It", Knopf Publishers; Prins, Gwyn & Rayner, Steve (2007), "The Wrong Trousers: Radically Rethinking Climate Policy", A Joint Discussion Paper of the James Martin Institute for Science and Civilization, University of Oxford and the MacKinder Centre for the Study of Long-Wave Events, London School of Economics

The main research question for the paper therefore is:

> ***"Through which policy measures can the EU-27 persuade the U.S. to join an effective Post-Kyoto regime at the COP-15 in Copenhagen in 2009?"***

To answer this question, two sub-questions are posed:

1) *Are EU and U.S. climate policies converging or diverging?*
2) *How can the EU and U.S. cooperate on a policy to lower the marginal costs of electricity from non-fossil-fuel sources?*

To answer the research question, the paper is divided into four parts:

Part II: "Scaling down the problem" explores the debates in climate policy relevant to the paper, e.g. on the *timing* of emission cuts such as the gradual emission reduction approach or the steep emission reduction approach, advocated by the Stern Review. Related to this question is the difference in policies that scale up existing technologies, versus policies that invest in new technologies because today's mitigation technologies are seen as inadequate.

Part III: "Assessing EU climate policy" investigates the policy developments in the EU-27, capable of ensuring "leadership by example", thereby influencing the ultimate outcome of the negotiations, the reform of the EU's Emissions Trading Scheme, the EU's effort-sharing agreement, and the past impact of EU emission reduction targets are analyzed.

Part IV: "Assessing U.S. climate policy" investigates U.S. policy developments under the Bush Administration. Then changes in political and economic factors central for adoption of national climate legislation are analyzed. The alternative policies proposed by experts and presidential candidates Senator McCain and Senator Obama are assessed, such as a carbon tax, a cap-and-trade system, a technological project such a "Manhattan Project on Climate Change" and finally a 5-10x energy R&D spending scenario.

Part V: "Evaluating Alternatives From Kyoto Critics: Should A Post-Kyoto Regime Address Energy R&D?" addresses the question of how to lower the cost of mitigation technologies to increase global deployment. This part debates proposals from critics of the Kyoto Protocol and discusses whether a Post-Kyoto policy alternative could be implemented by the Annex-I countries. Today, world-wide energy R&D levels are not responsive to the climate change challenge. Kyoto puts a price on emissions through emissions trading which is adjustment for

one market failure. But Kyoto does not adjust for the R&D market failure. As a result, too little funding may be spent on energy R&D, as all benefits may not be captured by governments and firms. The paper discusses the policies that could correct such a market failure.

In terms of research methodology, the working paper is a policy analysis focused on existing policies in the EU and U.S. Semi-structured anonymous interviews have been undertaken with Danish public officials in the Prime Minister's Office, in the Ministry of Climate & Energy and with the parliamentary opposition with the aim of generating hypotheses and guiding research. These interviews are kept on record.

Part II: Scaling Down the Problem

2.0 A FOCUS ON MITIGATION COSTS AND MITIGATION TECHNOLOGY

Climate change is accelerating. Evidence from the IPCC 4th Assessment Report from February 2007 concluded that global warming is real and unequivocal[8]. The study also concluded that annual CO_2 growth rates averaged 1.9 ppm per year from 1995-2005, which is higher than the average from 1960-2005, which was 1.4 ppm per year. Today's CO_2 level is the highest in 650,000 years with a rise from a pre-industrial value of about 280 ppm to 379 ppm in 2005, causing an enhanced greenhouse effect[9]. Temperatures may further rise between 1.5°C and 7°C before 2100, which is the temperature difference between the last Ice Age and today. Accelerated global warming is most likely caused by continued growth in U.S. emissions and strong economic growth in the "BRIC's" – Brazil, Russia, India and China. As a result, we may enter into a very different climate for which ecosystems and species are ill prepared. Faced with this challenge, what is the best strategy for cutting back emissions?

A major debate in climate policy concerns the *timing* of emission cuts and the related mitigation costs. Should emission cuts be steep in the near term, or should they be gradual and then ramp up in the future? Climate economists debate whether mitigation costs consequently will be high, if CO_2 reductions are steep in the present. Until the 2006 "Stern Review on the Economics of Climate Change", an optimal economic policy to slow climate change meant modest reductions in the short term, followed by ambitious, deep reductions in the medium and long term. As reduction measures tighten, societies will gradually shift scarce capital to investments in low-carbon technologies to speed up reductions. The leading climate economist, William Nordhaus from Yale University calls this policy approach the *"climate-policy ramp"*[10]. Conversely, the reduction philosophy of the Stern Review, which is a 700-page analysis of mitigation, adaptation,

[8] This report differed from other IPCC reports, because it ended much of scientific uncertainty; man is likely to be the cause of the warming trends.

[9] IPCC, (2007) "Summary for Policymakers". In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 10

[10] Nordhaus, William (2006), "Opposite Ends of the Globe", JEL, p. 3, http://www.sfu.ca/mpp/pdfs/Nordhaus%20Review%20of%20Stern.pdf

technology cooperation and carbon pricing undertaken by the UK government, recommends policy action that conflict with the climate policy ramp approach: High expected climate damage costs means action to reduce CO_2 emissions should increase dramatically in the next 20 years.

The timing of cutbacks relates to the technologies chosen and the *costs* of mitigation. Defining the costs to economic interest groups of near-term reductions is crucial for policy-makers. Climate policy can generate resistance among economic groups, and can cause voters to take away their support for policymakers, should jobs be lost due to competiveness distortion. Two industries against strong near-term reductions are the cement industry and the chemical industry, which have been critical of the EU's climate leadership as it is seen as imposing costs on their products. In fact, costs to society of ambitious climate policy are hard to estimate. But in a case study of selected UK industries, the Review estimated that high carbon pricing will lead to price increases of 2-10% for the most CO_2-intensive industries[11]. It is concluded by the Review that despite higher environmental regulation in the OECD countries than in other parts of the world, there has been little evidence to date of competitiveness distortion and subsequent dislocation by CO_2 intensive industries[12]. The fact is that firms assess other factors when deciding to build a plant, such as labor costs, stable macroeconomic conditions: low inflation and labor laws, etc.

Nevertheless, that climate policy imposes short-term costs and can lead to industry dislocation is a sensitive political question. Dislocation may undermine the emission reductions within a Kyoto nation. Industry dislocation can mean voluntary defection which poses negative incentives for cooperation on the Kyoto regime, because a nation has few incentives to enact deep emission cuts that constrain its economy, if the neighboring nation continues to pollute at no cost to his economy, with the risk of carbon leakage of carbon-intensive industries to the neighbor. This free-ridership on common obligations is known as the "Tragedy of the Commons" dilemma, that international environmental treaties face[13].

[11] The Stern Review (2006), "The Stern Review on the Economics of Climate Change", Chapter 11: Structural Change and Competitiveness**,** p. 7

[12] The Stern Review (2006), "The Stern Review on the Economics of Climate Change", Chapter 11: Structural Change and Competitiveness

[13] Hardin, Garrett (1968), "The Tragedy of the Commons", Science, December 13, 1968

2.1 IS SCALE-UP OF EXISTING MITIGATION TECHNOLOGIES SUFFICIENT?

A second major debate in climate policy connected to the debate on steep and gradual cuts and high or low mitigation costs concerns the adequacy of today's mitigation technologies. The question is can we stabilize the climate using only the best existing technologies, or should we wait for breakthroughs and improved and cheaper technologies, thereby increasing broader diffusion across societies? Reducing emissions means either to accept lower world economic growth, or to gradually decrease the energy intensity of the world economy. As most societies are directly competing for the highest long-term growth rates, stabilizing the climate implies *decarbonization* of the economy. Such decarbonization poses a major technological challenge, debated by scientists. One group of scientists, e.g. Pielke, Wigley & Green (2008) have recently argued in the journal "Nature" that stabilization with the use of existing technologies is more challenging than previously estimated: *"the size of this technology challenge has been seriously underestimated by the IPCC, diverting attention from policies that could directly stimulate technological innovation"*[14]. Understating this aspect of climate protection means we rely on current technologies, and incremental improvements.

Other researchers believe massive scale-up of existing technologies are sufficient for stabilization. Princeton professors Robert Socolow and Stephen Pacala represent this group. They have put a quantitative estimate on the necessary 'technology scale-up' to stabilize the climate before 2050, known as the *'stabilization wedges'* approach[15]. Vehicles must become twice as efficient given the global growth in car ownership; coal plants must become more efficient given a likely continued use of coal world-wide. Governments must add twice the capacity of nuclear power, expand the global wind turbine fleet by a factor 50 and upscale the solar panel fleet by a factor 700, etc[16]. None of these fifteen stabilization wedges can stabilize the climate independently. Socolow and Pacala's "portfolio" approach provides a road-map for the scale of the deployment needed in housing, mass transport, and the power sector, etc. But bringing just one wedge of solar power to

[14] Pielke Jr., Roger, Wigley, Tom & Green, Christopher (2008), "Dangerous Assumptions", Nature, vol. 452, April 2008, pp. 531-532

[15] Socolow, S. & Pacala, R. (2004), "Stabilization Wedges: Solving the Climate Problem for the next 50 Years with Current Technologies", Science, vol. 305, 2004

[16] Socolow, S. & Pacala, R. (2004), "Stabilization Wedges: Solving the Climate Problem for the next 50 Years with Current Technologies", Science, vol. 305, 2004

cost parity with coal-based power requires government price support and further investment in R&D.

The paper continues to assess how emission reductions and mitigation technology deployment have been handled within the European Union and by U.S. policymakers in adopted and proposed climate policies.

Part III: Assessing EU Climate Policy

3.0 EU LEADERSHIP BY EXAMPLE – AN ASSESSMENT

Traditionally, the Danish government has applied pressure on the U.S. at the UN climate conferences by negotiating side-by-side the other twenty-six EU member states. This section will explore how the EU-27's main climate policies have evolved, and how the EU has positioned itself as a climate leader. The paper will assess the components of EU leadership such as the 2ºC target, the -20% by 2020 reduction target, the reforms of the European Trading Scheme, as well as the rationales for the EU's leadership position in terms of developing a "low-carbon economy". The Danish government's efforts towards COP-15 to promote its domestic policies as a 'leadership by example strategy' are explored.

3.1 THE 2°C TARGET

In the EU, the 2ºC target was promoted in a 2005 strategy document as the primary target for the EU's climate policies: Scientists agree that the CO_2-level in the atmosphere should not rise to more than 550 ppm, corresponding with the 2ºC target, because major disruptions to ecosystems and the melting of ice-sheets are avoided at this level. With a temperature increase above 2ºC, three disruptions become more probable. First is the collapse of large-scale coral reef ecosystems, second is the melting of the West Antarctic Ice Sheet, and third, the weakening or shut-down of the Gulf Stream. Researchers predict that eruptions in all three can be prevented if temperatures do not increase above 3ºC warming, but that some abrupt change in either of the three may occur at the 2ºC target[17].

In a recent paper, RSJ Tol, climatologist at Carnegie Mellon University, argues that the evidence for the EU's 2ºC target is in fact arbitrary, loosely substantiated, and although claiming to be based on sound cost-benefit analyses, the nature of the economic analysis for choosing such a target is controversial. In fact, neither scientists nor economists have the data yet for setting such fixed temperature targets[18]. The EU's target is surrounded by uncertainty; temperatures could increase further than 2ºC even if policies aim at this target, due to the *"lag"* and feedback in the

[17] Barrett, Scott (2007), "A Multitrack Climate Treaty System", in : "Architectures for Agreement", by Stavins, R. & Aldy, J. (2007), Cambridge University Press, p. 239

[18] Tol, R.S.J. (2007), "Europe's Long Term Climate Target: A Critical Evaluation", Energy Policy, 35 (1), pp. 424-434.

climate system. In fact, global temperatures could continue to increase from 1.5ºC to 4.5ºC. But although there is some scientific uncertainty as well as policy uncertainty concerning the economic feasibility of the target, the 2ºC threshold has been accepted in public discourse today as the objective for common efforts, also outside the EU.

3.2 THE EU'S LEADERSHIP POSITION AS "TARGET-SETTER"

For the last fifteen years the leadership of the EU member states on the climate issue has been unrivalled. The climate leadership position coincides with policy-makers' willingness to cast the EU as a global player[19] [20]. The EU-bloc has assumed the role as "front runner" in the climate negotiations: In 1995, the EU proposed reducing emissions by -15% before 2010; a target that drove the numerical targets of the Kyoto Protocol. The overall reduction target in Kyoto was -5.5% for industrialized nations.

3.2.1 Understanding EU Climate Policy As Directional Leadership

Theoretically, the EU's climate policy strategy is known as 'directional leadership'. Directional leadership corresponds with a real desire to limit emissions as well as effective policies to back up targets with credible action. EU directional leadership can be achieved unilaterally, thereby demonstrating to other nations that climate protection is possible. Such leadership implies "setting an example" for others, shaping how negotiators perceive the climate issue and how they think of solutions[21]. The price of being a directional leader is that other nations watch the leader's policies closely, examining inconsistencies and the EU bloc's ability to "walk the talk". In the Post-Kyoto negotiations in Copenhagen the EU Council's strategy is that the -20% by 2020 reduction goal will influence the ultimate outcome of the Annex-I countries, just as the EU did in 1997.

[19] Oberthür, Sebastian (2007), "The European Union in International Climate Policy: The Prospect for Leadership", Intereconomics, March/April 2007, pp. 77-83

[20] But historically, the EU's environmental ambitions were small, and until the 1987 Single European Act there was no formal treaty recognition of the EU on environmental issues. Today, the EU is party to more than sixty multilateral environmental agreements from desertification to Kyoto. That the EU would act as a coherent negotiating bloc was also not foreseeable; often the EU was divided internally as member states protected their industries, Sbraghia, A. M. (2000), "Environmental Policy" In: Wallace, H. and Wallace, W. (ed.) (2000), "Policy-Making in the European Union", 4th Edition, Oxford University Press, pp. 293-316

[21] Gupta, Joyeeta & Ringius, Lasse (2001), "The EU's Climate Leadership: Reconciling Ambition and Reality", International Environmental Agreements: Politics, Law and Economics 1,2001, pp. 281-299,

Directional leadership is enhanced by enacting the effort sharing agreement ahead of the Copenhagen summit. The EU's "effort sharing agreement" binds members to the common emission reduction goal of -20% below 1990 levels by 2020. The distribution of the reductions across the 27 members is the most controversial part of the EU's leadership strategy. The energy package builds on an *equity* principle where national reduction targets are based on a GDP per capita criterion. Member states with a low per capita GDP and high GDP growth expectations can increase their emissions from 2005 levels[22].

But the EU-27 faces potential pitfalls. In the Kyoto commitment period, southern member states such as Spain, Portugal and Greece attracted much attention; could these cohesion member states meet their Kyoto targets?[23] Today, East European member states have even less regulatory experience with climate policy, and consequently, directional leadership ability can be lost if East European reduction goals are not met.

3.2.2 Factors Supporting EU Climate Leadership

Factors underpinning EU climate leadership are both political and economical. Public opinion supports EU climate leadership. In the EU, awareness and concern for climate change has grown rapidly. A recent "Eurobarometer" survey of public opinions from the end of 2007, found that 57% of Europeans saw climate change as the main environmental issue they were concerned about; in 2004, that number was 45%. EU leadership is an issue where the public supports action at the European level. The European public thinks favorably of EU leadership in managing environmental issues, as 67% of European citizens felt environmental decisions should be made jointly within the EU.

A major reason that the EU bloc *can* lead on the climate issue is the fact that the European economy has lower energy intensity per unit of GDP than the U.S. economy[24]. This difference has widened since 1990: The EU and the U.S. were at comparable emission levels in 1990, but between 1990 and 2004, the EU economy expanded by thirty-two percent and the greenhouse gas emissions decreased by one percent below 1990 levels. By contrast, the U.S. economy grew by 52.6 percent between 1990 and 2004, but U.S. emissions grew by 15.8 percent, and are projected

[22] EU@UN (2008), "Questions and Answers on the EU Commission's proposal for effort sharing, 23 January 2008, Brussels, Q&A

[23] Smith, Julianne & Mix, Derek (2007), "The Transatlantic Climate Change Challenge", The Washington Quarterly, pp. 139-154

[24] World Watch Institute (2004), "State of the World 2004", World Watch Institute

to increase to 32.4 percent above 1990 levels by 2010[25]. Structural features of the European economy thus facilitate EU climate leadership.

EU climate leadership is also a necessity because of the bloc's enormous resource consumption. In 2005, the EU-25 consumed 18.6% of world oil, only exceeded by the U.S. with 25% of total oil consumption[26]. With 14% of world total CO_2 emissions, the EU-27 is the third largest emitter after China and the U.S[27]. In terms of resource use, the EU is a heavyweight.

3.3 DIRECTIONAL LEADERSHIP: THE EUROPEAN TRADING SCHEME UNDER REFORM

Emissions trading is a *technology pull* approach; the impact on industrial sectors depends on the actual price of carbon. Carbon pricing creates incentives for cleaner substitutes, but the price of a pollution permit is a complex market signal which should reflect the expected damage costs of climate change, but emerges as an interaction between sellers and buyers of pollution permits. A carbon price ensures flexibility, because the number of permits can be reduced to ensure scarcity in the market, in face of new evidence of climate change.

The European Trading Scheme (EU ETS) is the cornerstone of the EU's reduction strategy, and targets electricity plants and industrial installations. Today, the EU ETS covers 40% of the EU-27's total emissions. Total coverage of the EU economy will increase as the scheme is extended, and the ETS reductions are intended to deepen, as the emissions cap is tightened.

[25] EU Commission (2007), "EU Can Offer U.S. Ideas On Climate Change", Ambassador John Bruton, http://www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2007/02/28/EDGRJN7A541.DTL

[26] Vogler, John (2005), "The European Contribution To Global Environmental Governance", International Affairs, 81, 4, (2005), p. 837

[27] http://www.iht.com/articles/2007/06/20/business/emit.php

Figure 1: Permit Prices of the EU ETS (January 2005-April 2006)

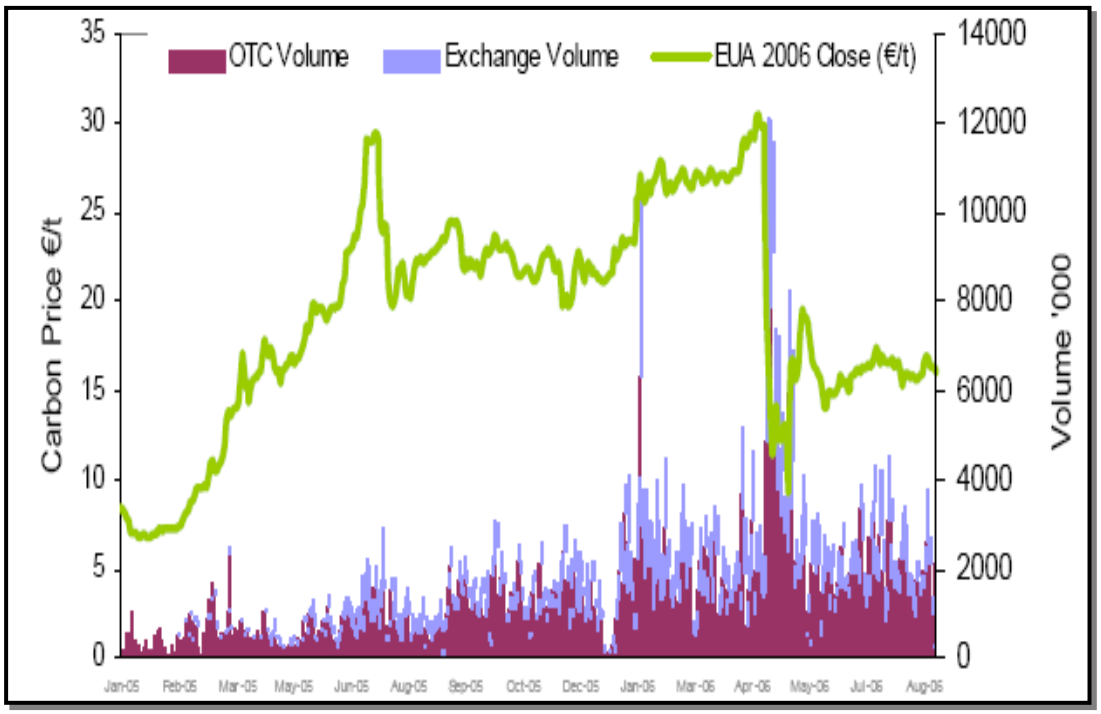


Figure 1: Some critics argued that the European Trading Scheme was a flawed policy with little impact on EU emissions, but the first period is best understood as a test phase. Measures have been taken to stabilize the prices of permits as they varied from $40 per ton of CO_2 to one dollar a day, visible on Figure 1. Fluctuations were a result of the inexperience of firms, and national governments supplying too many permits. Today the price of a one ton CO_2 permit varies around 25 Euro.

Source: Market for EU allowances, prices and volumes. www.pointcarbon.com

Despite the opening problems of the ETS, the system has become the hub of a fast growing. global carbon market. The global carbon market increased its trading with eighty percent in 2007 with an exchange of some 2.7 billion tons of CO_2 credits. Sixty percent of this exchange took place within the EU's European Trading Scheme with 1.6 billion tons of emissions, worth some twenty-eight billion Euro. Such a growth in emissions trading has caused a senior analyst at the global consulting firm "Point Carbon" in London to argue that the carbon market is increasingly becoming "a commodity market in its own right", which is debatable, as the market is in fact created by government mandate[28].

The ETS forms one component of the global market, alongside the carbon credits produced by the reduction projects undertaken within the framework of the Clean Development Mechanism (CDM). The CDM is the Kyoto mechanism aimed at transferring technology to developing

[28] Euractiv.com (2008), "Global carbon market set to explode in next decade", Euractiv.com, 19 February 2008

countries. Should the U.S. enact a cap-and-trade system similar to the ETS, a global regime of linked but separate carbon markets could emerge[29].

Reflecting the operational problems of the ETS, the ETS is being reformed in three ways to address three separate problems: First, policy-makers that look for political support from economic interest groups can be influenced by carbon-intensive employers, pushing for a lenient allocation of permits; and in fact, the German government has protected its coal industry by awarding free credits to coal-fired electric power plants[30]. An EU-wide cap on the number of permits aim to prevent national governments from surplus allocation, preventing that emissions trading is wrecked by problems of political resistance at the national level.

Second, the ETS cap will be reduced annually in a linear fashion towards 2020. The number of permits will be reduced by -21%, compared to 2005 by 2020. Sectors not covered by the EU ETS will be reduced by 10% compared to 2005, thereby creating a reduction of -20% compared to 1990[31]. To date, major electricity companies and industrial firms have received 90% of their allowances for free, but with the new plan, 60% of all permits will be auctioned from 2013 onwards with an increasing share[32]. Free allocation will continue to electricity generators, but is intended to be entirely phased out by 2020.

Finally, a tentative adjustment to the ETS concerns resolving the potential loss of competitiveness incurred by EU carbon-intensive industries, vis-à-vis imported goods from countries with no climate policy. A possible ETS-reform is the distribution of allowances to non-EU trading partners with an obligation to lower their emissions, e.g. per ton of steel produced[33].

[29] Wara, Michael (2007), "Is The Global Carbon Market Working?", Nature 445, pp. 595-596

[30] Victor, David & Cullenward, Danny (2007), "Making Carbon Markets Work", Scientific American, September 24, 2007

[31] Dimas, Stavros (2008), "The Climate Action and Renewable Energy Package", Speech by EU Commissioner Dimas, 28 February 2008

[32] Economist.com (2008), "An EU plan to Cut Hot Air", Jan. 23, 2008

[33] Economist.com (2008), "The Hot Air of Hypocrisy", Mar 19, 2008

3.4 THE EU'S "LOW-CARBON ECONOMY": WINNING THE TRANS-ATLANTIC BATTLE OF IDEAS?

In recent years, there has been something of a paradigm change in the EU's understanding of the costs and benefits of climate change, due to an increased research effort on the economics of climate change. This deeper understanding has implications for an important debate going on across the Atlantic on the cost and benefits of climate policy, where the EU has become the defender of a "low-carbon economy". Achieving a "low-carbon economy" is the underlying strategy of the EU-27, reached through the overall reduction target supported by EU energy efficiency policies, an expansion of renewables, and the expansion of the ETS.

Promoting the low-carbon economy concept is in fact a part of the EU Council's strategy to win the transatlantic debate on the impact of emission reductions on economic competitiveness. The Stern Review, launched in November 2006, was a first attack on the reduction strategy often advocated by the Bush administration - that cutbacks should be modest at first and then increase over time. The Stern Review sought to change the perception on the benefits and costs of *early* action, arguing that mitigation costs would be low, and that there would be benefits from ambitious policy.

In March 2007, the EU Council took the next step and began actively promoting the idea of a *'low-carbon economy'* with more societal benefits than costs. The story-line focuses on sustaining job growth through the export of sustainable technology. European Commissioner Stavros Dimas outlined this vision in the speech "What Jobs in a Low-Carbon Economy?"[34] Here the effect of EU climate leadership on employment is presented as something of a paradigm change:

> "Until recently the discussion on climate change and jobs focused on the negative impact on EU employment that many thought a strong EU climate policy would have. The studies and presentations discussed (…) have highlighted the numerous opportunities that can be created by an ambitious, but well designed action to tackle climate change".

[34] Dimas, Stavros (2007), "What Jobs in a Low Carbon Economy?", Speech, Brussels, 21 February 2007, European Trade Union Confederation, pp. 1-5

> (…) The Commission's energy and climate package, adopted on 10 January this year calls for nothing less than a new industrial revolution" [35].

Dimas argues that the 2007 EU climate package will provide European businesses with a competitive advantage in this low-carbon economy[36]. The statement is controversial, as the costs and benefits of climate policy influence industries in very different ways, as argued in Part I.

From a business strategy point of view, Dimas' new industrial revolution implies that EU firms must respond to climate regulation through innovation. The benefit is the creation of a 'first-mover advantage' ahead of firms from other countries. First-mover advantages can come from the choice to subsidize an industry until take-off; here Denmark's wind turbine industry is an example of a first-mover advantage industry[37].

Interestingly, the EU public does not directly perceive climate policy as a threat to economic growth but as an economic opportunity, perhaps because of the presence of the EU's first-mover advantage in renewables industries. Today, 63% of all Europeans perceive environmental protection as an incentive to innovate - and only 16% see environmental protection as a direct obstacle to economic performance[38].

The paper now turns specifically to the Danish government's climate policies and the nature of the domestic debate, as the country prepares for hosting COP-15.

3.5 THE ROLE AS THE HOST OF COP-15: CHANGING PERCEPTIONS THROUGH "THE DANISH EXAMPLE"?

While Denmark negotiates internationally as part of the EU-27 bloc, as the host of the UN climate conference, Danish climate policies will in some ways have to stand alone, as visiting negotiators assess the effectiveness of Denmark's policies. Questions will arise: Is Denmark on

[35] Dimas, Stavros (2007), "What Jobs in a Low Carbon Economy?", Speech, Brussels, 21 February 2007, European Trade Union Confederation, pp. 1-5

[36] Euractiv (2007), "Dimas on Business Attitudes to Climate Change", 9 February 2007, www.euractiv.com, (October 28, 2007)

[37] Porter, Michael (1998), "The Competitive Advantage of Nations", Palgrave, 2nd Edition, p. 92

[38] Commissions of the European Communities (CEC) (2008), "Attitudes of European Citizens Towards the Environment. Eurobarometer Special Report 295 Wave 68. 2TNS Opinion and Social. European Commission. Brussels.

track to achieve its current Kyoto target? What is the future ambition level of Denmark's post-Kyoto policies?

The Danish government promotes the "Danish example" of decoupling emissions from economic growth. World-wide, the story is advanced by the Danish Minister of Climate and Energy, and is a key component of the website that advertises COP-15[39]. Three elements of the "Danish example" aim to change the perception that climate policy has a negative effect on economic growth. These three elements are also interesting given the debate in the U.S. First, trends in energy efficiency, second, trends in renewables deployment and thirdly, trends in renewables exports.

Firstly, since the mid-1980's, the Danish economy has grown by 75% with stable energy consumption, and relative to the average of the 27 EU member states, the energy intensity of the Danish economy is in the low end. Decoupling has been achieved by a whole range of separate policies that focus on energy efficiency. Policy measures such as standards for the energy consumption of buildings, labeling schemes for electrical appliances and public campaigns for household energy savings have been enacted. Industries have enacted energy savings agreements, and energy taxes are tied to energy consumption[40].

Secondly, strong expansion of wind turbine deployment and biomass plants hold scale-up lessons for other countries. In 1980, the share of renewable energy in Denmark's overall consumption was 3% and in 2006 it was around 15%. Denmark currently produces 3,100 MW of wind power, ranking after Germany and Spain in deployment.

The Danish example generates enthusiasm in the U.S., although the two economies are different in structure and in size:

> In the beginning they (the Americans) stated that the Danish economy is not big enough to compare, they have heavy industries, and it is easier to decouple when you do not have heavy industry. When Connie (the Minister on Climate and Energy) visits and tells this story, then it is very disarming – they are used to the fact that it costs and it costs, and instead of taxes and them losing their jobs, they see some opportunities and that it is possible, and when Connie was in Washington (…) and

[39] http://www.cop15.dk/en/menu/About-Denmark/The-Danish-Example/

[40] http://www.cop15.dk/en/menu/About-Denmark/The-Danish-Example/

> told how we decoupled economic growth (from emissions) and that we have 16% of electricity from renewables, then there was spontaneous applause – and the fact that they see it is possible, it does mean a lot.
>
> Advisor, Danish Ministry of Climate & Energy[41]

Thirdly, Denmark has demonstrated that early investments in renewables industries can lead to job creation and enhance national revenue decades later. Driven by strong export growth, the Danish company "Vestas" is the world's largest wind turbine producer and exported 98.6% of their production in 2003[42]. Subsequently, Danish energy technology exports in 2006 reached 6.2 billion Euro, and such technology exports comprising wind power technology now make up about 8% of total Danish exports[43].

Despite these promising trends, Danish climate policy is a topic for strong domestic political debate. In the national election in the fall of 2007, the ambition level of future climate policy became a major issue. According to the opposition, certain trends give Denmark a bad point of departure for hosting COP-15:, the growth in wind turbine deployment has largely come to a halt since the Liberal-Conservative government took office; in 2007, more old wind turbines were dismantled that new turbines were erected, placing Denmark at the bottom end of new wind turbine deployment in the EU[44]. Coal is a contested energy source domestically, and the opposition has criticized the current government for voting to begin the use of coal in the country's two largest power plants, which originally were banned from using coal[45].

An advisor in the Danish Social Democratic Party sums up their view on these domestic issues:

[41] Anonymous interview (on record)

[42] Brandt, Urs Steiner & Svendsen, Gert Tinggaard (2006), "Climate Change Negotiations And First-Mover Advantages: The Case Of The Wind Turbine Industry", Energy Policy, Volume 34, Issue 10, July 2006, Pages 1175-1184

[43] http://www.cop15.dk/en/menu/About-Denmark/The-Danish-Example/

[44] www.socialdemokraterne.dk "Danmark tilbage på klimasporet", February 26, 2008, (Denmark back on the climate track")

[45] www.politiken.dk, "S: Fogh er hyklerisk på klimapolitik", June 12, 2008, ("Social democrats: Fogh is hypocritical on climate policy")

> We think the (Danish) government have given themselves a bad point of departure for conducting climate diplomacy. Partly because it is important to have "the moral high ground"[46].
>
> - Advisor in the Danish Social Democratic Party

Finally, the energy spokesperson for the governing party "Venstre" has argued that buying more credits through the Kyoto Protocol's CDM projects is necessary to ensure future CO_2 reductions[47]. The opposition argues that sponsoring more CDM projects would undermine the nation's climate policy. Instead more domestic action is needed, but here the opposition argues that the political will for stronger domestic action has been absent[48]. Using CDM projects as a reduction measure is contested by some Danish politicians, because meeting national measures abroad give little incentive towards advancing a national low-carbon economy, and may also take pressure off domestic firms that would be forced to innovate to meet the Danish reduction target.

From the efforts at the EU-level and "the Danish example", the paper now turns to the climate policy of the Bush Administration, and analyzes factors influencing U.S. climate policy under the next President and Congress, and the domestic policy alternatives being discussed in the current debate.

[46] Anynomous interview (on record)

[47] www.information.dk, "Den store globale byttehandel med CO2", April 3, 2008, "The great global exchange of CO2"

[48] www.information.dk, "Energiaftale når knap halvvejs til CO2-målet", March 28, 2008, "Energy agreement only goes half way towards the CO2 target"

Part IV: Assessing U.S. Climate Policy

This part analyzes the Bush Administration's climate diplomacy and its domestic efforts. Certain enabling trends among states, cities and in the business community favor the adoption of national cap-and-trade in the next administration. These trends are juxtaposed with the constraint of the U.S.'s high reliance on coal for electricity. The most contested issues in the Senate debate on the "Boxer-Warner-Lieberman bill" is analyzed, as the debate offers lessons on what will preoccupy the next Congress in 2009. The section analyzes proposals for future policy such as a carbon tax, emissions trading or a techno-optimist "Manhattan Project on Climate Change" in terms of problem effectiveness and political feasibility. Finally, recent trends in energy R&D are explored, as a national climate policy under a President Obama could have a major energy R&D component.

4.0 THE BUSH ADMINISTRATION'S TECHNO-OPTIMIST APPROACH

The U.S. debate on climate policy in the run-up to the 1997 Kyoto negotiations was highly attuned to Kyoto regulation's impact on economic competitiveness. A group of major economic interest groups launched the "Global Climate Information Project", and spread fear among policy-makers concerning the loss of competitiveness[49]. Such competitiveness concerns were directly codified on July 25, 1997, when the Senate enacted the Byrd-Hagel act with an overwhelming majority: 95-0. The act served as the mandate for what the U.S. Senate could agree to in the Kyoto negotiations, and the mandate was very narrow. The Byrd-Hagel act stated that the U.S. would accept no agreement that did not subject major developing countries (such as China and India) to reductions or that would hurt the U.S. economy. The act has become famous as it was the first time the "conditional logic" between the emerging economies and the U.S. was codified into law – a logic that in the run-up to COP-15 still dominates international climate negotiations.

In 2001, the competitiveness rationale was reiterated again by President Bush. The U.S. defected *"because (the Kyoto protocol) exempts 80% of the world, including major population centers such as China and*

[49] Bang, Guri & Tjernshaugen, Andreas (2005), "Future U.S. Climate Policy: International Re-engagement?", International Studies Perspectives, 2005, 6, pp. 293

India, from compliance, and would cause serious harm to the U.S. economy"[50]. As a result of Bush's rejection of the Protocol, the EU gained importance globally, and the U.S. was now seen by Europeans as a "rogue state" in global environmental politics[51] [52]. Recently, the UK government has attempted to change the U.S. perception surrounding competitiveness. As mentioned, the Stern Review's focus on the high damage costs of inaction on the Business-As-Usual path was a major attack on the Bush administration's policy-line. But despite Stern's visits to the U.S., and considerable international awareness surrounding the Stern Review, there has been little change in U.S. policy.

Domestic climate policy in the Bush administration has focused on "voluntary measures" to be taken by major industrial polluters such as power plants. Furthermore, the stimulus of technology development by the distribution of federal grants and tax credits. As a result, the Bush administration has spent $37 billion since 2001 on climate science and observation. From 2003 to 2006, the U.S. invested $3 billion annually in climate technology such as carbon capturing and sequestration, nuclear power and biofuels[53].

President Bush has been successful in tying climate policy to energy security. Energy security has become a major theme in recent years, as oil prices have soared. The interface between climate change and energy security is highlighted when climate policies such as efficiency and renewables deployment indirectly reduce U.S. reliance on foreign oil. In his 2007 State of the Union, President Bush pledged to reduce energy dependency by reducing gasoline consumption by 20% in 10 years and by boosting ethanol production. Similar proposals have been made by past presidents and almost all of these have failed. Since 1973, twenty-four of thirty-four "State of the Union addresses" have argued for solutions to U.S. dependency on foreign oil, yet oil imports have continued to grow[54].

[50] Text of a letter from the President to Senators Hagel, Helms, Craign and Roberts, White House Press Release, 13 March 2001, http://www.whitehouse.gov/news/releases/2001/03/20010314.html (Nov. 27, 2007)

[51] Vogler, John & Bretherton, Charlotte (2006), "The European Union As A Protagonist To The United States On Climate Change", International Studies Perspectives, 2006, 7, p. 9

[52] Falkner, Robert (2005), "American Hegemony and the Global Environment", International Studies Review (2005), 7, pp. 585-599

[53] Mignone, Bryan K. (2007), "International Cooperation in a Post-Kyoto World", Brookings Institution, pp. 1-9

[54] Krauthammer, Charles (2007), "Energy Independence? A Serious Plan Requires Taxes, ANWR and Nukes", Washington Post, January 26, 2007, A21

4.1 EVALUATING THE BUSH ADMINISTRATION'S CLIMATE DIPLOMACY

In his second term, President Bush acknowledged that climate change was a serious problem, and launched unilateral climate and technology partnerships; hardly a new approach but a continuation and projection of the domestic policy approach that focused on technology development.

The "Major Economies" initiative was launched in the end of May 2007, aiming to contribute to a post-Kyoto framework. The partnership focuses on energy security and climate change and aims to enhance coordination by the end of his term. The Major Economies are *Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, South Korea, South Africa, United Kingdom, the EU, the EC, and the UN*. The goals are first to establish a process for reaching agreement in 2008 on a long-term global goal for reducing greenhouse gas emissions. Second, to consider strategies over the mid-term, reflecting each nation's own mix of energy sources and future energy needs. Third, the "Major Economies" highlights research and development of clean energy. Participants will also discuss how to eliminate tariff barriers for clean technologies and services.

The reaction from European governments was suspicion that Bush's policy would be a decoy - the initiative has *no binding reductions targets,* and little real funding. Yet, in absence of real engagement of the Bush administration in the UN climate talks, the Danish government hopes that the major economies initiative could ind the end help to relay a coordinated perception of the climate problem into the UNFCCC process[55].

Towards the Asian economies the Bush Administration launched the "Asia –Pacific Partnership on Clean Development and Climate" (AP-6). The AP-6 includes Australia, China, India, Japan, Republic of South Korea and the U.S., and represents half the world's emissions and population. The approach particularly favors diffusion of policy learning; e.g. China is mimicking the U.S. Energy Star Program to produce efficient energy appliances[56]. The AP-6 addresses technology

[55] United States Mission to the European Union (2007), "U.S. Policy on Global Climate Policy", November 26, 2007

[56] U.S Department of State (2007), "U.S. Actions to Address: Energy Security, Clean Development, and Climate Change", November 26, 2007

cooperation and the reduction of the energy intensity of their economies, but also contains no binding reduction targets[57].

European critics have been very skeptic of Bush's Asian partnership; the AP-6's absence of reduction targets led commentator Dr. Anja Köhne from the World Wildlife Fund Europe to call the partnership a *"smoke screen",* because the AP6 is overly optimistic about technological transformation[58]. Nevertheless, Republican Senators such as former Public Works Committee Chairman, James Inhofe has worked with the Bush administration in developing the AP-6, and has argued that the initiative should be the focal point for future efforts in the next administration[59].

From the discussion of the current policies by the Bush administration, the paper now turns to two different analyses of U.S. climate policy: first is a tentative stakeholder analysis, which assesses the changing landscape among states, businesses, public opinion – and discusses how important these factors are in enabling and constraining a national policy. The paper then turns to an evaluation of the specific policies proposed by policymakers in the current U.S. debate.

5.0 TOWARDS THE NEXT U.S. PRESIDENT'S POLICY IN 2009: A DOMESTIC STAKEHOLDER ANALYSIS OF STATES, BUSINESSES AND PUBLIC OPINION

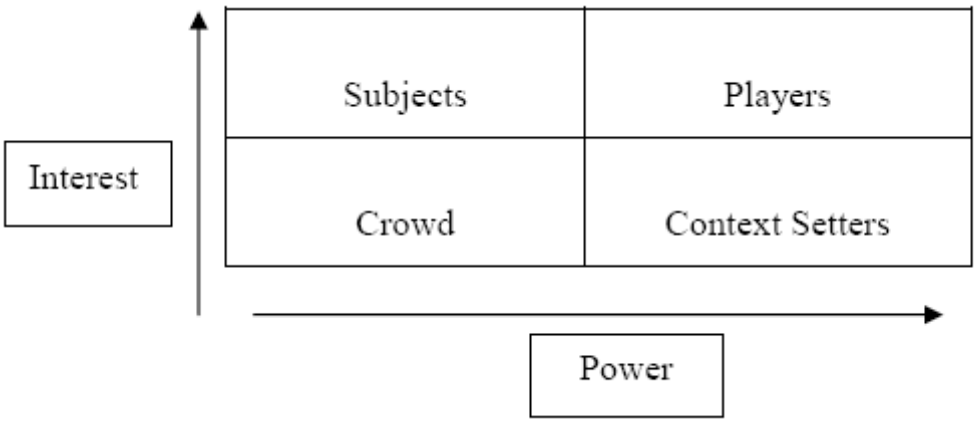
Several domestic factors determine the international room to maneuver for the next U.S. President and Congress. Factors considered influential are changes in public opinion and policies at the state level, the city level and investment trends in the business community. Their relevance can be categorized using a "Power vs. Interest Grid".

[57] Hammond, Geoffrey P. (2006), "What is the Economics of Climate Change? – A Response to the Discussion Paper by Sir Nicholas Stern", HM Treasury, London. 2005-2006, http://www.hm-treasury.gov.uk/media/B/7/geoffrey_hammond.pdf, (July 28, 2007) p. 12

[58] Köhne, Anja (2006), "New Arenas for Climate Policy – Energy & Climate Issues in EU Foreign Relations", WWF European Policy Office, Brussels, presented 28-29. September 2006, Berlin, p. 4

[59] http://epw.senate.gov/speechitem.cfm?party=rep&id=263759

Figure 2: Bryson's "Power vs. Interest Grid"



Source: Bryson, John M. (2004), "Strategic Planning for Public & Nonprofit Organization", p. 338, 3rd Edition, John Wiley & Sons, Inc.

The matrix explains the stakeholders' political interest in the climate change issue, and their power to influence the future of the issue. Four types of stakeholders are found: "Players" that have both an interest and significant power, "Subjects" that have an interest but little influential power, "Context setters", that have power but little interest and members of the "Crowd" that are stakeholders with little interest or power.

5.1 STATES AS "PLAYERS" IN INFLUENCING NATIONAL POLICY

First, U.S. state legislatures are obvious stakeholders who will play a crucial role in shaping national climate policy. High-ranking elected officials and specialists in the bureaucracies possess the highest level of power and a potentially high level of interest; they would be considered "players". For that reason it is highly relevant to examine in detail the policy actions at the state level as guide to national climate policy – especially on the issue of emissions trading, where states are pushing ahead for more action far beyond the federal level.

California is the front runner state where climate legislation has advanced the most. A progressive position was taken when Governor Schwarzenegger signed Assembly bill 32, known as the Global Warming Solutions Act 32 of 2006 or simply "AB32". The AB32 reduction goal parallels the

EU's goal of reducing -20% below 1990 levels by 2020[60]. The target means reducing emissions 10% from where California is today. The first measures will be those where consumers and industries can save money, through energy efficiency and conservation. California has also adopted an 80% reduction from 1990 levels by 2050 by Executive order S-3-05.

And where as the EU has adopted the target of having 20% of energy demand covered by renewables, California has adopted a 33% Renewables Portfolio Standard, which lets the utilities decide how to reduce emissions. In terms of adopting more renewable energy sources, twenty states have minimum renewable energy standards – a comparable policy to the EU's renewable targets in the recent 2007 energy package.

States particularly take the role as "Players" in shaping a national emissions trading scheme. Below the federal level, emissions trading schemes are emerging all across the U.S. Nine Northeast and Mid-Atlantic states have initiated the "Regional Greenhouse Gas Initiative" (RGGI). The RGGI includes New York, New Jersey, Connecticut, Delaware, Massachusetts, Rhode Island, New Hampshire, Vermont, and Maine. The target will limit emissions to 2005 levels through 2015, with a decline thereafter[61].

Also "The Midwestern Regional Greenhouse Gas Reduction Accord" was recently established by the states Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin and one Canadian province. Participants have agreed to establish regional greenhouse gas reduction targets, including a long-term target of 60 to 80 percent below current emissions levels, and to develop an emissions trading scheme. The agreement is to be fully implemented before the summer of 2010[62].

Finally, the "Western Climate Initiative" (WCI) was established in February, 2007, by states Arizona, California, New Mexico, Oregon, and Washington. Since then, Utah, Montana and two Canadian provinces as well as the province of Quebec have joined the WCI. Members agree to jointly set a regional emissions target and establish a cap-and-trade program covering several sectors. In August 2007, the Western Climate Initiative announced its regional, economy-wide

[60] California Air Resources Board (2008), "Climate Change Draft Scoping Plan – June 2008 Discussion Draft – Pursuant to AB32", California Air Resources Board, 2008

[61] Pizer, William (2007), "A U.S. Perspective on Future Climate Regimes", February 2007, Resources for the Future, pp. 1-19

[62] http://www.pewclimate.org/what_s_being_done/in_the_states/regional_initiatives.cfm (Retrieved on July 28, 20089

greenhouse gas emissions target of 15 percent below 2005 levels by 2020, or approximately 33 percent below business-as-usual levels[63].

Apart from states, city mayors can also be perceived as "players". Their efforts are becoming more organized, and they have expressed a high level of interest: Nearly eight hundred mayors representing twenty-nine million citizens in thirty-five states have now signed the "Mayors Climate Protection Agreement", making binding commitments to reduce emissions -7% below 1990, corresponding to the initial U.S. Kyoto target[64].

Despite such progressive developments among actors with high power and interest, there are structural limits regarding how far national policy can go. Several states have less interest in a strong national climate policy, as they are highly reliant on coal - the dirtiest source of energy among the fossil fuels. States such as Pennsylvania, Wyoming, West Virginia, Kentucky, Colorado, and Montana, Colorado, Indiana, Illinois, North Dakota are all major coal producers[65]. In fact, coal provides 50% of U.S. electricity, which is a constraint on any national climate policy[66]. Coal-fired power plants are the single largest stationary source of CO_2 in the U.S.

Climate policy imposes short-term adjustment costs on coal consumers and imposes a long-term threat to the industry, if electricity suppliers must substitute to alternative sources of energy due to a national emissions cap. Consequently, senators from such coal states could perceive national climate policy as well as a Post-Kyoto regime as a threat to their coal-mining industry and constituent jobs, and could make it very difficult for a Senate mandate to pass through the floor vote, if these Senators feel their reelection is jeopardized. A likely change to the U.S coal-based power infrastructure is the installation of carbon capturing and sequestration (CCS) on a large scale. But the technology is still experimental.

[63] http://www.pewclimate.org/what_s_being_done/in_the_states/regional_initiatives.cfm (Retrieved on July 28, 2008)

[64] http://www.yesmagazine.org/article.asp?ID=2291 (Retrieved on May 1, 2008)

[65] Curry, Tom (2008), "Governing the United States of Coal – Urgent Problem for Coal-State Governors: Power plants' carbon dioxide", Feb. 25, 2008, MSNBC.com, pp. 1-3

[66] http://web.mit.edu/coal/The_Future_of_Coal.pdf (Retrieved on March 11, 2008)

5.2 CITIZENS AS "THE CROWD" IN INFLUENCING NATIONAL POLICY

Second, individual citizens form another type of stakeholder. Most citizens have a low level of power on the issue of reducing carbon dioxide emissions, and citizens who possess a low to medium level of interest in this issue would be considered part of the crowd. Nevertheless, changes in U.S public opinion can still sway influence over the next President. There has been growing dissatisfaction in the U.S. general public with how current political leaders handle the climate issue.

In a 2007 poll in New York Times, 56% claimed they disapproved of how President Bush handled the environment. 70% said they thought the federal government ought to do more than it is currently doing to reduce global warming, and 49% argued that it should do "much more"[67]. U.S. public concern for climate change is on the rise. From 2003 to 2006, the proportion claiming that global warming is a top environmental priority tripled[68]. A recent Gallup poll conducted in March 2008 found that Americans are in favor of protection of the environment vis-à-vis reducing economic growth, even at a period of economic downturn[69]. This means that the American public's view on the issue is converging with the European public's view.

5.3 THE BUSINESS COMMUNITY AS "CONTEXT SETTERS" IN INFLUENCING NATIONAL POLICY

Thirdly, private sector businesses within the U.S. form yet another type of stakeholder. Since businesses may be affected by government regulation to reduce carbon dioxide emissions, they all have a high degree of interest in the issue. The larger corporations who posses more power and influence on the issue can be considered context setters while the smaller, less influential businesses become part of the crowd.

[67] New York Times (2007), "CNS News Poll, April 20-27-2007, "http://graphics8.nytimes.com/packages/pdf/national/20070424_poll.pdf; Washington Post (2007), "Washington Post - ABC News-Stanford University Poll: Environment Trends, Friday April 20, 2007, http://www.washingtonpost/wpsrv/nation/polls/pospoll_environment_042007.html

[68] MIT LFEE (2007), "MIT LFEE, "A Survey of Public Attitudes towards Climate Change and Climate Change Mitigation Technologies in the United States: Analyses of 2006 Results", April 2007, MIT, Laboratory for Energy and the Environment, MA

[69] Gallup (2008), "Gallup Poll – Environment", 6-9 March 2008, http: //www.gallup.com/poll/1057815/Half-Public-Favors-Environment-Over-Growth.aspx

In terms of their influence as a stakeholder group, one way climate policy-related industries can influence policymakers is through job creation and market growth, which increases their power on the issue. An example hereof is how clean energy investment has increased rapidly in the U.S. business community. Clean energy now captures a *third* of all U.S. venture capital investment, with 40% of "clean tech funding" going to California[70]. In the first nine months of 2007, U.S. venture investors allocated $2.6 bn into clean-energy start-up firms, which was more than the $1.8 bn invested in start-ups the year before[71]. World-wide, clean energy investments have increased with more one third in 2007 to $117 bn, influenced by concerns over global warming[72]. These developments mean that more U.S. businesses that have an interest in national policy are becoming involved. The U.S. business community is increasingly realizing the profits in clean technology markets. Such market growth rates and job creation counter the conventional Bush Administration's policy-line that climate policy is a straight-jacket on economic growth[73] [74].

In conclusion, city and state developments and public opinion are far ahead of the Administration's position. These trends could mean that the federal level will enact a national climate policy modeled on state policy under the next President[75]. The major question is whether a national policy will be strong enough to ensure climate stabilization, and whether it will be in place ahead

[70] Kammen, Daniel (2008), "Clean Energy and America's Future", Op-Ed, published first in San Francisco Chronicle, May 18, 2008

[71] http://online.wsj.com/article/SB120248998090254145.html

72 http://www.financialpost.com/story-printer.html?id=210984 Wednesday, January 02, 2008

[73] Interestingly, a growing share of global executives now factor climate policy into their business strategy. 61% of all executives interviewed in a McKinsey study of 2,192 global executives thought there would be profit opportunities if businesses adjusted to the climate challenge. 60% of global executives thought climate change would be a matter for business strategy, and ought to be part of product development, investment and corporate branding (Enkvist, Per-Anders & Vanthournot, Helga, "How Companies think about climate change", p. 47, McKinsey Quarterly, 2008, No. 2, p. 55)

[74] NGO's as "Subjects" In Influencing National Policy: A final group of stakeholders is comprised of non-governmental organizations (NGOs) that work to create awareness on global warming at the grassroots level. An in-depth analysis of their influence on the issue has not been possible, but a few worth noting are Al Gore's "Wecansolveit.com" campaign, the Apollo Alliance that support clean energy investment to fight climate change and NGO's such as "The Climate Institute" that organize outreach and policy hearings. These groups educate the public about global warming, and inform policymakers on the solutions. These specific NGO's have a high level of interest in the issue but a medium level of power and can be called subjects. As their power increases as a result of increased public support, this group of stakeholders could also become players.

[75] Selin, Henrik & VanDeveer, Stacy (2007), "Political Science and Prediction: What's Next for U.S. Climate Change Policy?", Review of Policy Research, 2007, Vol. 24, 1, p. 17

of Copenhagen? The next section explores national policy alternatives, put forth by policy-makers, national experts and Presidential candidates.

6.0 EVALUATING THE POLITICAL FEASIBILITY OF PROMINENT U.S. CLIMATE POLICY IDEAS

The paper now turns to a discussion of the policy ideas promoted in the U.S. debate and the actors that have promoted them. The most likely is a cap-and-trade system, which has been fairly close in passing through the Senate. The idea of a carbon tax, a "Manhattan Project on Climate Change" and an upscaled energy R&D scenario is also analyzed. The implication for U.S. participation in Copenhagen are discussed.

6.1 EVALUATING THE IDEA OF A CAP-AND-TRADE SYSTEM

U.S. experts Stern & Antholis (2007) and Parry & Pizer (2007) agree that the most likely climate policy is a *cap-and-trade system* similar to the European Trading Scheme (ETS)[76] [77]. Cap-and-trade is supported by the Democratic and Republican Presidential candidates, Senator Obama and Senator McCain. McCain has actually proposed cap-and-trade twice and lost both votes in the Senate since 2000, and experts have even labeled McCain's legislation, known as the McCain-Lieberman bill "promising"[78]. McCain's bill was seen as something of a paradigm change as it differed from Bush's technology approach, and set a limit on emissions in January 1, 2010. The bill covers about 70% of U.S. emissions, and as a result annual emissions would be lowered to the amount released in 2000 by 2016. But critics argue that McCain has not proposed any new climate legislation since 2003, while the science has become more certain in this period.

A cap-and-trade system is favored in the U.S., because such a policy solved the domestic acid rain problem cost-effectively in the past. A cap-and-trade system can create tax revenue for the government, so other taxes could be cut to balance the distributional impact of the policy[79]. The

[76] Parry, Ian & Pizer, William (2007), "Combating Global Warming", Regulation, Fall 2007

[77] Stern, Todd & Antholis, William (2007), "A Changing Climate: The Road Ahead for the United States", The Washington Quarterly, Winter 2007/08, p. 175-188

[78] Pizer, William A. & Kopp, Raymond J. (2003), "Summary and Analysis of McCain-Lieberman – "Climate Stewardship Act of 2003", D.139, introduced 01/09/03, January 28, 2003

[79] Stern, Todd & Antholis, William (2007), "A Changing Climate: The Road Ahead for the United States", The Washington Quarterly, Winter 2007/08, p. 175-188

downside of emissions trading is its volatility - unlike the tax that fixes the price of CO_2, prices are unpredictable as permit demand also vary with increases in energy demand and gas prices.

Carbon price volatility is to be avoided, as it imposes adjustment costs on special interest groups. In the short term, a cap-and-trade policy poses a dilemma: American Electric Power CEO Michael Morris has argued that with the arrival of an emissions cap, the most polluting coal electricity plants may have to shut down, possibly causing electricity shortages[80].

Any such shut-downs would put pressure on policy-makers for getting the carbon price right in a cap-and trade system. Set the carbon price too low, and power industries and other major polluters have no incentive to create substitutes. Set the price too high, and the effect would be punitive on the most carbon-intensive sectors of the U.S. economy. In theory, the carbon price signal reflects the expected damage costs per ton of extra CO_2 pollution such as the costs associated with sea level rise, declining crop yields, stronger hurricanes or deaths from heat waves. Critics debate whether carbon markets will be adequate to drive technological transformation[81]. The level of carbon pricing necessary to drive innovation could be higher than the marginal damage costs. Victor (2007) argues the carbon price could be $40 per ton of CO_2, but the Stern Review operates with a marginal cost of $85 per ton of CO_2, because the Review factors in equity weighting of poor people, discounts the future at a lower rate than other scholars, and estimates the cost of catastrophic climate events[82]. But setting a permit price of $85 per ton of CO_2 would generate enormous short-term resistance.

6.1.2 Can Cap-&Trade Policy Pass Through the Next Congress in 2009?

What can pass through the Senate before COP-15 will have a major influence on the U.S. negotiators' room to maneuver, or as a Danish public official involved in the COP-15 planning, says:

> When will they (the U.S.) have national legislation? Will they have it before a COP-15 agreement? Or later? Will they arrive in Copenhagen with legislation that says we can

[80] Curry, Tom (2008), "Governing the United States of Coal – Urgent Problem for Coal-State Governors: Power plants' carbon dioxide", Feb. 25, 2008, MSNBC.com, pp. 1-3

[81] Victor, David (2007), "Fragmented carbon markets and reluctant nations: implications for the design of effective architectures" In: "Architectures for Agreement" ed. by Stavins, Robert N. & Joseph E. Aldy (2007), Carmbridge University Press

[82] Stern Review (2006), "Executive Summary", p. xvi

> go no further than the legislation, or will they negotiate – and then implement national legislation (…) the question is whether they want a more flexible negotiation position or if they will come with a more ultimate bid, and say this is what we will implement.
>
> Advisor, Danish Ministry of Climate & Energy[83]

Finally, as seen with the Byrd-Hagel act, the most important factor influencing the next President's policy will be the alignment of Senators needed to get to 60 votes, needed to pass a cap-and-trade bill. Legislative activity has increased at Capitol Hill, and proposals are becoming increasingly detailed. The McCain-Lieberman bill aimed at stabilizing U.S. emissions at the 2000-level, but failed to pass with a vote of 48-36. Also recently, the Bingaman-Dominici bill which modifies the Byrd-Hagel position towards developing countries and its conditional cooperation logic, but failed to pass with a 54-43 vote.

The most recent vote and debate in June 2008 on the "Boxer-Warner-Lieberman bill" revealed the major legislative obstacles facing the next Congress. The bill was bipartisan and sought for stabilization around the 2ºC target, and increased investment in alternative energy. But the proposal was turned down, with a 48-36 vote, despite letters from Presidential candidates Obama and McCain, arguing they would support the bill. Reaching the 60 vote threshold, even with a Democratic majority after November will be a major obstacle towards Copenhagen. In June 2008, 10 Democrats wrote a public letter stating their concerns over the Boxer-Warner-Lieberman bill, and a major cited reason was the impact of climate legislation on the economy[84].

Major issues were the overall U.S. reduction target and whether industries would lose competitiveness towards China and India[85]. Another unresolved question in the Boxer-Warner-Lieberman debate was the redistribution of government revenue from the auctioning of emission permits. Permit auctioning will generate billions of dollars in public revenue[86]. Will the revenue

[83] Anonymous interview (on record)

[84] A final question often asked by Europeans is whether the EU and the U.S. can link up their emissions trading schemes. Likely, regulatory agencies and market players will need significant experience with a national cap-and-trade system before they link to a European Trading Scheme. Therefore, the *linking* options tend to be under illuminated in the U.S. debate, and not a central feature.

[85] E&E Daily (2008), " CLIMATE: Whether it's McCain or Obama, Washington preps for '09 warming debate", 07/29/2008, by Darren Samuelsohn, E&E Daily senior reporter

[86] Financial Times (2008), "Carbon Clincher – America weighs an emissions mechanism", Financial Times, June 18, 2008

be earmarked for special economic groups or spent on funding energy R&D? Will the revenue be used for short-term measures that will lower personal income taxes for groups that already now feel the pressure of rising gas prices? The redistribution question is contested, because several legislative committees will be involved in managing the revenue. Several Senate committees may be involved in drafting the bill, which slows things down.

Resolving these issues could mean that deliberations in the Senate could be protracted beyond December 2009. As the legislative debates heat up next year, more EU attention must be directed at legislative efforts in Congress, as such preparatory work hold clues to a future U.S. reduction target at COP-15.

6.2 EVALUATING THE IDEA OF A CARBON TAX

A part from the cap-and-trade policy, the idea of a carbon tax is often promoted in the U.S. debate. Recently, Senator Dodd (D-Conn), Congressman Larsen (D-Conn) and Stark (D-Calif) have argued for a carbon tax. The advantage of a carbon tax is that it provides stable government revenue, and gives certainty concerning the price of emissions.

The idea would be to feed the tax burden into the fossil fuel supply chain proportional to the carbon content on the fuel, then passing the burden of the tax on to coal, gas and petrol products and consequently to the price of electricity[87]. But will the carbon tax be politically feasible? Experts Warwick McKibben & Peter Wilcoxen (2007) argue that a carbon tax will not be supported by private groups with sufficient financial resources to ensure the continuity of a carbon tax. Fossil fuel users will lobby against the tax, and with no Post-Kyoto regime to keep the policy in place, the only incentive is the government revenue generated by the tax. Experience also shows that governments have run up deficits to reduce taxes[88]. Oppenheimer & Yang (2007) argue that taxes can create demand for climate-friendly products, e.g. in the energy sector and in transportation. But researchers also argue that it is difficult to determine the tax rate necessary to create the desired environmental result, such as emission reductions[89].

[87] Parry, Ian & Pizer, William (2007), "Combating Global Warming", Regulation, Fall 2007, p. 20

[88] McKibbin, Warwick J. & Wilcoxen, Peter J. (2007), "A credible foundation for cooperation", in : "Architectures for Agreement", by Stavins, R. & Aldy, J. Cambridge University Press

[89] Oppenheimer, Michael & Yang, Chi-Jen (2007), "A "Manhattan Project for Climate Change?", Climatic Change (2007), 80, p. 199-204

A carbon tax will is unlikely to be politically feasible, because of public opinion trends. In a Washington Post Survey, 79% of a sample opposed higher taxes on electricity to encourage reduced consumption; such a resistance would make a carbon tax unlikely. Instead, 62% of the sample favored the introduction of government legislation to reduce the greenhouse gases that power plants can emit, thus shifting the burden away from consumers.

6.3 MORE TECHNO-OPTIMISM – "A MANHATTAN PROJECT ON CLIMATE CHANGE" IN 2009?

The next section will discuss another frequently cited U.S. policy by policymakers, namely a major government-initiated technological project to create and diffuse clean energy. A climate technology project has also been explored, as leading energy experts have debated the relationship between energy research and climate change mitigation.

In the 2008 Presidential race, contenders Hillary Clinton and Rudy Giuliani have not discarded the Bush administration's techno-optimist approach to climate policy, indicating that technology development in some form could become a future feature of U.S. climate policy-making. Also, the influential author and columnist Thomas Friedman of the New York Times has argued repeatedly that a *"huge industrial project"* in clean energy is needed, paralleling the "Moon Project", the "Manhattan Project" and the "New Deal" in scope and scale[90].

Such an American techno-optimism is found in past successes; private companies innovated in research collaboration with the government under the auspices of the "Manhattan Project". The same public-private governance model was applied on a much larger scale when the Americans started the 'Apollo project' in the 1960's to put a man on the moon.

But is a techno-optimist, government-run project an applicable model for the climate problem? Princeton scientist Michael Oppenheimer (2007) argues the analogy is not comparable. Although such a project would aim to develop low-carbon technologies for energy generation and use, in fact, government regulation does a faster job in stimulating innovation. A Manhattan Project on Climate Change offers appealing political rhetoric and easy answers, but a *single* new technology will not yield the necessary scale of industrial transformation[91]. Unlike the Second World War,

[90] Friedman, Thomas L. (2007), "A Warning From the Garden", January 19, 2007, NY Times, pp. 1-3

[91] Oppenheimer, Michael & Yang, Chi-Jen (2007), "A "Manhattan Project for Climate Change?", Climatic Change (2007), 80, p. 199-204

the climate problem poses a long-term, generational problem. Unlike the Manhattan Project, Socolow and Pacala's "stabilization wedges" approach cited earlier, demonstrates that many climate friendly products are needed across sectors in transportation, energy generation and housing to achieve stabilization. The Manhattan Project was not market-driven, but cloaked in secrecy. Conversely, the only way innovations can become widely adopted across many sectors of the U.S. economy will be for market players to be intimately involved.

6.4 AN UP SCALED U.S. ENERGY R&D SPENDING SCENARIO?

Finally, another component of U.S. national climate policy could be a major boost of energy R&D. In 2008, the remaining Democratic Presidential candidate Barack Obama has proposed a grand, forward-looking energy and climate plan. Obama wants to spend $150 bn dollars on energy R&D as part of his climate policy, and his energy advisor, Dan Kammen (UC Berkeley) has said: *"The United States must mobilize the world's largest R&D if we are to address climate change"*[92].

Two trends both favor and oppose such an R&D spending scenario. Firstly, in favor is the fact that U.S. energy R&D is at an all-time low. In the private sector there has been a major decline in energy R&D, and energy research investments by U.S. companies fell by 50% between 1991 and 2003[93]. Since 1980, energy R&D as a share of U.S. R&D has fallen from 10% to 2%. Public and private sector R&D spending has remained at constant levels for renewable energy and energy efficiency. Kammen & Nemet (2005) conclude that the lack of industry investment indicates that the government must increase investment and remove any regulatory roadblocks[94].

To reverse these trends, a public boost of energy R&D could spill over to private sector energy R&D and could help to stabilize the climate. Kammen & Nemet (2005) therefore call for a five- to ten-fold increase in U.S. energy R&D spending at the cost of 15-30 billion/year. At a Con-

[92] Kammen, Daniel (2008), "Clean Energy and America's Future", Op-Ed, published first in San Francisco Chronicle, May 18, 2008

[93] Kammen, Daniel M. & Nemet, Gregory F. (2005), "Reversing The Incredible Shrinking Energy R&D Budget", Issues In Science And Technology, pp. 85-88, Kammen, Daniel M. (2006), "Climate Change Technology Research: Do We Need A "Manhattan Project for the Environment"?", Committee on Government Reform, United States House of Representatives Testimony for the September 21, 2006 Hearing. Dan Kammen is Professor in the Energy and Resources Group (ERG), Professor of Public Policy in the Goldman School of Public Policy, Co-director Berkeley Center for the Environment

[94] Kammen, Daniel M. & Nemet, Gregory (2005), "Reversing The Incredible Shrinking Energy R&D Budget", Issues In Science And Technology, (22), 1, pp. 84-88

gressional Hearing in 2006, UC Berkeley Professor Dan Kammen compared various past government spending scenarios in the twentieth century to a future energy R&D scenario. The comparison is shown in figure 3:

Figure 3: Comparison Of U.S. Energy R&D Scenarios and Major Federal Governmental R&D Initiatives

Program	Sector	Years	Additional Spending over program duration (2002 $ dollars)
Manhattan Project	Defense	1942-45	$25.0
Apollo Program	Space	1963-72	$127.4
Project Independence	Energy	1975-82	$25.6
Reagan Defense	Defense	1981-89	$100.3
Doubling NIH	Health	1999-04	$32.6
War on Terror	Defense	2002-04	$29.6
5x Energy Scenario	**Energy**	**2005-15**	**$47.9**
10x Energy Scenario	**Energy**	**2005-15**	**$105.4**

Figure 3: Comparison of major U.S. government R&D spending initiatives in science, space, defense and a proposed up scaled energy R&D scenario by Professor, Dan Kammen, UC Berkeley (Senator Obama's energy advisor).

Source: Kammen, Daniel (2006), "Testimony for the United States House Committee on Government Reform", September 21, 2006

Such an up scaled R&D spending scenario advocated by Senator Obama and Kammen differs from the "single technology" approach of the Manhattan project. Energy R&D instead tend to be broad-based - and thus targets a range of renewable energy technologies through applied university research and public-private sector research.

Financing an up scaled R&D spending scenario in a time of budget deficits will be difficult. Preliminary work in 2008 indicate that President Bush leaves a record-breaking budget deficit for the next President and Congress of 482 billion dollars – the largest deficit ever, borne by the costs of the Iraq War, the Afghanistan War and the recent housing bust[95]. Furthermore, it will be difficult for a President Obama to find $120 billion dollars for energy research, as long as the U.S. is heavily involved in the Iraq war – a war that Nobel Prize winner Joseph Stiglitz and Harvard Professor Linda Bilmes estimate have cost the U.S. three trillion dollars[96].

[95] http://www.politiken.dk, "Bush leaves astronomical deficit", "Bush efterlader astronomisk underskud", July 29, 2008 (Retrieved on July 29, 2008)

[96] Stiglitz, Joseph & Bilmes, Linda (2008), "The three trillion dollar war", Times Online, February 23, 2008

From the evaluation of policy ideas in the U.S. debate, the paper turns to discussing a policy alternative for a Post-Kyoto regime that the EU-27 and U.S. could initiate along with other countries to create technological progress, create more emission reductions and lower the global costs of mitigation.

Part V: Evaluating Alternatives from Kyoto Critics: Should a Post-Kyoto Regime Address Energy R&D?

7.0 INTRODUCING THE ENERGY R&D MARKET FAILURE

This section will illustrate how past R&D efforts in clean energy contributed to lowering the costs of electricity from solar panels. The section will then analyze current energy trends in the OECD, and discuss if a policy alternative that sets energy R&D targets is politically feasible.

Spending more public resources on mitigation such as low-carbon energy R&D poses an 'opportunity cost' for governments[97]. Invested funds in mitigation technology can not be spent on human capital development such as public schools or universities or infrastructure such as ports or high-ways. But financing mitigation measures can be seen as a trade-off with adaptation measures: Early investments in mitigation technology such as wind mills and solar panels today reduces the need for adaptation measures decades away, and also offers potential for job creation and economic growth.

Financial support by governments of research and development in energy is crucial because energy technology often face a 'positive externality' problem; the benefits of innovation such as inventing a new technology such as fuel cells or solar panel technology are not always fully captured by the companies or governments that have funded the research. Other nations can copy the research and further develop the patents. Thus, the societal benefits exceed the sunk costs incurred in the innovation process which represents a market failure. As a result, there can be too little investment in clean technology[98].

The incentive for some governments to supply more energy research could have been created *indirectly* by the pressure to reduce national emissions under the Kyoto Protocol. To reduce CO_2, the power sector in theory would develop products that would be climate-friendly. But as trends discussed below demonstrate, the public R&D levels in new power sources have continued to

[97] Barrett, Scott (2007), "Why Cooperate: The Incentive to Supply Global Public Goods", p. 188, Oxford University Press

[98] Jones, B., Keen, M. & Strand, J. (2008), "Paying for Climate Change", Finance and Development, March 2008, p. 28-31

decline within the advanced countries; trends that conflict with the need for cheaper mitigation technologies as climate change is accelerating. Consequently, we risk relying on many of the same mitigation technologies, causing some scientists to argue the technology challenge is underestimated, as discussed in part II.

7.1 CAN R&D SPENDING CUT THE COST OF MITIGATION TECHNOLOGIES?

Firstly, it is necessary to ask how certain can we be that increased energy R&D funding can bring technologies closer to the market? In a study on the cost development of solar panels (photovoltaics), Nemet (2005) found that their cost have declined by a factor x100 since the 1950's. A major cause of this decline is government and university R&D programs - in fact, ten of sixteen breakthroughs in solar panel efficiency have resulted from these programs. In one case, a rapid increase in efficiency from 1983 to 1990 was a consequence of an $1.5 bn investment push in worldwide solar panel R&D[99].

More funding can make expensive technologies such as solar power competitive with cheaper, dirtier sources such as coal. But even with a new R&D push to lower the cost of solar power significantly, mass deployment will still take decades and face multiple barriers. Traditionally, there is a delay in diffusing technologies such as solar panels as technical barriers exist, particular in linking new technologies to the existing electricity grid. Complementary technologies may be needed, and may only be invented once technologies are deployed. The current transition phase between our fossil-based energy infrastructure towards a future low-carbon economy can be compared to past changes in technological paradigms. Trehan (2003) argues that often *"complementary technologies"* must be invented to make break through technologies widely available; economic historians now know that in the second industrial revolution a range of new technologies were present, but the full effects of such inventions were not felt until decades after their introduction. The idea implies that more research in complementary technologies also is needed, e.g. to provide storage of solar energy[100].

While boosting energy R&D for low-carbon energy sources can lower their costs, other policies are needed. The question then is, how responsive are the energy R&D levels in the OECD?

[99] Nemet, Gregory (2005), "Beyond the Learning Curve: Factors influencing the Cost reductions in Photovoltaics", Energy Policy 34 (17), pp. 3218-3232

[100] Trehan, Bharat (2003), "Technological Change", FRBSF Economic Letter, Number 2003-08, March 21, 2003

7.2 DECLINING PUBLIC ENERGY R&D SPENDING IN THE OECD

A major OECD study has assessed energy R&D trends in conventional and alternative energy. In most industrialized countries, R&D expenditures have declined dramatically from the early 1980s onward, as demonstrated on figure 4 below. The trend is juxtaposed by the increase in total public R&D spending in the same period. Advanced nations are spending a smaller budget share on researching new energy technologies. Even before this trend, much of R&D was spent on the development and deployment of nuclear power.

Figure 4: Public R&D Expenditure in OECD countries (total R&D and energy R&D)

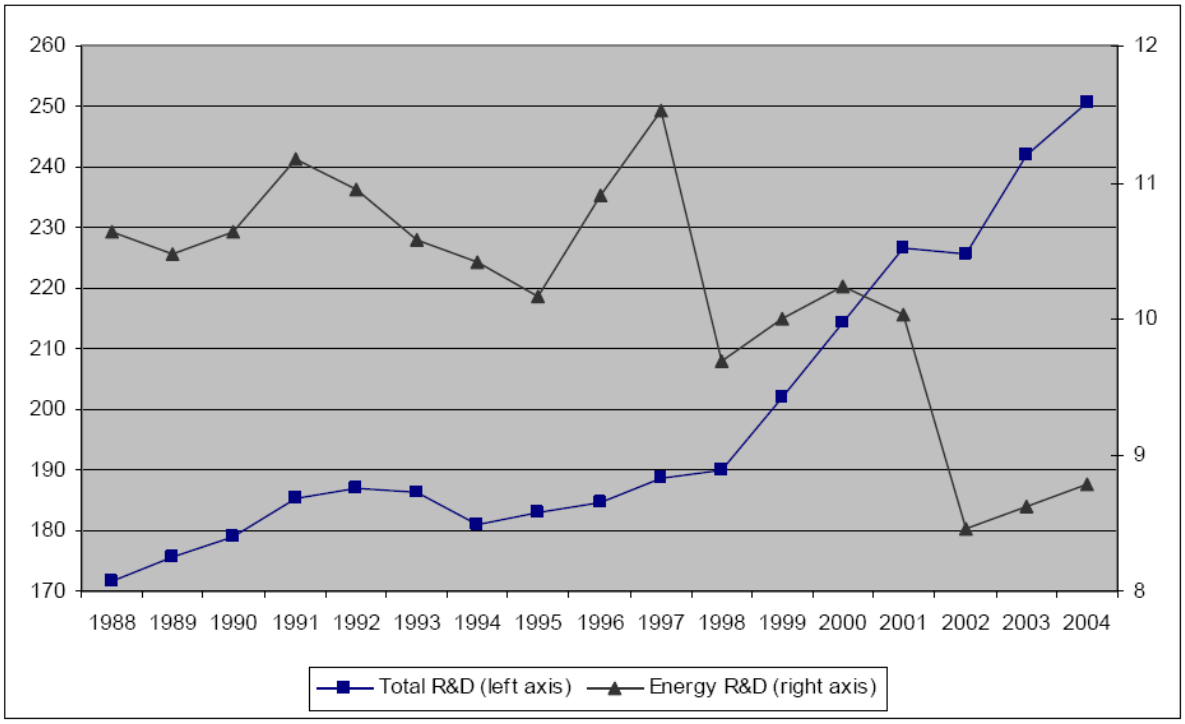


Figure 4 demonstrates that total public sector R&D has increased from 170 bn (in constant 2004 billion USD and PPP) to $240 bn. But in the same period, energy R&D within the OECD countries decreased from roughly $10.5bn to below $9bn annually in 2004.

Source: OECD (2006): 'Do we have the right R&D priorities and programs to support energy technologies of the future'. 18th Round Table on Sustainable Development background paper Paris: OECD, http://www.oecd.org/dataoecd/48/28/39356629.pdf

The decline in energy R&D expenditure from the peak in 1984 to 2003 occurred among several major EU members: In the UK energy R&D declined by -95%, in Spain by -85%, in Germany by -73%, in Italy by -63% and in France by -55%. The trends have not been contrasted by a shift of resources to the EU-level. In the EU research program the energy budget dropped from $0.9

billion annually in the 1984 – 1987 period to $0.5 billion annually in the 2002–2006 period[101]. Senator Obama and Dan Kammen's idea of an "up scaled U.S. energy R&D spending scenario" can indeed have international implications as the U.S. and Japan account for 70% of the total energy R&D expenditure of all OECD countries, amounting to $ 6.8 billion in 2004[102].

But why have such dramatic declines occurred all over the OECD countries? There may be several reasons, but one factor is the fact that energy R&D funding and oil prices are correlated[103]. As oil prices have been historically low since the mid-1980's, there has been fewer incentives to fund research in alternative energy. The paper has however not been able to document whether trends are reversing, now that oil prices have reached record high levels.

7.3 TOWARDS AN INTERNATIONAL ENERGY R&D FRAMEWORK?

With this parallel trend of declining support for energy research in several major countries and the need for reversal to create low-cost renewables, a relevant question is whether such a mitigation policy can be lifted to the international level, and made part of global cooperation? Is inclusion within a Post-Kyoto framework politically feasible?

Member of the IPCC, Steve Rayner have argued that explicit reference to energy R&D targets could be a part of a Post-Kyoto framework[104]. Also, the 700 page Stern Review on the economics of climate change has researched the energy R&D question, and concludes that global support for energy R&D should *double*, and that more formal agreements can help to boost innovation worldwide[105]. Finally, IPCC member Scott Barrett (2007) supports a future protocol that promotes research and development into new energy sources - as well as a protocol to ensure the diffusion of new mitigation technologies[106]. The section below will explore how energy R&D targets can be related to the Post-Kyoto regime.

[101] OECD (2006): 'Do we have the right R&D priorities and programs to support energy technologies of the future'. 18th Round Table on Sustainable Development background paper Paris: OECD, http://www.oecd.org/dataoecd/48/28/39356629.pdf

[102] http://www.oecd.org/dataoecd/48/28/39356629.pdf

[103] http://www.interacademycouncil.net/CMS/Reports/11840/11953/11962.aspx (retrieved on July 30, 2008)

[104] Rayner, Steve & Prins, Gwyn (2007), "Time to Ditch Kyoto", Nature, vol. 449, 25 October 2007

[105] Stern Review (2006), "Conclusions", p. 575

[106] Barett, Scott (2007), "A Multitrack Climate Treaty System", in : "Architectures for Agreement", by Stavins, R. & Aldy, J. (2007), Cambridge University Press

An international framework for energy R&D could take the form proposed by Barrett (2007), who argues that a 'two-step treaty' is possible. First governments set the international R&D requirements for the specific technologies and secondly, they agree on how to *finance* the technologies chosen[107].

In determining the finance question, in international energy R&D policy mimicking 'Official-Development Assistance' (ODA) targets has been proposed by the highly controversial Danish Kyoto critic and author, Bjorn Lomborg. Lomborg (2007) supports boosting energy R&D levels, and argues that the R&D option must be chosen for every nation as a choice to support its own industries: Every nation must choose to spend at minimum *0.05% of GDP* on mitigation technologies[108]. Lomborg's work helps in estimating the exact R&D levels necessary, and the sort of agreement that would be needed. Targets for spending a fraction of GDP on energy R&D could be distributed across the nations according to wealth, e.g. by the use of a per capita principle. But such targets would not be mandatory such as citizen's taxes but voluntary which makes free-riding more likely. For that reason, public officials involved in the Post-Kyoto negotiations do not give this idea much political viability:

> (…) I do not think a certain percentage of GDP devoted to technology development would work. You have these sort of objectives already in development aid, and only Denmark, Norway, Sweden, The Netherlands and Luxembourg fulfill the UN 0.7 pct. target. In the EU you have the objective that 1% is devoted to R&D. In the U.S., their R&D is larger than in the EU, so I think the Americans will sort that out themselves.
>
> Special Climate Advisor, the Danish Prime Minister's Office

In a globalized world, general "R&D internationalization" is occurring which perhaps makes more collaboration likely, but in the current period, conventional research partnerships are changing. The share of U.S. R&D expenditures in Europe is declining, whereas the share of U.S.

[107] Barett, Scott, (2007), "Why Cooperate – The Incentive to Supply Global Public Goods", Oxford University Press

[108] Lomborg, Bjørn (2007), "Cool It", Knopf Publishers

R&D spending in Asia is rapidly increasing[109]. Such trends should warn EU policy-makers that closer transatlantic research cooperation may no longer be the first option.

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Part VI: Conclusion

8.0 CONCLUSION

This section will draw conclusions on the findings of the working paper:

8.1 EU LEADERSHIP BY EXAMPLE TOWARDS COPENHAGEN

In concluding on EU Leadership towards COP-15, the paper finds that EU climate policy has followed the "directional leadership" model of enacting more ambitious emission cuts than other actors. Much of the EU's influence on the outcome of COP-15 now depends on the acceptance of negotiation partners of the -20% target as a global target for Annex-I countries. Within the EU-27, climate change now is considered the main environmental issue that concerns citizens, and EU citizens support that action is taken at the EU level. Leadership is possible, because the European economy as a whole has lower energy intensity per GDP unit produced than their U.S. counterparts. Now, the focus is on reforming the ETS so that it actually delivers emission reductions in targeted sectors.

Promoting the idea of a European "low-carbon economy" today rests on past first-mover advantages and the perception of climate policy as an economic opportunity. Such a notion is supported by the EU public. Within the low-carbon economy logic, it is the strategy that much larger emitters can learn from the Danish example in energy efficiency, renewables deployment and export growth. Nevertheless, U.S. policymakers have argued the Danish economy is difficult to compare in size and structure to the U.S. economy.

The intention of the Danish example is to change the underlying perception of U.S. policy-makers that economic growth and emissions reductions are not opposites. For U.S. officials preoccupied with short-term costs and benefits to constituents, the fact that 8% of total Danish exports comes from energy technology highlights how a country's industries can be positioned early on to capture global market shares in a low-carbon future.

8.2 U.S. POLICY DEVELOPMENTS TOWARDS COPENHAGEN

Will there be a transatlantic convergence in climate policy? Under President George W. Bush, policies diverged across the Atlantic with voluntary measures and partnerships as the preferred U.S. approach, whereas the EU in the same period adopted emissions trading[110]. In concluding on U.S. developments, the paper evaluated several of the main policy ideas promoted by key stakeholders in terms of their political feasibility. Of the debated ideas such as a carbon tax, a cap and trade system, technological solutions such as a "Manhattan Project on Climate Change" and an up scaled energy R&D scenario, a cap-and-trade system is the most likely.

As more regional trading systems evolve across the country, U.S. policymakers face pressure to create a uniform carbon pricing mechanism across the economy. The U.S. cap-and-trade debate is still years behind the European debate, but the sooner these regional systems become operational and yield experience, even in absence of federal legislation, the more likely Senators will be to make more realistic assessments of the benefits and costs of carbon pricing on their constituents.

Given that both Presidential candidates have made electoral pledges to support stronger climate policy, and that both candidates support market-based cap-and-trade policy, much of the responsibility for cutting the knot of conditional cooperation between the U.S. and China now lies in the hands of the U.S. Senate. Responsibility especially lies with the Senators that did not support the Boxer-Warner-Lieberman bill in June 2008, and are needed to pass the 60-vote threshold for national legislation. A new President will not likely sign a Copenhagen Protocol without Congressional support, e.g. by the use of Executive Order. The climate issue is likely too contentious in terms of industrial competiveness to bypass Congress – and such a move will create enormous resistance.

Therefore, the executive and legislative branch will need to work closely together to finalize national legislation ahead of Copenhagen, and in this process, Presidential leadership may be essential to sway the remaining Senators. Whether a national policy is enacted ahead of COP-15 depends on a new President establishing a legislative majority of 60 Senators. Senators will be careful to enact policy that imposes a cost on their constituents such as a carbon tax, as their track record on a climate bill may influence their prospects for re-election. For that reason the

[110] Smith, Julianne & Mix, Derek (2007), "The Transatlantic Climate Change Challenge", The Washington Quarterly, Winter 2007-2008, pp. 139-154

most politically feasible bill is one that can also create jobs. Especially, Senators from coal states will need some kind of compensation, if policy imposes a cost on their constituents.

The design of a compensatory transfer mechanism that redistributes the billion of dollars of revenue originating from a cap-and-trade system to industries that lose competitiveness due to carbon pricing will create major redistributive problems among economic interest groups. The more these debates on specific parts of the cap-and-trade deal are protracted in the Senate, the more unlikely it will be that national legislation is ready before COP-15 in December 2009. If the next President truly believes they must have a national mandate from the Senate in the form of a passed cap-and-trade bill to negotiate a global agreement in Copenhagen, then a global agreement may crucially depend on the balance of jobs lost and gained as a result of climate policy in states such as Pennsylvania, Iowa and Ohio.

Finally, not only redistribution debates can protract the legislative process, but so can also competing national issues in the next Congress. Priorities such as pulling out the troops of Iraq or national health care reform will tap energy from the legislative and executive branch. The challenge for the EU-27 then is to continue to stress that the climate policy debates in Congress are not decoupled from the timeline of the international Post-Kyoto negotiations track.

The timeline in 2009 is very tight if U.S. national policy is a pre-condition for U.S. acceptance of a deal at COP-15. In the end, realism is therefore warranted regarding the prospects for Copenhagen.

8.3 A POLICY ALTERNATIVE TO BROADEN THE POST-KYOTO AGENDA?

Introducing a policy alternative can prevent the Post-Kyoto negotiations from again stalemating in distributional bargaining over emission reductions. The paper addressed the work of Kyoto critics and related it to empirical policy developments. The paper documented that public energy R&D funding is low in the OECD compared to past energy R&D expenditures, and found that at least one study has shown that R&D spending has been a contributing factor in lowering the cost of solar panels (photovoltaics). To bring in the Americans, the EU could push for more U.S. responsibility in areas, where the EU itself does not have a comparative advantage or is yet a well-developed actor, such as the area of energy R&D cooperation. The Annex-I countries could undertake more joint research projects within the auspices of their research universities, where the U.S. is a world leader. But setting energy R&D targets for all countries are contentious; experience from ODA goals demonstrate that such international obligations are only fulfilled by the few.

The commitments to an up-scaled energy R&D scenario among OECD countries could be followed by enhanced research collaboration to lower the cost of mitigation technologies such as solar panels and the necessary complementary technologies that can bring them closer to the market-place.

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