S. HRG. 111–119

INDUSTRIAL COMPETITIVENESS UNDER CLIMATE POLICIES: LESSONS FROM EUROPE

HEARING

BEFORE THE

SUBCOMMITTEE ON EUROPEAN AFFAIRS

OF THE

COMMITTEE ON FOREIGN RELATIONS
UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

JULY 8, 2009

Printed for the use of the Committee on Foreign Relations

Available via the World Wide Web: http://www.access.gpo.gov/congress/senate

U.S. GOVERNMENT PRINTING OFFICE
52–910 PDF WASHINGTON : 2009

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON FOREIGN RELATIONS

JOHN F. KERRY, Massachusetts, *Chairman*

CHRISTOPHER J. DODD, Connecticut
RUSSELL D. FEINGOLD, Wisconsin
BARBARA BOXER, California
ROBERT MENENDEZ, New Jersey
BENJAMIN L. CARDIN, Maryland
ROBERT P. CASEY, JR., Pennsylvania
JIM WEBB, Virginia
JEANNE SHAHEEN, New Hampshire
EDWARD E. KAUFMAN, Delaware
KIRSTEN E. GILLIBRAND, New York

RICHARD G. LUGAR, Indiana
Republican Leader designee
BOB CORKER, Tennessee
JOHNNY ISAKSON, Georgia
JAMES E. RISCH, Idaho
JIM DEMINT, South Carolina
JOHN BARRASSO, Wyoming
ROGER F. WICKER, Mississippi

DAVID MCKEAN, *Staff Director*
KENNETH A. MYERS, JR., *Republican Staff Director*

SUBCOMMITTEE ON EUROPEAN AFFAIRS

JEANNE SHAHEEN, New Hampshire, *Chairman*

CHRISTOPHER J. DODD, Connecticut
ROBERT MENENDEZ, New Jersey
ROBERT P. CASEY, JR., Pennsylvania
JIM WEBB, Virginia
EDWARD E. KAUFMAN, Delaware

JIM DEMINT, South Carolina
JAMES E. RISCH, Idaho
BOB CORKER, Tennessee
ROGER F. WICKER, Mississippi

CONTENTS

INDUSTRIAL COMPETITIVENESS UNDER CLIMATE POLICIES: LESSONS FROM EUROPE

WEDNESDAY, JULY 8, 2009

U.S. SENATE,
SUBCOMMITTEE ON EUROPEAN AFFAIRS,
COMMITTEE ON FOREIGN RELATIONS,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:47 p.m., in room SD–419, Dirksen Senate Office Building, Hon. Jeanne Shaheen (chairman of the subcommittee) presiding.

Present: Senators Shaheen, Boxer, Kaufman, and Risch.

OPENING STATEMENT OF HON. JEANNE SHAHEEN, U.S. SENATOR FROM NEW HAMPSHIRE

Senator SHAHEEN. Good afternoon, everyone. I apologize for the late start. We are—we've just come from a vote, and I am going to go ahead and begin. We may have other Senators joining us after the vote, but, so that we're not too much later than we had promised, we will begin.

I'm Jeanne Shaheen. I'm the chair of the Subcommittee on European Affairs, which is the sponsor of this afternoon's hearing.

We are here today to examine the European experience with climate change policies, with a particular focus on the effect that these policies are having on the European industrial base. As Congress endeavors to craft a comprehensive climate policy, the experiences and lessons learned from Europe will provide valuable insights in helping United States policymakers shape domestic legislation.

Now, many of us in Congress, myself included, believe that enacting policies to address climate change and move our economy into a clean energy future will be a net benefit for our country. Millions of new jobs will be created if we do it right. Our national security will be improved by reducing our dependence on foreign oil. Public health will improve, and a cleaner planet will be left for our children and our grandchildren.

However, we do know that certain sectors of our economy will be vulnerable under a clean energy incentives program that puts a price on carbon. Industries that produce cement, iron, and steel, aluminum, refined petroleum products, and chemicals, among others, use large amounts of energy in their production and face stiff global competition. These industries will be affected under a climate program because their ability to pass along additional costs will be limited.

Maintaining the competitiveness of American business and growing American jobs are goals that we all share. Therefore, I believe it's prudent for Congress to consider policies to mitigate the adverse effects a domestic climate program will have on these industrial sectors. We need to learn from our friends in Europe what's working, what's not, and why.

We're fortunate today to have with us a respected panel of experts.

Welcome, Senator Kaufman.

Dr. Felix Matthes is the research coordinator for energy and climate policy at the Institute for Applied Ecology in Berlin, and he's written extensively on these issues.

Welcome, Dr. Matthes.

Dr. Steven Fries is the chief economist for Royal Dutch Shell, in The Hague.

Welcome.

Dr. Wolfgang Weber is the head of energy and climate policy with BASF Group in—pardon me if I get this wrong—Ludwigshafen, Germany. Not bad, huh?

Dr. WEBER. Very good.

Senator SHAHEEN. And Ben Lieberman is the senior policy analyst at the Heritage Foundation's Roe Institute for Economic Policy Studies, here in Washington, DC.

For our friends who have come such a long way from Europe, we very much appreciate your taking the time to be here this afternoon, and for coming such a long way to join us.

And, Mr. Lieberman, even though you haven't come so far, we're equally pleased that you're here, too.

We look forward to hearing from our witnesses today about their experiences of maintaining competitiveness under the European Union's Emissions Trading System, or EU ETS—I will try to limit all acronyms this afternoon—and how we might learn from them in crafting domestic climate legislation here in Congress.

So, again, thank you very much. We would like to begin, Dr. Matthes, with your testimony.

STATEMENT OF FELIX MATTHES, RESEARCH COORDINATOR FOR ENERGY AND CLIMATE POLICY, INSTITUTE FOR APPLIED ECOLOGY, BERLIN, GERMANY

Dr. MATTHES. Mrs. Chairman, members of the committee, thank you for the invitation to speak today and for giving me the opportunity to comment on the critical issues of industrial competitiveness under the EU ETS.

This scheme is, without any doubt, one of the central pillars of Europe's policy to combat global climate change. I offer my personal thoughts today, based on my experience gathered from a broad range of work on conceptual and design issues, as well as the practical implementation and an ex-post evaluation of the EU ETS. In other words, I've spent the last 10 years of my life as the European Union emissions trading scheme.

We went through a steep learning curve, especially during the pilot phase, in the years 2005 to 2007. We raised vulnerable experiences and we can summarize some evidence.

No. 1, the EU ETS creates a robust carbon pricing, even during the recent economic crisis.

No. 2, we can prove abatement measures triggered by the carbon price signal even during the pilot phase of the EU ETS, before the allowance price collapsed.

No. 3, design features beyond the cap, especially allocation of allowances, can have a significant impact on the economic efficiency of the scheme. Allocation can no longer be seen as a purely distributional measure.

No. 4, the EU ETS has significantly changed the scene. Significant efforts to develop innovative mitigation options can be observed also in fields in which even the technical feasibility of major emission reductions was subject to heated debates for the—before the carbon price signal was created. And I can give you many, many examples, even from the cement industry or the iron and steel industry.

No. 5, an evidence-based design of the scheme is crucial. If key design features are based on speculations or even on suspicions, as it was the case in the pilot phase of the EU ETS, the system becomes overcomplex and creates unforeseen drawbacks. In the end, simplicity and robustness are more valuable for all participating parties than efforts to achieve nonachievable microjustice. The scheme created rents and significant windfall profits arising from the free allocation of allowances mainly but not exclusively in the power sector. The windfall profits for the German power sector alone are estimated at 20 billion euro for the 2008 to 2012 period. An in-depth analysis of trade flows for the EU27 in the last few years indicates that no significant changes have come about which could have been triggered by the introduction of the EU ETS. However, industrial competitiveness and, more importantly, emissions leakage from the ETS-regulated sectors to nonregulated sectors or regions, are major concerns and must be addressed by suitable measures. This is especially important for the trading periods from 2013 onward, when the EU ETS caps are tightened significantly and the basic allocation approach is shifted toward auctioning.

There are two key issues that must be carefully assessed with regards to carbon leakage. No. 1, for which sectors should significant leakage effect be considered if no complementary measures are taken? And, No. 2, which measures are appropriate to combating carbon leakage without distorting the carbon price signal and thus the incentives to implement cost-efficient emission mitigation measures?

Many options were analyzed to identify leakage-relevant sectors. In the end, a robust three-step approach was developed, a bottom-up analysis of direct and indirect carbon costs for industrial sectors based on statistical data at a high level of disaggregation, a bottom-up analysis of trade intensity for the respective sectors, and a supplementary qualitative analysis.

Although this approach is not perfect, it should be regarded as the most robust and appropriate one. The analysis of carbon cost for the EU, as well as for selected Member States—the United Kingdom, Germany, the Netherlands—show that the robust set of a few sectors which face significant carbon costs, about 30 euro per metric ton of CO_2—I included a list of these sectors in my written

testimony—the total share of these sectors and the gross domestic product is less than 1.5 percent for Germany, as a heavily industrialized country, and less than 1 percent in the United Kingdom, a country with a more service-based economy.

However, the political deal on the revision of the EU ETS directive led to a nonappropriate definition of "leakage" or "relevant sectors." Sectors with additional carbon cost, direct and indirect, of at least 5 percent, and a trade intensity with non-EU countries of at least 10 percent, that was the original intention. No. 2, sectors with an additional carbon cost, direct and indirect, of at least 30 percent. No. 3, sectors with a trade intensity with non-EU countries of at least 30 percent and additional sectors which meet certain criteria laid down in the directive.

This approach goes beyond the initial concept of a robust leakage sector identification. A significant increase of sectors which can claim special leakage provisions, to a large extent, solely based on a trade-intensity trigger is a problem. The high ranking of trade intensity as a singular indicator becomes even more questionable if the patterns of trade flows are considered. For many of the relevant products, the most important trade partners are OECD countries, like the USA, like Norway, like Turkey, or other industrialized countries—for example, Russia. Whereas, trade with China for the relevant product is less important for many carbon-intensive products. Thus, the introduction of carbon pricing in the OECD or other industrialized countries with carbon constraints could remove a key share of the relevant leakage concern.

If an effective identification of leakage-relevant sectors has been carried out, the question arises, how to deal with the issue with an ambitious climate policy in an emissions trading scheme. Border adjustments are the most popular measures for limiting carbon leakage from the textbook perspective. By many, many reasons, the EU has rejected these options. Free allocation can be used as a compensation for carbon costs. The European Union has used this, based on a 10-percent best ex-ante benchmarking scheme to compensate sectors for CO_2 cost burdens. Using the revenues from allowance auctions for direct compensation can be an interesting option for providing compensation; thus, the EU allows the Member States to compensate industries with the high exposures to indirect carbon costs, the state-aid measures. And the introduction of broader climate policies in other industrial countries is obviously another option.

If the EU would have to design the provisions to deal with the leakage concern from scratch, a more tailored approach would probably emerge. For the sectors with a significant potential for operational leakage—that is, cost-driven reallocation of production to nonregulated regions or sectors—free allocation with plant-closure provisions could be seen as the most suitable approach. For the sectors with a significant potential for investment leakage—that is, cost-driven reallocation of investment to nonregulated regions or sectors—direct subsidies for investments could provide a sufficient countermeasure to combat leakage.

To summarize, all in all, it should be pointed out that leakage is a serious issue in a world of different carbon prices. Second, serious leakage concerns must be raised for only a few carbon-intensive

products or sectors. Third, from the EU perspective, many leakage concerns are related to trade flows with other OECD or industrialized countries. Fourth, tailored approaches can be developed which remove incentives for leakage and maintain a nondistorted carbon pricing. Last, but not least, it should be also considered that carbon pricing provides strong incentives for the growth of new and future-proof industries.

I hope these comments are helpful, and look forward to your questions.

Thank you.

[The prepared statement of Dr. Matthes follows:]

PREPARED STATEMENT OF FELIX MATTHES, RESEARCH COORDINATOR FOR ENERGY & CLIMATE POLICY, INSTITUTE FOR APPLIED ECOLOGY, BERLIN, GERMANY

Mrs. Chairman and members of the committee, thank you for the invitation to speak today and for giving me the opportunity to comment on the critical issues of industrial competitiveness under the European Union Emissions Trading Scheme (EU ETS). This topic is without any doubt one of the central pillars of Europe's policy to combat global climate change.

I offer my personal thoughts today based on my experience gathered from a broad range of work on conceptual and design issues as well as the practical implementation and the ex-post evaluation of the EU ETS.

After a steep learning curve during the pilot phase of the EU ETS from 2005 to 2007 which created valuable experiences on a large-scale emissions trading scheme for greenhouse gases and its introduction on the fast track, the key evidence can be summarized as follows:

- The EU ETS creates a robust carbon price signal, even during the recent economic crisis;
- We can prove abatement measures triggered by the carbon price signal even during the pilot phase of the EU ETS;
- Design features beyond the cap, e.g., allocation of allowances, can have a significant impact on the economic efficiency of the scheme (less efficiency today is equivalent to higher allowance prices in the future); allocation can no longer be seen as a purely distributional matter;
- The EU ETS has significantly changed the scene; significant efforts to develop innovative mitigation options can be observed, also in fields in which even the technical feasibility of major emission reductions was subject to heated debates before the carbon price signal was created (iron and steel industry, cement production, industrial gases, etc);
- An evidence-based design of the scheme is crucial; if key design features are based on speculations (or even suspicions), the system becomes overcomplex and creates unforeseen drawbacks—in the end simplicity and robustness are more valuable for all participating parties than efforts to achieve (nonachievable) microjustice;
- The scheme created rents and significant windfall profits arising from the free allocation of allowances—mainly but not exclusively in the power sector (the windfall profits for the German power sector alone are estimated at 20 billion euro for the 2008–2012 period);
- An in-depth analysis of trade flows for the EU27 in the last few years indicates that no significant changes have come about which could have been triggered by the introduction of the EU ETS.

However, industrial competitiveness and, more importantly, emissions leakage from the ETS regulated sectors to nonregulated sectors or regions are major concerns and must be addressed by suitable measures.

This is especially important for the trading periods from 2013 onward when the EU ETS caps are tightened significantly and the basic allocation approach is shifted toward auctioning.

Two key issues must be carefully assessed with regards to carbon leakage:

- For which sectors should significant leakage effects be considered if no complementary measures are taken?
- Which measures are appropriate to combating carbon leakage without distorting the carbon prices signal and thus the incentives to implement cost-efficient emission mitigation measures?

The evaluation of a wide range of modeling exercises showed the merits and demerits of such approaches:

- The models present consistent and fundamental insights on systemwide effects;
- The results of the modeling exercises show a wide range of different results, mainly depending on different input parameters and different methodological results;
- The level of disaggregation in most of the models is not suited to identifying the leakage-relevant sectors in the necessary detail;
- Leakage effects are linearized in many models whereas investment leakage is increasingly seen as the major leakage route.

Against this background, the identification of the leakage-relevant sectors within the EU ETS is based on a three-step approach:

- A bottom-up analysis of direct and indirect carbon costs for industrial sectors based on statistical data at a high level of disaggregation (4-digit NACE);
- A bottom-up analysis of trade intensity for the respective sectors; and
- A supplementary qualitative analysis.

Although this approach is not perfect, it should be regarded as the most robust and appropriate one.

The analysis of carbon costs for the EU as well as for selected Member States (U.K., Germany) showed a robust set of (a few) sectors which face significant carbon costs (at 30 € per metric ton of CO_2):

1. Manufacture of paper and paperboard;
2. Manufacture of coke oven products;
3. Manufacture of refined petroleum products;
4. Manufacture of other inorganic chemicals;
5. Manufacture of fertilizers and nitrogen compounds;
6. Manufacture of bricks, tiles, and construction products;
7. Manufacture of cement;
8. Manufacture of lime;
9. Manufacture of basic iron and steel and of ferro-alloys;
10. Aluminium production.

The total share of these sectors in the gross domestic product is less than 1.5 percent for Germany (a heavily industrialized country) and less than 1 percent in the United Kingdom (a country with a more service-based economy).

A more in-depth analysis of trade flows shows that the increase of carbon costs does not necessarily lead to leakage effects. Transport costs, other policies, other economic risks (currency, labor force, etc.), regulatory risks, customer links and relations are important factors which must be considered with regard to the relocation of productions possibly leading to leakage.

Since existing trade intensities can be seen as a robust indicator for the broad range of factors influencing relotation decisions, the initial idea for the bottom-up assessment of potential leakage was to combine carbon costs with trade intensities. With this approach some of those sectors which are typically linked to regional markets (bricks, tiles, and construction products, cement, lime) would not have been assessed as leakage relevant.

However, the political deal on the revision of the EU ETS Directive led to a non-appropriate definition of leakage-relevant sectors:

- Sectors with additional carbon costs (direct and indirect) of at least 5 percent and a trade intensity with third-world countries of at least 10 percent;
- Sectors with an additional carbon cost (direct and indirect) of at least 30 percent;
- Sectors with a trade intensity with third-world countries of at least 30 percent; and
- Additional sectors which meet certain criteria laid down in the directive.

This approach goes beyond the initial concept of a robust leakage sector identification. The significant increase of sectors which can claim special leakage provisions, to a large extent solely based on the trade intensity trigger, will have impacts on the efficiency of the scheme and thus the future allowance prices.

The high ranking of trade intensity as a singular indicator becomes even more questionable if the patterns of trade flows are considered.

For many of the relevant products, the most important trade partners are OECD countries (USA for paper and paperboard, fertilizers and nitrogen compounds, other inorganic chemicals; Norway for aluminium, fertilizers and nitrogen compounds; Turkey for basic iron and steel) or other industrialized countries (Russia for aluminium, basic iron and steel, fertilizers and nitrogen compounds) whereas trade

with China is less important for many carbon-intensive products (except in the case of other inorganic chemicals, basic iron and steel).

Thus, the introduction of carbon pricing in the OECD or other industrialized countries with carbon constraints (within national emissions trading schemes or within an OECD-wide carbon market) could remove a key share of the relevant leakage concerns.

If an effective identification of leakage-relevant sectors has been carried out, the question arises of how to deal with the issue within an ambitious climate policy and an emissions trading scheme:

- Border adjustments are the most popular measures for limiting carbon leakage effects from a textbook perspective. However, the implementation of border adjustments faces a wide range of practical, legal, and political challenges. Thus, the EU has decided (driven by Member States with a strong focus on international trade) not to go for this option.
- Free allocation can be used as compensation for carbon costs. However, if the allocation is not adjusted for plant closure or production levels, the incentive for leakage is not removed on the one hand. On the other hand, the updating of free allocation will distort the carbon price signal and decrease the efficiency of the scheme. Thus, the EU decided to offer free allocation based on a 10-percent best-benchmark scheme to sectors regarded as having leakage concerns in combination with a plant closure provision.
- Using the revenues from allowance auctions for direct compensation can be an interesting option for providing compensation for leakage incentives without major distortions of the price signal taking place. Thus, the EU allows the Member States to compensate industries with a high exposure to indirect carbon costs (from increased electricity prices) with state-aid measures.
- The introduction of broader climate policies in other industrialized or developing countries can remove leakage concerns on a broader scale. Thus, the EU will review the compensation measures for the leakage-concerned sectors if the global scene has changed.

If the EU would have to design the provisions to deal with leakage concerns from scratch, a more tailored approach would probably emerge:

- For the sectors with a significant potential for operational leakage (cost-driven relocation of production to nonregulated regions or sectors), free allocation with plant closure provisions could be seen as the most suitable approach.
- For the sectors with a significant potential for investment leakage (cost-driven relocation of investments to nonregulated regions or sectors), direct subsidies for investments could provide a sufficient countermeasure to combat leakage.

All in all it should be pointed out that leakage is a serious issue in a world of different carbon prices. Second, serious leakage concerns must be raised for only a few carbon-intensive products or sectors. Third, from an EU perspective many leakage concerns are related to trade flows with other OECD or industrialized countries. Fourth, tailored approaches can be developed which remove incentives for leakage and maintain a nondistorted carbon price signal—a fundamental basis for effective climate policies. Last, but not least, it should also be considered that carbon pricing provides strong incentives for the growth of new and future-proof industries.

Senator SHAHEEN. Thank you very much, Dr. Matthes.

Dr. Fries.

STATEMENT OF DR. STEVEN FRIES, CHIEF ECONOMIST, ROYAL DUTCH SHELL, THE HAGUE, NETHERLANDS

Dr. FRIES. Chairwoman Shaheen and members of the committee, thank you for this opportunity to testify on the topic of European experience with industrial competitiveness under climate policies.

The energy challenge and climate challenges facing the world are, indeed, formidable. Much more energy will be needed to support rising living standards, particularly in developing countries. At the same time, carbon dioxide emissions from energy will have to fall substantially to mitigate climate change.

Shell is working on many fronts to help meet these challenges. We are adopting our production processes and our products to existing and anticipated emission constraints, and building new

technological capabilities in biofuel and carbon dioxide capture and storage. We're also providing input to help government policy development, including building support within industry for effective climate change policy.

My focus today is on industrial competitiveness under the EU ETS, which is a particular concern for phase three of the scheme that will run from 2013 to 2020.

In the first two phases of the system, most of the emission allowances were allocated initially to producers for free, but in the third phase there will be a transition toward auctioning of emission allowances in those sectors and subsectors that are not at serious risk of carbon leakage.

We analyzed this issue in the industrial sectors where Shell operates in Europe—upstream crude oil and natural gas production, crude oil refining, and petrochemicals. Our analysis led us to conclude that potential impacts on competitiveness, job losses, and carbon leakage are real. But, Shell has also concluded that the potential impacts can be managed through well-designed policies, such as those being implemented for phase three of the EU ETS.

In the long run, Shell believes that the problem of job loss and carbon leakage can be addressed through a strong multilateral framework that requires all major economies to contribute fairly to the global climate effort. However, there will be a transition period during which the global competitive landscape will be uneven, due, in part, to the principle of the U.N. Framework Convention on Climate Change of common, but differentiated, responsibilities. Managing this transition effectively to an even global competitive playing field is a key to advancing climate reforms.

Let me speak briefly to the risks identified in each of the three sectors that we analyzed from our own operating perspective.

EU refining could face a significant loss of competitiveness and a high rate of emission leakage in its export markets in the absence of a similar emission constraint in other countries. Ongoing and planned refining capability expansion in South Asia and in the Middle East, which would, we anticipate, remain outside the climate policy framework in the medium term, poses significant competitiveness concern in EU markets for refined products over the medium term.

In petrochemicals, market structures and trade exposure vary widely across subsectors. Some are globally traded commodity products in which EU competitiveness impacts and emission leakage could be quite high. In other sectors, they are more regionally segmented, but with a significant proportion of EU demand met from non-EU supplies. In these subsectors, the impacts in EU competitiveness could be less pronounced, but still significant, in our view.

EU crude oil production is sold into globally competitive markets, while the market for EU natural gas is more regionally segmented. In many fields, oil and natural gas are jointly produced in largely fixed proportions. These characteristics of EU upstream production point to the potential for significant competitiveness impacts and leakage rates.

While several potential policy instruments could be used to address competitiveness and leakage issues, Shell advocates the free allocation of allowances in sectors that are at risk of significant

carbon leakage. These allowances should be linked to the volume of production in an allocation formula that recognizes process complexities. We think this approach is pragmatic and effective. We do not advocate the use of import protection in those countries that implement cap-and-trade systems, because of the risks of trade retaliation.

Key features of our preferred free-allocation approach are the criteria for selecting industries that are eligible for free allowance allocations and the use of emission intensity benchmarking to calibrate these allowance allocations.

The EC directive for phase three, in Shell's view, sets out a workable and pragmatic approach. It identifies both quantitative and qualitative criteria for judging whether a sector or subsector is a significant risk of emission leakage. The two quantitative criteria include the increase in direct and indirect production costs in the sector due to the directive that exceed 5 percent of gross value added, and the total value of its imports and exports exceed 10 percent of the value of its turnover and imports. Additional thresholds are the increase in production costs that exceeds the 30 percent of gross value added or the sector's imports and exports exceed 30 percent of its turnover and imports.

For sectors identified as being at risk using these criteria, the phase-three directive provides for sector assistance rates of 100 percent of free allowance allocation, to the extent that installations use the most efficient technologies.

The directive calls for the initial evaluation of sector exposures to be completed by the end of 2009, and then reviewed every 5 years thereafter. There is also the potential to change the amount of, and form of, existence of support for these sectors by June 2010, depending on the outcome of the Copenhagen negotiations.

While this introduces an element of policy uncertainty for the framework from 2013 to 2020, it does provide for feedback from experience with the scheme and allows for flexibility if international circumstances change.

To conclude, I would like to emphasize two key points that emerge from the experience with European competitiveness under climate policies. First, concerns regarding competitiveness, potential job loss and carbon leakage are real. But, second, these concerns can be addressed through the judicious use of free allowance allocations. This is a pragmatic and effective approach during the transition period in which the global competitive playing field will be uneven.

Shell believes it will be also necessary for the United States to take similar steps to protect business investment and jobs. For example, U.S. refineries are energy intensive and exposed to international trade. According to EI—Energy Information Agency's statistics—U.S. reliance on gasoline imports is growing. For the last 5 years, the United States has imported between 5–15 and 17 percent of its gasoline from overseas. Ten years ago, that number was 10 percent.

In Shell's view, the United States should allocate free allowances to its emission-intensive trade-exposed sectors, and the EU approach illustrates how this can be done in practice.

The bill the Senate is receiving from the House is a strong start toward a workable cap-and-trade program. In regard to protecting at-risk industries, there is more work to be done. Shell is, in particular, concerned with the current allowance value allocated to the U.S. refining sector in the Waxman-Markey bill, as it does not cover direct missions as fully as other sectors are covered.

Shell is committed to helping the 111th Congress enact a fair and effective cap-and-trade program at the lowest possible cost to the economy.

Thank you. I would be happy to answer your questions.

[The prepared statement of Dr. Fries follows:]

PREPARED STATEMENT OF DR. STEVEN FRIES, CHIEF ECONOMIST FOR ROYAL DUTCH SHELL, THE HAGUE, NETHERLANDS

Chairwoman Shaheen and members of the subcommittee, thank you for this opportunity to testify on the topic of European experience with industrial competitiveness under climate policies. I am Steven Fries, chief economist for Royal Dutch Shell.

Shell is a global group of energy and petrochemical companies. With approximately 102,000 employees and operations in more than 100 countries and territories, Shell helps to meet the world's growing demand for energy in economically, environmentally, and socially responsible ways. Shell's presence in the United States dates back nearly 100 years, and today we employ more than 20,000 people here and operate in all 50 States.

Looking forward, the energy and climate challenges facing the world are formidable. Much more energy will be needed to support rising living standards, particularly in emerging markets and developing countries. At the same time, carbon dioxide emissions from energy will have to fall substantially to mitigate climate change.

Shell is working on many fronts to help meet these challenges. First, we are controlling emissions from our operations and helping our customers manage their emissions by offering advanced fuels and lubricants. Shell is searching for better biofuels and building a capacity for carbon capture and storage, a critical technology for managing emissions from fossil fuel use.

We also provide input into the shaping of government policy, including building support within industry for an effective climate policy. In the United States, Shell is a member of the U.S. Climate Action Partnership and supports the introduction of a cap-and-trade system. In Europe, Shell is an active member of Prince of Wales' U.K. Corporate Leaders Group on Climate Change. Shell also works within the oil and gas and chemical industries and with governments and the European Commission to promote effective climate policies.

Key priorities for Shell in its European climate policy advocacy are measures to address competitiveness and emission leakage issues in Phase III of the EU Emission Trading System (ETS) and funding to support a series of demonstration projects for carbon dioxide capture and storage so that the technology could be deployed at scale by around 2020 if proved effective.

I will focus today on the competitiveness issue, which is a particular concern for Phase III of the EU ETS that will run from 2013 to 2020. While in the first two phases of the system most emission allowances were allocated initially to producers for free, in the third phase there will be a transition toward auctioning of emission allowances in those sectors and subsectors that are not at serious risk of emission leakage.

Our analysis of this issue in industrial sectors where Shell operates in Europe—upstream crude oil and natural gas production, crude oil refining and petrochemicals—leads us to conclude that the potential impacts are significant, but that they can be managed through well-designed policies such as those being implemented for Phase III of the EU ETS.

COMPETITIVENESS AND EMISSION LEAKAGE UNDER CLIMATE POLICIES

The impact of climate policy on competitiveness is potentially most pronounced for those industries that are energy intensive and whose products are traded in global markets (trade exposed). These industries will face higher costs with the implementation of a cap. However, their product prices are set in international markets and their ability to pass on higher costs from the cap into product prices will be limited if foreign producers do not face similar emission constraints.

These costs, can be much higher than just the direct cost of purchasing and using allowances to cover emissions. Industries also face a host of indirect costs such as higher fuel prices and higher electricity prices. There are also costs associated with abatement, including the purchase of new technology and the cost of process changes needed to cut emissions.

These higher costs could ultimately drive investments and production capacity to countries with no climate policies. That means driving jobs offshore. Unless you have a well-crafted climate policy, the potential for job loss can be substantial. Carbon leakage from the movement of industry to countries that do not have climate policies also reduces the cost-effectiveness of the cap.

In the long run, Shell believes the potential problems of job loss and carbon leakage can be addressed through a strong multilateral framework that requires all major economies to contribute fairly to the global climate effort. However, the principle of the United Nations Framework Convention on Climate Change of "common but differentiated responsibilities" means that there will be a transition period during which the global competitive landscape will be uneven. Managing this transition effectively is a key to advancing climate reforms.

SHELL ASSESSMENT OF EUROPEAN COMPETITIVENESS AND EMISSION LEAKAGE ISSUES

Shell has analyzed the competitiveness impact of Phase III (auction phase) of the EU ETS for the three previously mentioned Shell industries that operate in Europe. Shell concluded that the potential for carbon leakage and an impact on competitiveness are a serious concern for Shell's energy-intensive sectors open to international trade.

(1) EU refining could face a significant loss of competitiveness and a high rate of emission leakage in its export markets (primarily the United States) in the absence of similar emission constraints on the United States and other producers. Ongoing and planned refinery capacity expansion in south Asia and the Middle East pose a significant medium-term competitiveness concern in EU markets for refined products.

(2) In petrochemicals, market structures and trade exposure vary widely across subsectors. Some are globally traded commodity products, such as monoethylene glycol and styrene monomers, in which EU competitiveness impacts and emission leakage could be quite high. Other subsectors, such as polyolefins, are more regionally segmented but with a significant proportion of EU demand met from non-EU suppliers. In these subsectors, the impacts on EU competitiveness and emission leakage could be less pronounced but still significant.

(3) EU crude oil production is sold into a globally competitive market, while the market for EU natural gas is more regionally segmented. In many fields, oil and natural gas are jointly produced in largely fixed proportions. These characteristics of EU upstream production point to potentially significant competitiveness impacts and correspondingly high rates of carbon leakage.

Shell remains concerned about the loss of jobs and competitiveness and the potential for carbon leakage under Phase III of the EU ETS. But we also believe that these concerns can be effectively addressed with effective implementation of Phase III as it is currently designed.

ADDRESSING COMPETITIVENESS AND EMISSION LEAKAGE UNDER EU ETS PHASE III

While several potential policy instruments could be used to address competitiveness and leakage issues, Shell advocates the free allocation of allowances in sectors that are at risk of significant carbon leakage. These allowances should be linked to the volume of production with an allocation formula that recognizes process complexities. We think this approach is pragmatic and effective. We do not advocate use of import protection in countries that implement cap-and-trade systems due to trade retaliation risks.

Key features of our preferred, free allocation approach are (1) the criteria for selecting industrial sectors that are eligible for free allowance allocations and (2) the use of emission intensity benchmarking to calibrate these allowance allocations.

The EC directive for Phase III, in Shell's view, sets out a workable approach. It identifies two quantitative and three qualitative criteria for judging whether a sector or subsector is at significant risk of emission leakage. The two quantitative criteria are:

- The increase in direct and indirect production costs in the sector due to the directive exceeds 5 percent of gross value added and the total value of its exports and imports exceeds 10 percent of value of its turnover and imports.
- Alternatively, the increase in production costs exceeds 30 percent of gross value added or its import and exports exceed 30 percent of its turnover and imports.

The three qualitative criteria are:

- The extent to which it is possible for individual installations in the sector or subsector to reduce emission levels or electricity consumption, including the increase in production costs related to the investment that this may entail.
- The current and projected market characteristics, including when trade exposure of production cost increases are close to the above thresholds.
- Profit margins as a potential indicator of long-run investment and/or production relocation decisions.

For sectors judged to be at significant risk of emission leakage using the above criteria, the Phase III directive provides for sector assistance at the rate of 100-percent-free allowances to the extent that installations use the most efficient technologies.

The total of potentially available free allowances to a sector in a given year is based on its average share of total emissions from industries covered by the EU ETS for the baseline years 2005–07 and the overall cap in that year. For example, if a sector's emission accounted for 15 percent of the total emissions covered by the EU ETS in 2005–07, the total allowances potentially available to the sector in 2013 would be 15 percent of the 2013 cap.

The directive calls for the initial evaluation of sector exposures to emissions leakage, to be completed by end 2009 and then every 5 years thereafter. There is also the potential to change the amount or form of support for these sectors by June 2010, depending on the outcome of the Copenhagen negotiations. While this introduces elements of uncertainty into the policy framework for 2013–20, it provides feedback from experience with the scheme and allows flexibility if international circumstances change.

CONCLUSION

To conclude I would like to emphasis two key points that emerge from the European experience of competitiveness under climate policies from a Shell perspective. First, the concerns regarding competitiveness losses and emission leakage under cap-and-trade systems are real. Second, these concerns can be addressed through the use of free allowances. This is a pragmatic and effective approach during the transition period in which the global competitive playing field will be uneven.

Shell believes the pragmatic approach being followed in Phase III of the EU ETS will keep jobs and business investments in-country and prevent carbon leakage. Shell also believes it will also be necessary for the United States to take similar steps to protect business investments and jobs. Our U.S. chemical plants and refineries are energy intensive and exposed to international trade. According to EIA statistics, the U.S. reliance on gasoline imports is growing. For the last 5 years, the United States has imported between 15 to 17 percent of its gasoline from overseas. Ten years ago, that number was approximately 10 percent.

The United States should allocate free allowances to its emission-intensive, trade-exposed industries. The EU approach illustrates how this can be implemented in practice. The bill the Senate is receiving from the House is a strong start toward a workable cap-and-trade program. In regard to protecting at-risk industries, there is more work to be done. Shell is particularly concerned that the current allowance value allocated to the U.S. refining sector in the Waxman-Markey bill does not cover direct emissions as fully as other sectors are covered.

Shell is committed to helping the 111th Congress enact a fair and effective cap-and-trade program at the lowest possible cost to consumers and the economy. We recognize the value of such legislation in spurring investment and positioning the United States as a leader in the coming international climate negotiations. We will continue our efforts to improve this legislation as it moves to the Senate.

Senator SHAHEEN. Thank you very much, Dr. Fries.

Dr. Weber.

STATEMENT OF WOLFGANG WEBER, HEAD OF ENERGY AND CLIMATE POLICY, BASF GROUP, LUDWIGSHAFEN, GERMANY

Dr. WEBER. Thank you very much. Good afternoon, Senator Shaheen. My name is Wolfgang Weber, and I'm pleased to be invited to testify here before the subcommittee to talk about our experiences with the EU climate and energy legislation.

Please allow me that I would start with making a few remarks about BASF. BASF is the world's largest chemical company, with

close to 100,000 employees and an annual turnover of more than 60 billion euros. It's active all over the world, with production sites and sales activities.

We do support a good greenhouse gas control regime. We believe that this is necessary. And I will also tell you why we believe that this is something that would not be to the detriment of our industry. We have analyzed a corporate carbon footprint, where we compared all the emissions that we cause, directly and indirectly, when we make our products, including the supply chain, including disposal, with the greenhouse gas savings that our products enable when you use them. For example, insulation to insulate homes. And the result is that this ratio is 3 to 1. So, our products help to save three times more greenhouse gas emissions than we cause when we produce chemicals. And actually, if I may say, the Institute of Felix Matthes validated this data and confirmed that this was right.

Now, in order to make this ratio work, you have to have a real global greenhouse gas regime so that, first of all, the competitiveness of the chemical industry is secured, but also a regime which takes into account all sectors. Because only if the homeowners get credits for insulating their homes, that equation is solved and our industry can fully deliver. So, that is why we really support this global greenhouse gas regime.

If I may add, we have reduced our own greenhouse gas emissions by more than 60 percent since 1990. We achieved this by integrating our production activities and by investing hugely in CHP. We have more than 20 CHP installations worldwide supplying our energy needs at our production sites. And all together those savings are more than the residential energy consumption in New Hampshire, if I may say that.

Turning to the lessons learned from the EU ETS, I would have four. I will also briefly say for each of them what you should learn and what you should not learn from the EU, or what you should do differently.

First of all, the whole issue is very complex. It's not a black-and-white issue and you have to get it right. And I think this is something that the EU did not really do properly. There was too much wish to do it quick and dirty, if I may say that. The result was that many of the very important decisions were postponed and delegated to sublegislation activities. I would pledge—or, I would ask you—not to do the same in the United States, but take your job seriously, as legislators, and decide on who is actually, in the end, paying the bill, because there may be a huge impact.

Second—and this is something that you should copy from the EU—second, the EU realized that, in the end, the system is about having a cap, and it's not about earning revenues for the budget. So, this was recognized by the EU. So, like the EU, don't make it a production tax through auctioning the CO_2 allowances, but rather base the allocation on free allowances based on benchmarks. I will say a few words about that later. Because, in the end, companies need the money to actually invest in greenhouse gas mitigation, so don't take the money from the companies that they need to actually do the job.

Third—and this is, again, rather a bad experience from the EU, the definition of "exposed sectors." While there has been some effort to try to get this quantitatively assessed in terms of trade intensity and CO_2 intensity, we have realized—and this is backed by preliminary findings from the EU Commission which were just presented last week—that this purely quantitative approach runs too short of the real world. If I may say, in the chemical industry, we have a rather complex production integration. We have rather CO_2-intensive products at the very beginning of our value chains, but then, at the same site, we produce more downstream products, and those are trade-exposed. So, only if you look at the whole industry as such, you would have a real good picture of the real exposure to CO_2 costs and global trade. And indeed, the chemical industry was recognized by the Commission as being exposed, taking into account also qualitative arguments. Only doing it at a quantitative level, is our experience from the EU, would not work. So, you should identify exposed sectors differently, as well.

And then, finally, two remarks about the allocation formula. First, as I said earlier, we suggest that you should base the free allocations on benchmarks. So, what does that mean? That means that if you produce a given chemical, then, of course, you would find some installation which does it best, most efficiently. So, that installation should get the allowances for free, because you cannot get any better. But, if you are worse than that, you should pay for the difference. And you can show, mathematically, that the incentive to actually mitigate greenhouse gas emissions is exactly the same in this benchmark-based approach as in the full auctioning approach, while, at the same time, you avoid the incentive to relocate.

The second issue about the allocation is the base year for the production. It probably will be that, in the EU ETS, the production base will be one base year ex-ante. And this will be, then, the same base for the next 10 years to come. The problem with that fixed base year is that, even if you are the most efficient company, and you want to grow with your efficient installations, you will be penalized. While, at the same time, a company that is not efficient, but reduces production, would be rewarded. So, you must make sure that the base year—that is the base for the allowance allocation—is readjusted every few years.

So, if I may sum up again, we do support a good greenhouse gas regime. Make it right. It's very complex. And so, learn from the EU that, indeed, it's about the cap, it's not about earning money for the budget. However, find a better way to define "exposed sectors." And don't be afraid to just decide that industry as a whole, in a learning phase, should be considered as exposed. And finally, for the benchmarks, make it a very simple system and base the allocation on a rolling average base year.

Thank you very much.

[The prepared statement of Dr. Weber follows:]

PREPARED STATEMENT OF DR. WOLFGANG WEBER, HEAD OF ENERGY AND CLIMATE POLICY, BASF GROUP, LUDWIGSHAFEN, GERMANY

INTRODUCTION

Good afternoon, Senator Shaheen and members of the subcommittee. I am pleased to be here today to represent BASF Group. Thank you for the invitation to testify.

My name is Wolfgang Weber. I am the head of energy and climate policy for BASF Group. In this capacity, I am responsible for policy development and communication of BASF's position on energy and climate matters before the European Union and the governments of Member States. In addition, I consult with my BASF counterparts in other countries, including here in the United States, on matters relevant to my portfolio that impact our company.

My testimony below explains BASF's work in the area of sustainability and talks about our experiences under the European emissions trading system (ETS). If I could sum up our views briefly at the outset on how an ETS impacts the business of chemistry, it would be as follows:

- Chemistry is one of the keys to the sustainable future to our planet, as evidenced by BASF's own 3:1 carbon ratio (see below), which was confirmed industrywide in a recent study by McKinsey and Company [1];
- But chemistry is an energy-intensive, globally competitive business, one in which regionally unilateral costs from climate and energy legislation cannot be offset by passing them through to customers;
- And every payment made by the chemical industry for CO_2 allowances, or CO_2 taxes or renewable levies would be equivalent to a production tax and would jeopardize—in the absence of a truly global GHG regime—the existence of entire value chains and put the entire chemical production system in that region at risk;
- Therefore, 100-percent-free baseline allowances for chemistry in any trading system based on benchmarks are critical for not only our survival as a business through the prevention of carbon leakage,[2] but the long-term success of any climate protection scheme that involves energy-efficiency and reduced GHG emissions.

And, if I may add one further point before going on, one that is particularly relevant to this subcommittee's jurisdiction: Climate protection is a global challenge that requires a multinational solution. No matter the course selected here, or in Europe, or China or India, we must all end at one point—a global accord on climate protection. Then and only then we will seize all the greenhouse gas (GHG) efficiency potentials across all sectors and avoid distortions of global competition.

ABOUT BASF AND OUR COMMITMENT TO SUSTAINABILITY

BASF is the world's leading chemical company: The Chemical Company. We are headquartered in Ludwigshafen, Germany. Our portfolio includes chemicals, plastics, and performance products to agricultural products and fine chemicals, as well as oil and gas. As a reliable partner, BASF helps its customers in virtually all industries to be more successful. With our high-value products and intelligent solutions, BASF plays an important role in finding answers to global challenges such as climate protection, energy efficiency, nutrition and mobility. BASF has approximately 97,000 employees and operates 330 facilities on five continents. In the United States, we employ approximately 15,000 people and have facilities in more than half of the States.[3]

To underscore our commitment to sustainability, I invite the subcommittee's attention to the following:

- BASF has been successful in significantly reducing emissions of greenhouse gases through numerous measures in recent yeers. Since 1990 we have reduced our absolute GHG emissions by 38 percent and our specific GHG emissions per ton of sales product by 61 percent.
- We have developed a widely recognized Verbund system, where we link production plants intelligently to save resources and energy. For example, heat from

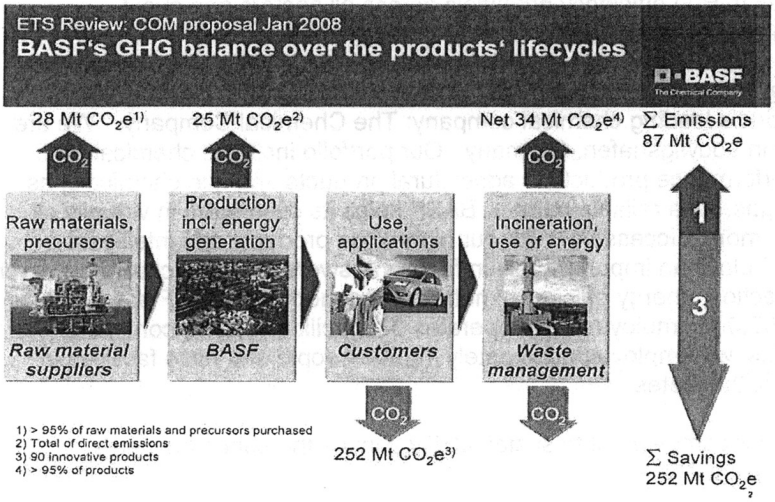
[1] The McKinsey study was commissioned by the International Council of Chemical Associations. The study found that the products of the chemical industry enable greenhouse gas (GHG) savings 2–3 times greater than their emissions report summary at http://www.icca-chem.org/ICCADocs/LCA-executive-summary-english.pdf. The Oko Institut reviewed the report's calculations.

[2] The term "carbon leakage" refers to the loss of jobs to locations without a similar climate control scheme.

[3] Further information on BASF is available on the Internet at www.basf.com.

production processes is not discharged to the environment but instead captured to power other production plants. In 2008, our energy Verbund helped us to save 1.6 million metric tons of oil equivalents globally. We have six Verbund sites globally, with two in the United States.

- To supply our production sites with steam and electricity, we operate combined heat and powerplants, which allows us to achieve an overall efficiency of almost 90 percent.
- BASF spends some €400 million per year in energy efficiency and climate-related R&D.
- Globally our products save three times more CO_2 than is produced by the manufacture and disposal of all of these same products. When our customers use our products, it results in a decrease in 252 million tons of CO_2-e over their use phase. (See diagram below.) The results demonstrating the emission reduction reality of our products were confirmed by the Oko-Institut, a leading European research and consultancy institution working for a sustainable future.[4]



Returning to one of the points I made at the outset of my testimony about chemistry being a key to our sustainable future, part of the major GHG emission savings achieved by our customers through BASF materials take place in the following areas:

- Housing with savings of 140 million tons of CO_2-e per year (e.g., through insulating materials);
- Mobility with savings of 30 million tons of CO_2-e per year (e.g., through plastics that make cars lighter or fuel additives);
- Industry with savings of 48 million tons of CO_2-e per year (e.g., through industrial catalysts, processes); and
- Others with savings of additional 34 million tons of CO_2-e per year.[5]

Moving forward, BASF has dedicated itself to reduce specific GHG emissions by 25 percent by 2020 compared with 2002 and increase energy efficiency in production by 25 percent by 2020 compared with 2002.

THE IMPACT OF THE EUROPEAN ETS

To begin a discussion on the European ETS and its impact on BASF, we should first note that Europe is required to take these steps in light of its adherence to

[4] Visit http://www.oeko.de/home/dok/546.php.

[5] For more information on BASF products that increase energy efficiency and help to reduce GHGs, please see Testimony of Armstrong, BASF Corporation, U.S. Senate Committee on Environment & Public Works, Business Opportunities and Climate Protection, May 2009, at http://epw.senate.gov/public/index,cfm?FuseAction=Hearings.Hearing&Hearing__ID=37159346-802a-23ad-4ea2-afa619aa8c43.

the Kyoto Protocol[6]; that the system is being implemented in three stages; and no matter what safeguards are in place; until a global system is achieved, carbon leakage will remain an issue.

Stage I took place 2005–2007, was limited in scope, and was considered a learning phase and did not result in added costs for BASF. Stage II takes place from 2008–2012 and covers more installations.

Stage III will take place from 2013–2020, and negotiations among Member States of the EU regarding this phase were concluded in December 2008. It is this stage that one may consider analogous to what is being considered here in the United States. The European system will rest on auctioning, as well as allocations of baseline credits based benchmarks.[7]

There is still work to be done in addressing a number of details regarding Stage III, and we cannot provide any concrete numbers. This is because the EU heads of state postponed and delegated quite important decisions to the so-called comitology procedure over the years 2009 until 2011. But, what we can draw from our rough calculations of the projected costs associated with this last stage and our experience with the first two stages is that for chemistry to grow, to prevent contractions, and continue to provide solutions to reducing GHGs, the industry must be listed as an exposed sector and qualify for 100 percent free baseline allocations. Baseline allocations based on benchmarks is the best way to help minimize carbon leakage for large and homogeneous products. Without these free baseline allocations, the price for BASF could be as high as €400 million per year.

LESSONS LEARNED FROM THE EUROPEAN EXPERIENCE

The lessons that we have drawn from our experience with the European ETS are as follows:

(1) *Carbon Leakage and Exposed Sectors.* A measure for reducing GHGs must include an early and unambiguous statement that the chemical industry and other energy-intensive sectors qualify for continued free allocation of baseline allowances based on benchmarks. (Note: As explained earlier, the chemical industry has substantial potential to help the world reduce further emissions both through GHG emissions savings in its own production and through its products. If steps are taken to facilitate emissions reductions and fully utilize chemical products, the ratio of emissions savings to emissions could increase to more than "4 to 1" by 2030.[8]) The difficulty is defining an "exposed sector." Today's economy, and in particular the chemical industry, is extremely interlinked and complex. The methodology used in the European Union ETS directive to define exposed sectors[9] has proven difficult to implement. Thankfully, the European Commission applied additional qualitative and quantitative analyses, which resulted in a preliminary finding that chemistry is an exposed sector, which would make it eligible for free baseline allowances.[10]

(2) *Electricity and Combined Heat and Power (CHP).* Electricity production from industrial CHP installations should be subject to free allocations. Industrial energy uses should be free from CO_2 costs to avoid an unequal footing of electricity and heat-based industrial activities.

---

[6] "The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Prototol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions." http://unfccc.int/kyoto__protocol/items/2830.php.

[7] "Benchmarking" in the context of climate discussions refers to a process whereby, "Homogenous emitters are benchmarked, rated by an independent auditor. From that rating, a performance reference of CO_2 emissions per unit of production is derived. If a company wants to compete without additional costs, without then paying CO_2 rights, it has to manufacture its products according to processes meeting this performance reference." European Chemical Industry Council, at http://www.cefic.be/templates/shwNewsFull.asp?HID=l&NSID=704&NID=1. Under the scheme approved in December 2008, the starting point for benchmarks in the European ETS shall be "the average performance of the 10-percent most efficient installations in a sector or subsector in the Community in the years 2007–2008. The European Commission shall consult the relevant stakeholders, including the sectors concerned." European Commission, at http://ec.europa.eu/environment/climat/emission/benchmarking__en.htm.

[8] Supra note 2.

[9] Exposed sectors have a high CO_2 cost share of gross value added and/or high trade intensities. Specifically, "the extent to which the sum of direct and indirect additional costs induced by the implementation of this directive would lead to a substantial increase of production cost, calculated as a proportion of the Gross Value Added, of at least 5 percent; and the Non-EU Trade intensity defined as the ratio between total of value of exports to non-EU + value of imports from non-EU and the total market size for the Community (annual turnover plus total imports) is above 10 percent." European Commission, at http://ec.europa.eu/environment/climat/emission/carbon__en.htm.

[10] Id.

(3) *Coverage*. The designers of an ETS should clearly limit installation definitions to cover only the large emitters to keep the administrative burden and bureaucracy at an acceptable level.[11] The installation definitions under the European ETS are sometimes unclear; e.g., combustion versus chemical installations.

(4) *Benchmarks*. While we support the benchmarking concept, the benchmarks set under the European directive are somewhat ambiguous. The legislative text to establish an ETS should be very specific with respect to benchmarks and the benchmarks should be simple, as opposed to defining hundreds of benchmarks for the many different heat uses. One benchmark should be defined for the production of heat. We also believe that benchmarks should be feedstock-specific in some cases to allow for a continued broad energy mix and increased security of supply. Otherwise the natural gas supply will suffer.

(5) *Allocations.* We have learned through our experience that the manner in which allocations are set out should be clearly stated in the legislation. This is not always the case in the European system. Because of this lack of clarity, it is likely that allocations will be ex ante, based on historic production in a given installation. This hampers growing companies and awards declining production. We suggest a regular adjustment of the production base.

(6) *Border Control Measures, e.g., Tariffs.* We believe that the European Union has taken the correct approach by not implementing border control measures. First, we believe it likely that targeted countries would export their "clean" products and keep their "dirty" products for domestic use. Second, to comply with international law, they could be targeted to only against countries which have committed to GHG reductions under a post Kyoto agreement and do not live up to their commitments Third, border mechanisms are unlikely to be compliant with standards established by the World Trade Organization and would lead to protectionism and retaliation measures.[12] We note, for example, the existence of Article III of the General Agreement on Tariffs and Trade, which contains fundamental principle of nondiscrimination; i.e., the EU cannot discriminate against foreign products. The United States is also a member of WTO. Fourth, they would be almost ineffective for the chemical sector due to our huge range of (mostly upstream) products.

CONCLUSION

Thank you, Senator Shaheen and members of the subcommittee. BASF looks forward to sharing our expertise and experience in the area of climate protection. I would be pleased to answer your questions.

Senator SHAHEEN. Thank you, Dr. Weber.

Mr. Lieberman.

STATEMENT OF BEN LIEBERMAN, SENIOR POLICY ANALYST FOR ENERGY AND ENVIRONMENT, THOMAS A. ROE INSTITUTE FOR ECONOMIC POLICY STUDIES, HERITAGE FOUNDATION, WASHINGTON, DC

Mr. LIEBERMAN. Thank you, Chairwoman Shaheen.

My name is Ben Lieberman. I'm the senior policy analyst for energy and environment at the Heritage Foundation. I'd like to thank the Subcommittee for European Affairs for inviting me to testify.

What the subcommittee is doing today is very important, but it's what was largely missing from the House global warming debate, and that is taking a look at the real-world experience in Europe with the Kyoto Protocol and the cap-and-trade approach to reducing emissions of carbon dioxide and other greenhouse gases. Notwithstanding questions about the seriousness of man-made global warming, the Heritage Foundation is very concerned about the cost of this approach which was embodied in the Waxman-Markey bill.

[11] More than 80 percent of chemical emissions are covered by less than 10 installation types.

[12] We are aware of the recent WTO/UNEP report titled "Trade and Climate Change," which the press has said backs tariffs as part of a climate protection mechanism, at http://www.wto.int/english/res_e/booksp_e/trade_climate_change_e.pdf. However, the press's interpretation and even the statements in the report are not held unilaterally, and there are differing views, among academia the business community, and even elected officials, including the President of the United States, which should be examined by this subcommittee.

Our analysis of the bill estimates higher energy costs and other costs for household of four, averaging nearly $3,000 annually, and an overall lost GDP of $393 billion annually and $9.4 trillion cumulatively by 2035. We also estimate over a million lost jobs.

And even if it is—even if—assuming it works to reduce emissions, Waxman-Markey has been estimated by climate scientist Chip Knappenberger to reduce the Earth's future temperature by no more than 0.2 degrees Celsius by 2100.

But, will it even work? Will it even reduce emissions enough to accomplish that 0.2 degrees? The European experience with cap-and-trade strongly urges caution. The Washington Post recently described it as Exhibit A of what not to do on climate, and for good reason. The Senate would be wise to take a close look at Europe's track record with the 1997 Kyoto Protocol and the emissions trading scheme adopted in 2005.

Most Western European nations are currently learning, the hard way, that ratcheting down carbon dioxide emissions in this manner is difficult and expensive. In fact, most of these nations, not to mention other Kyoto Protocol signatories, like Canada and Japan, have not been reducing their emissions over the last several years, though it should be noted that they are doing so now, but only as a result of the recent recession. Indeed, several were seeing faster increases since 2000 than those in the United States, which has not been subject to such a scheme.

And despite lofty rhetoric from some about setting even more stringent future standards, we also see signs of fracturing in the cap-and-trade coalition, from German automakers to Italian steelmakers to nations that still rely on coal for a substantial percentage of electricity generation. Discussions about exclusions and delays and handouts are now very much a part of the debate on climate in Europe. The Russian cutoff of natural gas to Europe was also a reminder of the geopolitical risk of discouraging domestic coal under cap and trade.

We have also seen examples of fraud and unfairness in the process, and, given the similar politics here, where big businesses have lobbied for free allocations much more effectively than the little guys—consumers, homeowners, small-business owners, farmers—it's quite likely that the inequities would appear here, as well. And the reason for the failure of carbon cap and trade is simple: Reducing carbon dioxide from the existing installed base of energy-producing and energy-using equipment and vehicles is prohibitively expensive, and that isn't likely to change anytime soon. Many nations committed to emissions reductions under the Kyoto Protocol are going to miss the targets unless the recession lingers, and any talk of tougher targets is empty rhetoric.

The record in Europe suggests that the Heritage Foundation and others predicting high costs for Waxman-Markey are right, while those predicting postage-stamp-per-day costs are wrong. If it really were postage-stamp cheap, Europe's emission reduction record would be much better by this point and there would be no need to make excuses for it.

Further, a study by the Taxpayers Alliance in the U.K. estimates that the cost of various green taxes in the U.K. is up to $1,200 per household per year, and that's to achieve only a fraction of what

Waxman-Markey requires. Again, this points to high household costs for Waxman-Markey.

To the limited extent that European nations have reduced emissions below business-as-usual levels, it has hurt their economies. Almost every Western European nation has had higher unemployment and energy costs than America, and a weaker overall economy, even as emissions were still rising. Far from seeing evidence of the bright, new green economy some are now promising, we're seeing that cap and trade has contributed to the harm. For example, Spain has been cited repeatedly as the example of a successful clean energy economy and source of green jobs, but it's rarely mentioned that Spain currently has 18-percent unemployment.

There are reasons that may explain this seemingly counterintuitive result that cap and trade is not only the wrong approach for the economy, but is also the wrong approach for reducing greenhouse gas emissions. Any sensible approach to global warming has to center on technological innovation as it applies to energy production and use. Breakthroughs, such as ways to produce energy economically with low or no carbon dioxide emission or improvements in energy efficiency, these make good sense, irrespective of global warming. Innovation is what we really want, and we know, from long experience, that free economies innovate better than centrally planned ones. But, cap and trade introduces a significant element of central planning, and thus, stifles innovation.

We also know that strong economies innovate better than weak ones, but cap and trade weakens economies. Perhaps most importantly, stable economies innovate better than unstable ones, especially for something like energy, where the investments often run into the billions of dollars and the payoffs play out over decades. But, cap and trade adds a significant element of instability, which we have seen in Europe, with wild swings in the price of carbon allowances, and energy companies less interested in long-term investment and more interested in short-term gaming of the system.

In conclusion, the economic realities of cap and trade are becoming clear in Europe. If we adopt a similar approach here, we can expect considerable economic pain for questionable environmental gain.

Thank you.

[The prepared statement of Mr. Lieberman follows:]

PREPARED STATEMENT OF BEN LIEBERMAN, SENIOR POLICY ANALYST, ENERGY AND ENVIRONMENT, THOMAS A. ROE INSTITUTE FOR ECONOMIC POLICY STUDIES, THE HERITAGE FOUNDATION, WASHINGTON, DC

My name is Ben Lieberman, and I am the senior policy analyst for energy and environment in the Thomas A. Roe Institute for Economic Policy Studies at the Heritage Foundation. The views I express in this testimony are my own, and should not be construed as representing any official position of the Heritage Foundation.

I would like to thank the Subcommittee for European Affairs for inviting me to testify. What the subcommittee is doing today is very important but was largely missing from the House global warming debate, and that is taking a look at the real world experience in Europe with the Kyoto Protocol and the cap-and-trade approach to reducing emissions of carbon dioxide and other greenhouse gases. Notwithstanding questions about the seriousness of man-made global warming, the Heritage Foundation is very concerned about the costs of this approach, which was embodied in the Waxman-Markey bill. Our analysis of that bill estimates higher energy and other costs for a household of four averaging nearly $3,000 annually and overall lost

gross domestic product of $393 billion annually and $9.4 trillion cumulatively by 2035.[1] We also estimate over a million lost jobs. And even assuming it works to reduce emissions, Waxman-Markey has been estimated by climate scientist Chip Knappenberger to reduce the earth's future temperature by no more than 0.2 °C by 2100.[2]

But will it even work? Will it even reduce emissions enough to accomplish that 0.2 degrees? The European experience with cap and trade strongly urges caution. The Washington Post recently described it as "Exhibit A" of what not to do on climate, and for good reason.[3] The Senate would be wise to take a close look at Europe's track record with the 1997 Kyoto Protocol and the Emissions Trading Scheme adopted in 2005.

Most western European nations are currently learning, the hard way, that ratcheting down carbon dioxide emissions in this manner is very difficult and expensive. In fact, most of these nations (not to mention other Kyoto Protocol signatories like Canada and Japan) have not been reducing their emissions over the past several years, though it should be noted that they are doing so now but only as a result of the recent recession.[4] Indeed, several were seeing faster increases since 2000 than those in the United States, which has not been subject to such a scheme.[5]

And despite lofty rhetoric from many European nations about setting even more stringent future standards, we also see signs of fracturing in their cap-and-trade coalition. From German automakers to Italian steelmakers to nations that still rely upon coal for a substantial percentage of electric generation, discussions about exclusions and delays and handouts are now very much a part of the debate in every European Union meeting on climate. The Russian cutoff of natural gas to Europe was also a reminder of the geopolitical risks of discouraging domestic coal under cap and trade.

We have also seen examples of fraud and unfairness in the process.[6] Given the similar politics here, where big businesses have lobbied for free allocations much more effectively than the little guys—consumers, homeowners, small business owners, farmers—it is quite likely that the inequities would appear here as well.

The reason for the failure of carbon cap and trade is simple—reducing carbon dioxide from the existing installed base of energy producing and using equipment and vehicles is prohibitively expensive, and that isn't likely to change any time soon. Many nations committed to emissions reductions under the Kyoto Protocol are going to miss the targets (unless the recession lingers) and any talk of tougher targets is empty rhetoric.

The record in Europe suggests that the Heritage Foundation and others predicting high costs for Waxman-Markey are right, while those predicting postage stamp per day costs are wrong. If it really were postage stamp cheap, Europe's emissions reduction record would be much better, and there would be no need to make excuses for it.

Further, a study by the Taxpayers Alliance estimates the cost of various green taxes in the U.K. is up to $1,200 per household per year, and that to achieve only a fraction of what Waxman-Markey requires.[7] Again, this points to very high household costs for Waxman-Markey.

To the limited extent European nations have reduced emissions below business-as-usual levels, it has hurt their economies. Almost every western European nation has had higher unemployment and energy costs than America, and a weaker overall economy, even as emissions were still rising. Far from seeing evidence of the bright new green economy some are now promising, we are seeing that cap and trade has

---

[1] William W. Beach, et al., "Son of Waxman-Markey: More Politics Makes for a More Costly Bill," Heritage Foundation Web Memorandum No. 2450, June 16, 2009, at http://www.heritage.org/Research/EnergyandEnvironment/wm2450.cfm.

[2] Chip Knappenberger, "Why Waxman-Markey Is Not A Climate Bill," June 29, 2009, at http://masterresource.org/?p=3507#more-3507.

[3] "Climate Change Solutions Sen. Boxer Is Open To Everything—Except What Might Work Best," the Washington Post, February 16, 2009, at http://www.washingtonpost.com/wp-dyn/content/article/2009/02/15/AR2009021501425.html.

[4] Press Release, "UNFCC: Rising Industrialized Countries Emissions Underscores Urgent Need for Political Action on Climate Change," United Nations, November 16, 2008, at http://unfccc.int/files/press/news__room/press__releases__and__advisories/application/pdf/081117__ghg__press__release.pdf.

[5] Energy Information Administration, "International Energy Annual 2006," Table H.1co2: World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1980–2006, at http://www.eia.doe.gov/pub/international/iealf/tableh1co2.xls (December 11, 2008).

[6] Open Europe, "Europe's Dirty Secret: Why the EU Emissions Trading Scheme Isn't Working," August 2007, at http://www.openeurope.org.uk/research/etsp2.pdf.

[7] Mathew Sinclair, "The Burden of Green Taxes," Taxpayers Alliance, August 2008, at http://tpa.typepad.com/home/files/the__burden__of__green__taxes.pdf.

contributed to the harm. For example, Spain has been cited repeatedly as the example of a successful clean energy economy and source of green jobs, but it is rarely mentioned that Spain currently has 18 percent unemployment.

There are reasons that may explain this seemingly counterintuitive result that cap and trade is not only the wrong approach for the economy but is also the wrong approach for reducing greenhouse gas emissions. Any sensible approach to global warming has to center on technological innovation as it applies to energy production and use. Breakthroughs such as ways to produce energy economically with low or no carbon dioxide emissions or improvements in energy efficiency—these make good sense irrespective of global warming.[8]

Innovation is really what we really want. And we know from long experience that free economies innovate better than centrally planned ones. But cap and trade introduces a significant element of central planning and thus stifles innovation. We also know that strong economies innovate better than weak ones, but cap and trade weakens economies. Perhaps most importantly, stable economies innovate better than unstable ones, especially for something like energy where the investments often run into the billions of dollars and the payoffs play out over decades. But cap and trade adds a significant element of instability, which we have seen in Europe with wild swings in the price of carbon allowances, and energy companies less interested in long-term investment and more interested in short-term gaming of the system.

In conclusion, the economic realities of cap and trade are becoming clear in Europe. If we adopt a similar approach here, expect considerable economic pain for minimal environmental gain.

Senator SHAHEEN. Thank you very much, Mr. Lieberman.

Obviously, there are different perspectives represented in this testimony. And I'd like to pursue some of the comments made by panelists, and see if we can get a little more detail on some of what you're suggesting.

Dr. Matthes, in your testimony you talked about an in-depth analysis of trade flows for the EU in the last few years that indicated that there have been no significant changes as the result of the Emissions Trading System. Could you elaborate on that a little bit? And I think you specifically talked about phase one. So, is the same true of phase two? And can you project out what might happen under phase three of the system?

Dr. MATTHES. Yes, thank you for the question. First is, we have evidence from the data which are available from the years since the turn of the century and including the year 2007. That means we have a couple of years without any price on carbon, we have 1½ years with a pretty high price on carbon, we have the year 2007 without any price, because the bloody lesson learned that you never should introduce an instrument of quantity controls if you don't have a very clear imagination on the quantities, but that has changed—that has changed for the second phase. And for the years prior to year 2007, we see no outlay or no differentiation. It's a short term. But, on the other hand, if you look on investment streams, et cetera, et cetera, and if you take into account that, for the year 2008, the cap was tightened and the future prices for allowances which we have at the moment, by the year 2015, are pretty significant, we can't see any significant reallocation of investment. Even in industries like the iron and steel industry, which is heavily exposed to carbon prices, we see ongoing investments there. And therefore, at the moment, we don't see this.

And the key lesson learned from this is that—and that I tried to at this point, I tried to make in the end of my presentation—

[8] Iain Murray and H. Sterling Burnett, "10 Cool Global Warming Policies," National Center for Policy Analysis, June 2009, pp. 20–22, at http://www.ncpa.org/pdfs/st321.pdf.

that the major problem is probably not the reallocation of production from existing facilities, but the reallocation of investments, because there you need a vision on future prices, et cetera, et cetera. And probably because the most of the potentially affected industries are capital-intensive industries. It's the reallocation of investments to more important challenge for the economy. That is, at the moment, solved by free allocation, because the net present value of free allocation is an investment subsidy. But, there are also other ways to do this with direct subsidies, et cetera, et cetera.

And summarizing, even in the statistical analysis, the heavy or the carbon-intensive productions, which are there in Germany or in the U.K., are mostly there because of links to customers, et cetera, et cetera. And it is not that easy to reallocation reductions. And if you see the bad example, then you should look to the Brazilian adventure of a big German steel company who tried to make it cheaper there, and there it became more expensive, at the end.

Senator SHAHEEN. Thank you.

Do any of the other panelists want to address that question before we move on?

Yes, Dr. Weber.

Dr. WEBER. Well, thank you. So, perhaps one should just bring back to your attention that, of course, in phase one and two, and we don't know yet for phase three, there is no auctioning. Now, I'd say, of course, that that explains why there is no major change of trade flows. EU politics, so far, has recognized that it must do something—to avoid carbon leakage; i.e., allocating allowances for free. And in terms of investments and productions, if I might just say, that—of course, that depends very much on the very issue. I could tell you that if we had to fully auction allowances, also some production activities would be closed. So, it's not only about——

Senator SHAHEEN. I'm sorry, say that again.

Dr. WEBER. So, if there was full auctioning for some of our production facilities, very, very likely those production facilities would be closed, they would not continue to produce. So, it's not only about investment, it's also about continuation of production.

Senator SHAHEEN. Yes, Dr. Fries.

Dr. FRIES. Yes, I will just to follow up on the two previous sets of comments. I think it's important to realize that the timescale over which investment decisions are made in capital-intensive industries and energy intensive industries is quite long. I think it would be unrealistic to expect to see already signs of competitiveness problems from the EU ETS given the long lead times that are required for forming investment decisions and actually implementing them. The second important point is that the allocation of emission allowances under the EU ETS has so far been largely for free and that their partial auctioning will only begin in 2013. Both points suggest that it would be premature to try to gauge the impacts on competitiveness from what we've observed so far.

Senator SHAHEEN. But, you must be thinking, both at Shell and BASF, about your investment decisions for the future, and factoring into that what's required under the phase three of the system. So, are you looking at impacts on your competitiveness under phase three? And are you—you said, Mr. Weber, that if the credits were auctioned and you had to pay for them, that there would be

facilities that closed. So, as you're looking at the future, how are you factoring in those kinds of decisions under phase three? Either one of you.

Dr. WEBER. So, of course, this is taken into account, and—as Steven Fries said, yes, indeed, investments take some time to be planned, and then also to be implemented. In an industry like the chemicals, the discounting would not take place over the next 20 or 30 years. I mention this because often people say, "Well, in 20, 30 years, there will be a carbon price in many parts of the world, so why do you bother?" But we need to discount our investments much sooner than that, because we don't know yet what the world would look like in 20 or 30 years from now.

So, an investment in 2019, when we know that from 2021 there will be full auctioning, will, of course, be differently viewed than an investment that we think about today, because then much of the discounting would have taken place by 2020. So, it's indeed much about timeframes and somewhat longer planning certainty. So, to sum up, these things are taken into account, yes.

Senator SHAHEEN. Yes?

Dr. FRIES. Yes. On this point, we have systematically gone through our energy-intensive and trade-exposed sectors to assess the potential impacts from phase three of the EU ETS. We began with what you might expect from, say, fairly standard textbook economics, be it how the markets in these various sectors would adjust under very competitive conditions and uniform regulation, and then moved toward more imperfectly competitive market structures with very uneven regulation. This provided a baseline from what you might expect economic first principles.

We then worked very closely with our specialists in each of these industries, who actively participate in these markets and understand the institutional norms, the pricing norms, and the sector dynamics, to understand better how the adjustment process to phase three of the EU ETS is likely to play out.

So, what we've done is to take a fairly rigorous and analytically driven approach to anticipating and understanding these impacts, and then to feed that analysis back into our own strategic thinking. We have combined basic economic analysis with our market knowledge to shape our long-run investment responses to these policy developments.

Senator SHAHEEN. Thank you.

Did either of the other panelists want to address that at all?

Dr. Matthes.

Dr. MATTHES. Yes. I think it is worth to have a look on the trade-flow patterns, because the trade flow—the existing trade-flow patterns somehow reflect the problems which might result from leakage problems.

And I would highlight one interesting issue, that is the inclusion of Norway into the European Union emissions trading scheme. Norway is the trading partner No. 1 for aluminum, it's for fertilizers and others, and the inclusion of Norway—that means one of the target countries of potential leakage or reallocation has at least removed these very near-term leakage effects. And I think—I would highlight this.

And we have, also, for some of the key products for those products which are, without any doubt, carbon intensive, the United States, for example, is a key trading partner. And I think that must be reflected.

And the last remark is, we had a lot of studies when—before we started the pilot phase, which made projections on the immediate reallocation of cement, et cetera, et cetera. And there, we see the evidence, it didn't happen.

Senator SHAHEEN. Thank you.

Mr. Lieberman, did you have anything you wanted to add?

Mr. LIEBERMAN. Oh, I would just add that probably the biggest fear of leakage is to fast-developing nations, namely China and India, who have repeatedly—I don't know how many times they have to say no—they don't want to go along with anything like this, and it is unlikely that they will. So, that is something that needs to be kept in mind, as well.

Senator SHAHEEN. Well, clearly that is one of the biggest concerns that, I think, many have in Congress as we look at what would be the impacts of putting in place a policy to address climate change. And new energy technologies is the potential shift of jobs overseas to India and China, and—do any of you want to address what you're seeing as part of the European experience with respect to India and China?

Dr. Matthes.

Dr. MATTHES. Yes, I think it's one of the usual suspects, India and China. But, if you really look to the trade patterns and to the import and export streams, at least empirical evidence from the last years—and China is not only cheaper in terms of carbon, it's cheaper in terms of labor force, et cetera, et cetera, and some productions are heavily subsidized—if you look to the—if you have a look on the total export-import streams, at least for the European Union, it must—not true for every product, but for the total of the European Union—India is negligible, and China, there is a problem limited to a few sectors, to a few sectors. And I think the suspicion everybody has that that is the major source, that is at least not proved by the evidence we have from the data for the last years.

Senator SHAHEEN. Dr. Fries, I'm going to ask you for your comments, but I just want to explore that a little bit more, if I can. You said "China, except for a few sectors." Can you identify the sectors that you've seen?

Dr. MATTHES. Yes. What we see from the data is iron and steel is a challenge. The—but, the major challenge comes from China, and we have inorganic chemicals—yes, inorganic chemicals, basic iron and steel, and might be, in the future, some organic chemicals. But, we have a wide range of other products. Aluminum is no problem. Fertilizers is no problem, et cetera, et cetera. And so, it is limited to some product streams, and, at least if you have a closer look to the iron and steel sector, we get, more or less, the, let's say, less quality steel products from there, and there is a limited demand. And the low-quality steel production from Germany has left, 15 years ago.

Senator SHAHEEN. And so, has there—well, it might be like comparing apples and oranges, but has there been an effort to respond

to any of the loss of competitiveness in those sectors by the system—the EU system?

Dr. MATTHES. Yes, we have free allocation, at the moment. It——

Senator SHAHEEN. OK, so that has responded——

Dr. MATTHES. That has responded, but you have to take into account, from—at least from economic theory, opportunity costs are costs. And at least—even in a world with free allocation, there are some incentives to reallocation productions if you don't introduce complementary measures, like plant closure provisions, et cetera, et cetera, and preferably base this on benchmarking. But, at least the free allocation which was introduced at the moment, has compensated for this; but, without this complementary measures on the long run, even free allocation would not avoid leakage.

Senator SHAHEEN. Thank you.

Dr. Fries, and then Dr. Weber.

Dr. FRIES. I was simply going to reinforce the point that you need to avoid making sweeping generalizations about the nature of the competitive threats and where the unevenness in the global competitive playing field will arise. And I think you need to look at it, as has just been illustrated, on a sector-by-sector approach. We have done that, and we understand the competitiveness issues from our own perspective and they are necessarily from India and China—they can also emerge from other developing countries.

Senator SHAHEEN. Thank you.

Dr. Weber.

Dr. WEBER. Yes, thank you. Well, again, the reason why we don't face major changes is because we have that free allocation. And again, let me make the point that the whole idea behind the ETS is the cap, about doing something to mitigate greenhouse gas emissions, and not about earning money for the budget. So, we have, I think, heard, today, quite a few good reasons why not to go to that auctioning.

If I may, I would like to briefly touch upon the issue of specific relocation—India, China—and fertilizers was the given example. So, fertilizers is something which is highly CO_2 and energy intense. So, of course, it's other issues also which are relevant for the production decisions, not only CO_2, and this is the gas price. So, already now much pressure on the fertilizer production in the United States comes from Trinidad and Tobago because of the high gas price.

And now, the question is, that I would like to ask you—it's a rhetorical question, if you'll allow—Do you want to accelerate that by adding another cost component on top of that? In Europe, we still have some ammonia production. We, as a company, produce that. But, of course, the same challenge that we face in Europe, as you have it with Trinidad and Tobago, is—for us, is the Middle East, which also has much cheaper gas price. And the question, again, is, Do you want to accelerate that?

Ammonia is definitely one of the very highly CO_2-intense—sensitive production. But, to make that point further, it's not only about ammonia, but ammonia is the starting point of a long value chain that we produce also in our sites. So, for example, resins for making tables and surfaces are based on ammonia. And, of course, at some point, if you don't produce ammonia anymore, in the long

run you would then also not produce the more downstream processes.

So, there is an issue, and you really have to look at the industry as a rather complex system.

Senator SHAHEEN. Well, clearly that's why we've asked you here, so that we can try and learn from your experience so that we don't affect the competitiveness of those industries in a way that loses them to the United States.

Dr. Matthes, you talked about the phase one of the system leading to windfall profits, particularly in the electricity sector. What steps have been taken to address those windfall profits? And how quickly did people recognize that that was an issue? And how do you need to adjust for that in the future?

Dr. MATTHES. Yes, that's a very easy answer. That's—all free allocation to power generation was removed from the third phase, because we saw that very clear—in the first phase, about 90 percent of the allowances were given for free for the power sector, and the second phase, in Germany, it is between 50 and 60 percent. They have passed-through the full cost of carbon. That was clear from the beginning. That was very difficult to communicate in the political process during the legislation. Now we have made this experience, with these huge amounts of money, and now it's removed. And we see it as—we also saw some windfall profits in the cement industry, et cetera, et cetera.

But, I think—and that is the core of the problem. If the carbon price signal only generates windfall profits, then for those sectors, free allocation is no option. Because there is a huge potential for perversion, the free-allocation approach to the power industry in Germany has introduced incentives for building coal-fired powerplants, compared to gas-fired powerplants. Because allocation does measure—does measure allocation changes the investment approaches, et cetera, et cetera. And therefore, the—for those sectors which are not facing serious leakage concerns, full auctioning is the option of choice. And for those sectors where you have a leakage problem, then you have to decide would you address operations or investments. And the EU has decided to go for free allocation, for the time being, but they—if we would start from scratch, there would also be other options, especially to address the investment issue. And climate change is about future, and future is about new installation, and new installations is about investments. And therefore, the investment issue must be addressed more than a very broad free and—undifferentiated free-allocation approach.

Senator SHAHEEN. Well, relative to the investment issue and the cost, I think, Mr. Lieberman, that you, in your testimony, said that, according to a study that Taxpayers Alliance has done, that the cost to the U.K. is about $1,200 per household per year. Am I correct?

Is that the analysis that you have also seen, Dr. Matthes? Or, have you done that kind of an analysis to look at the potential cost per household of——

Dr. MATTHES. No. No.

Senator SHAHEEN. [continuing]. The system?

Dr. MATTHES. That's far from every relevance, I think. You can see we have the major part of the cost for the private households

come from the electricity consumption, which is covered by the EU ETS, and we have coal-fired powerplants at the margin, which set the price. That means every—the allowance prices going—it's going one-to-one to the power prices. We have, in Germany, after taxes and power price, of about 30 cents per kilowatt hour, and in the times—very high carbon price—the carbon price was 30 euro; that means 3 cents out of 30; that means 10 percent, and that is one order of magnitude, at least—probably two orders of magnitudes—less than the number which was demonstrated here. And I think that must be made very clear, that these cost estimates are not based on the reality we have at the moment in the EU ETS.

One comment, perhaps on the volatility of the price. You can see the volatility of the price as a demerit, but, on the other side, you could also see that as a merit. If you would have the alternative, which is a carbon tax, whatever else, this carbon was—would never have—it would have never been possible to adjust the carbon tax in the economic recession at the moment. The allowance price adjusts automatically on a different framing, on energy prices, on recession, et cetera, et cetera. And therefore, I would see this flexibility in the carbon price more a merit than a demerit. And we have seen significant innovation and significant emissions abatement triggered by the carbon price. Without the emissions trading scheme in the European Union, we would not have this major effort on CCS. We see an increasing interest in blending of cement. We see an impressive increase of coal-firing of biomass. That was triggered by the carbon price, even if it was volatile.

Senator SHAHEEN. I don't know if either of you have any statistics relative to the cost of the system.

Dr. Weber.

Dr. WEBER. Well, I would rather say it's not that difficult. I mean, Felix Matthes, earlier testified what the windfall profits are for the electricity producers. Well, of course, you simply can use that number, divide by the electricity consumption of each household, and then you have the number by how much the costs have increased. That is a rather easy thing to do.

But, perhaps, if I may, I would add two things here. One is, as just Felix Matthes rightly has said. Yes, we do have price signal now, without auctioning, that does deliver. Without auctioning, and it does incentivize investments in the right direction. That is exactly the point that I tried to make earlier. So, I'm happy that—well, yes, this seems to be a common understanding here.

And, in terms of the windfall profits for the electricity producers, of course one way to avoid them is to go to auctioning. But then we have the problem that electricity also goes into chemicals production, iron and steel, and so on, and then you have to introduce rather complicated measures to compensate that for those exposed industries. So, there's an even better—easier way to avoid windfall profits, and that just goes back to what I suggested, to adjust the base for the allocation with the given production. So, if you do that, you could show that windfall profits do not really occur. I mean, also Felix Matthes said that, you must make sure that, in a system without auctioning, you must avoid to award companies who decrease their production. And how do you do that? By adjusting the production base. And the more detailed you do it—in the extreme

case, year by year—well, then you'd also take away all the incentives to reduce production, and then you also reduce the chance to generate windfall profits. So, that would be an easier—even better way to avoid windfall profits.

Thanks.

Senator SHAHEEN. Yes, Dr. Matthes, you want to respond to that?

Dr. MATTHES. I made a calculation, only to make sure. The average German household has an annual electricity consumption of 3,000 kilowatt hours, which is 3 megawatt hours. In the times of the highest allowance prices, which was in the beginning of 2006, and last year—in summer of last year—we had a carbon price of 30 euro. That means every household, in the highest case, had the burden of 90 euro per year, at—and at the recent carbon price, the annual burden per household is 45 euro annually. That is—compared to a good German beer, it's between 9 and 18 beers a year. [Laughter.]

Senator SHAHEEN. I like quantifying it in that way. That's very good.

So, you all have come to different conclusions about the costs than Mr. Lieberman has, in your analysis. Can I also ask you to respond to Mr. Lieberman's testimony that there has not been a reduction in emissions as the result of the system? I think I did understand you to say that the analysis that you all have done at the Heritage Foundation has not indicated that there has been an emissions reduction. Is that correct?

Mr. LIEBERMAN. For covered entities, up until the current recession.

Senator SHAHEEN. Is that your analysis, also, Dr. Matthes?

Dr. MATTHES. Definitely not. We have a lot of modeling, and we worked with a big group of analysts from MIT, from U.K., from France, from Germany, and we—there will—a book come out in a couple of weeks, in Cambridge University Press, where we have compiled all the evidence. And you can do this very easy. The problem is to—which is the counterfactual development. Even if you focus the electricity sector—we have huge electricity-market models which explain the price at the electricity exchanges, and you can make, in very easily, modeling exercise, you can remove the carbon price signal from these models, which explain the reality very good. And then you have the difference, in terms of CO_2 emissions.

And even for the pilot phase, for the 16 months where we had a significant carbon price, this emission abatement amounted, alone for Germany for the power sector, to an order of 10 million tons annually, only by changing the merit order. Without any investment, without other issues. And, as I said, we have also seen, empirically, in there, that is very clear—we have seen an interest—increased interest of blending in cement, to lower the cement clinker content, which is a very cheap, very easy option to decrease carbon emissions. And we have seen that very well, and we see this development also for the year 2008, where we had be—where we had significant carbon prices before we faced the recession in the last 2 months.

And I think we see very clear—in a couple of sectors, very clear indication, and we can measure this emission abatement, because

the yardstick or the reference is the business-as-usual emissions. And without the EU ETS carbon emissions last year, where the gas prices rocketed and the ratio between gas prices and coal prices went very much in favor of coal-power production, we would have seen skyrocketing CO_2 emissions even from the power sector, and we have seen—not. And that was because the carbon price reacted to the differential between gas and coal prices. And so, we can see very clear, we can prove this abatement.

Senator SHAHEEN. Thank you.

Dr. Fries, did you want to add?

Dr. FRIES. Yes, it's important to also gauge the impact of the current policy framework on investment behavior and to identify, as Dr. Matthes has done, how it's influencing investment decisions. At Shell we're taking very substantial investment decisions based on the expectation of future CO_2 prices that will be delivered by the EU ETS. These investments are focused in particular on carbon dioxide capture and storage capabilities and also on advanced biofuel that has a very low CO_2 footprint when measured comprehensively.

So, private investors are responding to the policy framework to deliver the solutions that are required.

Senator SHAHEEN. Yes. In fact, I was very—I'm looking for the numbers now, but I was very impressed with the difference in investment in clean energy in the EU compared to the United States, so that—the numbers I have are that, since 2005, investments in clean energy in Europe increased from $17.7 billion to $49.7 billion, or a net increase of $32 billion. At the same time in North America, our investments increased only about $19 billion, so from $10.3 billion to $30.1 billion. So, clearly there's something going on.

Dr. Weber.

Dr. WEBER. Yes, thank you, Senator Shaheen.

If those numbers are from 2005, probably the ETS impact cannot be that high, and you should recognize that in Europe—in particular, in Germany—we have a huge subsidizing promotion scheme for renewables, which is still there today, on top of the EU ETS. So far, we did not touch much about the promotion of renewables. And while we support that, and, if I may say, we—at BASF, we contribute toward the wind blades, to photovoltaic, and other renewables, so we believe in the technology for the future times, we would question if the promotion scheme now in Europe and many European countries is the right thing. And again, you can see that the CO_2 price signal—and again, we have all agreed that it is there—is not high enough to bring CCS or renewables really into deployment. This is basically because they are still too expensive, and that—in the market, you would find many other abatement opportunities which are there for lower CO_2 prices.

And I believe that, indeed, you should make it a market-based approach, which means you should deploy those technologies which you get for the lowest price—and that is more energy efficiency, that is more on insulating homes, having more efficient vehicles, and many other efficiency issues—rather than to invest heavily into renewable deployment today. We must invest heavily in R&D. We must make sure that they will be ready soon, at an economic level. But, some technologies are not there yet, where we should really bring them into mass deployment.

Senator SHAHEEN. I think we would agree that energy efficiency is the cheapest, fastest way to deal with our energy needs.

I have a final question that I guess is for all of you, although those of you who have been dealing with this system can probably answer it most effectively, and that is—what we're talking about is a very complicated system, and, as we have been talking about it in the United States, one of the challenges has been trying to describe what we want to do, in a way that is easy for the average person out there to understand.

Can you give us any advice or any—tell us what your experiences were and how—how were you able to get people to buy into a system that is complicated and not always easy for people to understand?

Dr. MATTHES. Yes, because that is a—one of the nasty experiences of the last 10 years. But, one of the clear message is that you have to present benefits to the people. And the benefits are there if people are interested in clean energy, et cetera, and—at least in my country, or in Europe, there is an awareness on this. You have to present the benefits in terms of environmental issues.

And on the other hand, you have to avoid very complex schemes which necessarily lead to perverse effects. And, I think, to give you an example, there are many, many good economic reasons for not giving any free allowances to the power sector. There are many, many good economic reasons.

The only argument which worked also in the public was that it created windfall profits. And therefore, that was—the introduction of full auctioning for the power sector was one of the parts under revision which were very much supported because the public wasn't accepting perverse incentives. And channeling new additional profits isn't perverse incentive. And the other perverse incentive was, it is not possible to present a scheme which, by accident, in an overcomplex scheme, has provided more benefits for coal-fired powerplants than for gas-fired powerplants. It was impossible to explain this. And the only lesson learned from this, to hold to system as simple, as robust, and as clear as possible. It is getting complex.

And if I was heavily involved in two national allocation plans, and I can—right behind every paragraph, the company which has pushed through this paragraph. But, if you have too much of these very complex regulations, the problem of perverse incentives arises, and that leads to the lose of public acceptance. And I think the auctioning issue is in very—it's a very important—it's a very important issue. And from the point of political communication, might be that works in Europe better than in your country, but the prices must tell the ecological truth—was quite an impressive and convincing argument for the political communication.

Senator SHAHEEN. Thank you.

Dr. Fries.

Dr. FRIES. Yes. I think that it would be ideal to try to simplify the system, but I do think it's inherently complex. And trying to make something that is inevitably complex more simple is perhaps not the right way to go.

I think that there are two dimensions that are important to emphasize. One is the effectiveness of the system—that it actually delivers real change and real environmental benefits for the long

run—and to demonstrate the system is actually delivering the change that's required to meet the challenges. Second, I think that the system has to be perceived as fair. And here, I think that the—the point that Dr. Matthes had made about designing the system so that it neither arbitrarily enriches nor arbitrarily impoverishes shareholders of existing companies is quite important. But to get that balance right, unfortunately, it's quite complicated, which is why we're all here today.

But, I think finding a formula that delivers fairness—and that formula will include auctioning, in our view, for those sectors that are not trade-exposed and that can effectively pass through the cost of allowances into product prices. I think that's actually critical to achieving a fairness under the scheme, and then return the value of those allowances returned to the consumers who are paying for them in the form of higher products prices through some other mechanism, such as tax cuts.

I think getting the balance right by making sure that it's perceived as fair, and also by managing the complex transition that arises from the inherently uneven competitive playing field that will arise in the transition phase of the scheme are two keys to its success.

Senator SHAHEEN. Thank you.

Either of you like to comment on that?

Dr. Weber.

Dr. WEBER. Yes, thank you, Senator Shaheen.

I mean, of course, I would agree that the scheme should be as simple and robust as possible, but I also would agree that this is very difficult to achieve. And that's why I said, earlier in my testimony, yes, indeed, this is very complex. And so, I would really ask you to go through that complex procedure, because I believe you have to.

And, in terms of the windfall profits, I would agree with Felix Matthes's analysis, that, indeed, the public did not accept those windfall profits anymore. But, again, here I would ask you—make it better than we did in the EU. Don't start by avoiding the windfall profits by auctioning, but just make it cleverer than we did with that regular readjustment of the production base. I think it was good—very good PR from those NGOs to start explaining that windfall profits could be only avoided by those auctioning. And at some point, politics in the EU did not accept any more our ideas of those regular readjustments of the production base. And if you don't introduce that in your scheme, then, indeed, the only option is to go for auctioning.

But, I think, for me, this was rather good PR and was not the wise and really intelligent way to approach and to solve the problem.

So, if you allow, I would conclude saying, yes, it should be a fair system. You should be cautious not to play out one sector against the other; I mean, not to say, "Well, these are the winners, those are the losers." I mean, like windmill producers are the winners, and steel producers are the losers. That, I think, probably is not the right way to get public acceptance, but rather to find a good, balanced, fair system. I think, the only good way to achieve that is a system based on technology-specific benchmarks, which allows

a fair assessment of what steel can do, what renewables can do, and what chemicals can do to lower their respective carbon footprint. And, I think, then the system will be fine and gain public acceptance.

Senator SHAHEEN. Now if we could only get the media to buy into "no winners and losers," we'd be all set, huh?

Dr. WEBER. Excuse me?

Senator SHAHEEN. If we can only get the media to buy into the idea of "no winners or losers," then we could better accomplish that.

Dr. WEBER. Yes.

Senator SHAHEEN. Mr. Lieberman, do you want to have any final comments?

Mr. LIEBERMAN. Well, I certainly agree that cap and trade is complex, but my conclusion from the European experience is pretty simple: Economic central planning doesn't work, and trying to tinker with it, which can happen endlessly—and, I suspect, will—will always disappoint. I think, as we look at the state of the economies across Europe—unemployment rates, energy prices—that's certainly something we don't want to repeat in the United States. And, to the extent—and I believe, to an extent—cap and trade has contributed to the economic weakness, that's certainly a lesson we need to take in mind here.

Senator SHAHEEN. Dr. Matthes, I'll give you the final word to respond to that.

Dr. MATTHES. I grew up in a social system that was based on central planning. I was born in the United—on the—in the German Democratic Republic, and I spent my last—my first professional years there. And I can ensure you, a market-based instrument, like the emissions trading scheme, has nothing, but nothing, to do with central planning.

Senator SHAHEEN. Thank you very much.

Oh, Senator Boxer. Well, we were just concluding. We've had a very interesting discussion about competitiveness and how the EU system has worked to try and address those industries that are most at risk for competitiveness concerns for any climate system that we put in place. We can—we will give you any opportunity——

Senator BOXER. I guess——

Senator SHAHEEN. [continuing]. To——

Senator BOXER. I just want to make a couple of comments. The reason I came——

Senator SHAHEEN. Great.

Senator BOXER. [continuing]. Over here—I'm working so hard on a climate change bill, so I didn't have a chance to come earlier. I really did come over to just say it's very important that you share your experiences with us, because clearly you're ahead of us on all of this. And I wanted to welcome you and thank you, and thank our Chair. And, you know, we will be calling on you and visiting you and learning from you.

And I also wanted to say, Senator Shaheen has been a real partner with me as we try to do this right, because we don't want unintended consequences; we want to make sure that this is the job creator.

So, I guess I would have a yes-or-no question, if I could. One. And that is to ask each of you if you feel, if done right, that a climate change bill can create really good jobs and boost up the economy.

If we could go from one to the next, that would be great.

Senator SHAHEEN. Mr. Lieberman, do you want to begin?

Mr. LIEBERMAN. I'm—oh, I'm the designated "no." The whole point——

Senator BOXER. That's fine. That's fine. Designated "no" is OK. Because?

Mr. LIEBERMAN. The whole point of cap and trade is to constrain the supply of energy and, therefore, drive up its price, and that will have adverse effects throughout the economy.

Senator BOXER. Well, I totally disagree. We don't want to constrain the production of energy; we want to spur it on, but we don't want to spend all our money, you know, buying oil from people that don't like us very much and use the proceeds to support terrorism. So, I think, clearly, the aim is to create other sources to compete with that foreign oil and to lead to independence.

What do you think, sir?

Mr. LIEBERMAN. Well, these other sources, if they can only compete because fossil energy is made artificially more expensive, that means these other sources——

Senator BOXER. Well, again, I will——

Mr. LIEBERMAN. [continuing]. Are also expensive, as well.

Senator BOXER. Artificially? Do you know about the coal ash spill that just occurred at the TVA? Do you know what it's going to cost to clean that up? Because we take the toxins out of the air, and we put them on the ground, and then they rushed down and destroyed a whole community. So, to say that the full price of oil is reflected is just not true because of what it's doing to the planet—do you think that's a cost? When your kids, you know, can't buy insurance someday because they live near a coast? There's lots of costs.

So, I think the true costs of carbon have not been reflected. It's been an artificially low price, even with the manipulation that we have.

Let me ask the rest of the panel.

Dr. WEBER. Yes, thank you, Senator Boxer.

Well, I would agree—I'm from BASF, and I would agree that we need this greenhouse gas regime. But, of course, it must be—it has been said so often, but it's still true—it must, of course, be really a global system, including all sectors. I outlined, earlier, a carbon footprint that we made, where we showed that, indeed, our sector provides more greenhouse gas savings through our products in other sectors—insulation, in vehicles, and so on, than we cause. And in order to really get the full potential of using technology to save greenhouse gas emissions, we must make sure that those credits are really taken into account; i.e., take all sectors and all countries into account.

And if I may, you mentioned the new jobs. I think we—my feeling is that we rather agreed, here, that we should not play out one sector against the other. Of course, there will be winners and losers. I think you will have the difficult task ahead of you to make

sure, in order also to win the public acceptance, that you really create a very fair system——

Senator BOXER. Yes.

Dr. WEBER. [continuing]. That allows a fair transition and that you keep jobs in those efficient industries, efficient companies, even if they emit greenhouse gas emissions, while, at the same time, also get the right credits to create new jobs in new areas.

Senator BOXER. I was just going to say, sir, in my State—and I think Senator Shaheen would be interested—we've been very hit—hit very, very hard by a recession. And the only bright spot in California, according to the Pew Charitable Trust, is that, over the past 10 years, we've seen, you know, really about 1,000 new alternative-energy companies spring up, and 125,000 new jobs. Were it not for that, I don't know, really, where we'd be, because the housing industry collapsed, and the—you know, the financial sector's in trouble, and new construction. So, for me, from our experience—because we are ahead—you know, California would be the fifth-largest nation. And, because of its getting ahead of the game, we have at least had this one area—one area that's had the growth rate. And so, I think this is very important. And the doom and gloom that I hear sometimes from folks is just not playing out in my State.

Mr. LIEBERMAN. If I could just make one——

Senator BOXER. Could we quickly just go—I don't think we have time—could we just hear from the other two? And then I'm done.

Dr. FRIES. I'm Steven Fries, from Royal Dutch Shell, and I think the answer to your question is yes. Yes, you can both change the way in which we produce and consume energy, fundamentally, and grow, at the same time.

I think that that transition, though, has to be handled very carefully. And what is key is starting early and starting with a credible policy framework that delivers the kinds of investments that you were emphasizing, and the kinds of changes of behavior toward more energy—greater energy efficiency, that will allow for a smooth and effective transition.

Senator BOXER. Thank you.

Dr. MATTHES. Unfortunately, I have four answers.

Senator BOXER. Yes? OK.

Dr. MATTHES. And I think it is about the policy mix. Because climate policy is a complicated issue.

The first is, What is the alternative? If the alternative is "nothing" to—doing nothing, then we will have to pay a bill, and all will have to pay a bill of—in the beginning, far from our countries, but increasingly close to our countries. And therefore, the issue to make—to implement the necessary policies as efficient as possible. And I strongly believe this emissions trading allows the implementation of emission mitigation for the lowest cost. That means at the lowest burden. And therefore, the—I think this—that's the first one.

The second is that we—after the year 2008, we have to think about—differently, from my point of view, in terms of burden and in terms of vulnerability. What we have seen last year is that our—that the energy consumers and the economies are more vulnerable to volatile energy prices than to higher energy prices. The

pain at the pump in Europe was significantly different than in the United States. I stayed at the MIT at this time, and the vulnerability of consumers was different. And I think we have to think about vulnerability more, instead of costs, et cetera. And vulnerability is an issue.

These were the two—let's see past—the two issues which are important to the conventional wisdom.

And the two other issues is that we will next backstop technologies. We will implement emissions trading, which is a baseload, which enables the market penetration of those technologies which are matured and close to market. But, we will need special investments in backstop technologies. These are those technologies which we need—which you don't need for the next 10, 15 years. We don't need wind for the next 15 years. We need wind for the longer term—and if it now—and that's the experience of my country—the investment we do now in—at the moment, for a bit more expensive technologies, is at least not buying megawatts, it is buying the future costs down. I think that is the issue. And that is about the future vulnerability of consumers, economies, voters, whatever.

Senator BOXER. In other words, your point is that, down the line, we need these energies to be there, these——

Dr. MATTHES. Yes.

Senator BOXER. [continuing]. These new energies; otherwise, what Mr. Lieberman says is true.

Dr. MATTHES. Yes.

Senator BOXER. But, if we do the right thing, then what he says is not true. And I think that's the whole goal, is to get these new energies out there.

And I would say, in terms of vulnerability, you're absolutely right. And vulnerability, in our country, it—we don't want our consumers to have to feel a lot of pain when they pay an electricity bill. And that's why a lot of the work we're doing, the chairman and I, right now, is trying to make sure that our consumers—that a lot of the proceeds of our bill go to keep the consumers whole during this period of transition, while we're waiting for those new technologies to come online, down the road.

Dr. MATTHES. Yes. My fourth point was, it's about lead markets. They're——

Senator BOXER. Lead?

Dr. MATTHES. Lead markets. There are special benefits for those who are the frontrunners. German companies cover, at the moment, 50 percent of the world market on energy efficiency. We want to maintain this. That is in future competition, but competition decreases prices, and therefore, it is important. But, there are, in terms of the lead-market benefits for industries, et cetera, only benefits for the frontrunners. And these benefits will only be achievable if you really go to the cutting edge of these issues. And there are limits of solidarity in between the OECD, but that is an important issue.

The wind-power energy efficiency, et cetera, gains in the industry and the employment in this industry, 500,000 employees in the renewable energy industry in Germany, is because this country has decided to be a lead market, to develop the production facilities which have a competitive advantage for the future.

Senator BOXER. Oh, I have a last question.

Senator SHAHEEN. Go ahead, Senator Boxer.

Senator BOXER. How many parts go into a windmill? How many parts go into making a windmill?

Senator SHAHEEN. Is this a trick question?

Senator BOXER. No. [Laughter.]

No. Because my understanding is, it's a lot of work, and it's a lot of good jobs, and that's what I'm trying to ascertain here.

Senator SHAHEEN. I think we'll all agree with that.

Senator BOXER. Do you know, sir?

Dr. WEBER. I don't know a precise number, I just know that we, as a chemical producer, we also produce chemicals that go into the windmills. What is so important is that you don't play out the sectors against each other. We want to have the right balance so that—for example, for you in the United States, that you would be able to produce both, windmills and the high-efficient chemicals you need for them, both in the United States and not abroad. I think you must make sure to combine the best from each sector's capabilities. That is best achieved with a good cap-and-trade system with free allocations.

Senator BOXER. Thank you.

Senator SHAHEEN. Thank you very much, Senator Boxer, for your leadership.

And to all of our panelists, thank you very much for your time and for coming such a long way.

Hearing is closed.

[Whereupon, at 4:20 p.m., the hearing was adjourned.]

○