

EU EMISSIONS

ROUNDTABLE

BEFORE THE

COMMITTEE ON

ENERGY AND NATURAL RESOURCES

UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

TO

DISCUSS THE PROGRESS OF THE EUROPEAN UNION'S EMISSIONS TRADING SCHEME AND TO RECEIVE INFORMATION ON LESSONS LEARNED FOR POLICYMAKERS WHO WANT TO BETTER UNDERSTAND HOW A MARKET-BASED TRADING PROGRAM COULD OPERATE EFFICIENTLY AND EFFECTIVELY IN THE UNITED STATES

MARCH 26, 2007



Printed for the use of the
Committee on Energy and Natural Resources

U.S. GOVERNMENT PRINTING OFFICE

36-310 PDF

WASHINGTON : 2007

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
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EU EMISSIONS

MONDAY, MARCH 26, 2007

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 2:07 p.m., in room SD-G50, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. All right, why don't we go ahead and get started? Nearly a decade ago, over 100 countries negotiated the Kyoto Protocol, an international treaty to address the challenge of climate change. While the United States did not ratify the treaty, many others did. Many have moved forward on their commitments under that treaty. The program put in place by the European Union to establish a market-based cap-and-trade program is one of the most significant endeavors being undertaken on climate change today. The EU's emission trading scheme began in early 2005 and its second phase will begin this next year.

A few weeks ago, EU Environmental Ministers expressed support for an ambitious post-Kyoto reduction target of a 20 percent—I believe that's below 1990 levels, as I recall reading those reports—below 1990 level reduction in greenhouse gas emissions by 2020. The EU is to be commended for its ambition and leadership on the issue, but we've not had sufficient clarity here in the United States about what is truly being done in the European Union. There is a lot of confusion and even misinformation about the EU's program, and I hope that we'll be able to address some of those important issues here today and gain a better understanding of that program.

The lessons learned by the EU are extremely valuable for policymakers in this country at this time. There are a number of cap-and-trade proposals in Congress right now, including one that Senator Specter and I are working on. It's important that we learn from the EU about their experiences with the cap-and-trade program and as a result, try to create an effective program here that builds on what has been learned in Europe.

To that end, we welcome the six experts on the EU Emissions Trading System that are here today. Let me just briefly introduce the names of these individuals, and then I'll call on Senator Domenici for his comments. But first, let me just indicate who is here.

Jos Delbeke is Director for Climate Change and Air of the European Commission's Directorate-General for Environment. In this capacity, he oversees the implementation of the European Union's Emission Trading Scheme and other clean air programs.

Mr. Per-Otto Wold is a founding partner of Point Carbon, which is a world-leading provider of independent news analysis and consulting services for European and global power, gas, and carbon markets.

Mr. Garth Edward is Shell's Trading Manager for environmental markets. Mr. Jean-Yves Caneill is a Project Manager at Electricité de France and Dr. Bruno Vanderborgh is the Vice President of Environmental Strategy for Holcim, a leading global cement group that is based in Switzerland. Dr. Denny Ellerman is Senior Lecturer with the Sloan School of Management at MIT.

Today's roundtable will be much less formal than a hearing. After a brief background presentation on this EU Emissions Trading System by a scholar from the Resources for the Future, Raymond Kopp, panelists will be given about 5 minutes each to summarize their thoughts and make the main points that they think we need to be aware of, and what was done right and what was done wrong in the EU system to date.

Following the opening remarks, senators will have the opportunity to ask questions and make comments. We will not have any time limits on those questions or the give-and-take. The hope is that senators who seek recognition, ask their questions, and then we will take the discussion wherever it leads from there on.

But I thank you all for being here and let me now defer to Senator Domenici for any opening comment that he has.

**STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM
NEW MEXICO**

Senator DOMENICI. Hello, everyone. It's good to be with you. I met with some of the people from the Union that are not on the panel, Senator Bingaman, but are experts in their own rights, and I had a little extra time in my office this morning, so I had to chance to visit with them. That was very good for me and I appreciate them. They are here and I thank them for their time.

I do want to say that I'm not prepared to give an opening set of remarks because I was of the opinion that we were not going to. That doesn't mean that I am offended. Your opening statements never offend me, whatever it is that you choose to say.

On the other hand, I think that you should not be misled. The implication, if any, that American legislators look at Europe and think that you are doing quite well—if that's what the good Senator, my colleague from New Mexico said—I think that's a little of an overstatement. I don't think that there is a majority, or anything like a majority, of legislators that think the European community is doing really well or that we can model something off of them that might work in America.

There are a few things we could learn. The most important thing is that you are off and running; you're trying something. I guess Americans would have to admit that. Beyond that, then, we'd go to work on what? That's probably why this was a good meeting today because you might think it is decided that Senator Domenici

is deciding not to participate; not at all. But I don't think that I want to spend a lot of time when you are here. I think it is most important that you spend a lot of time and tell us why you're here and what you think, even to the extent that you tell us what you think we are doing or not doing that we ought to do and why. I think that would be good for any of you who are here. Don't think you can't tell us quite openly today that you think we are—whatever nice words you use. I love to hear you talk so I hope you will. I love your use of the language. I wish we talked like you.

But in any event, if you could tell us what we ought to be doing that is better, that would sure be helpful. What you are doing that's wrong, if you have some opening observations in that regard, would be very helpful also.

Now, that's about enough for now and thank you, Senator Bingaman and again, thanks to all of you and let's have a good afternoon.

The CHAIRMAN. Thank you very much. Senator Salazar wanted to just make a short statement. Let me call on him at this point.

**STATEMENT OF HON. KEN SALAZAR, U.S. SENATOR
FROM COLORADO**

Senator SALAZAR. Thank you very much, Senator Bingaman. Let me just say that I think this committee, over the last 2 years in the 109th Congress, did a lot of great work, in part because we almost unanimously passed the Energy Policy Act of 2005. We have a lot of work that we continue to do this year on new technologies, on renewable energy and a whole host of other things that obviously impact climate change and global warming.

I'm one of those members of this committee that is looking for some guidance in terms of what it is that we ought to do, with respect to the issue of global warming. We have, obviously, the Kyoto Protocols that have been out there that many countries signed up for. We have other legislation that has been proposed, including the McCain-Lieberman legislation from several years ago. We have Senator Bingaman, and I think Senator Specter and others, who are working on another package. The House of Representatives, I think, is poised to pass some kind of a global warming cap-and-trade system, perhaps by August. At the end of the day, the one thing that I know fully really are two things.

The first is that I believe that the scientific community has said, loud and clear, is that global warming is a major issue that does, in fact, threaten civilization, and we need to do something about it. I agree with that conclusion. Second of all, that there are a number of different approaches out there on how we should approach this issue of global warming. I think for us, in this committee and in this Senate, it is very important to learn from the European Union, since you have already embarked upon a program that is trying to deal with the issue. So I'm very much looking forward to the discussion this afternoon, to learn what has worked, what hasn't worked, and what kind of guidance you might give us as we struggle with this very, very difficult issue. Thank you, Senator Bingaman.

The CHAIRMAN. Thank you. We have six distinguished witnesses here. Let me just call on each of you to, as I indicated before, take

about 5 minutes to give us your views, the main points that you think we need to be aware of before we get into questions.

Before we do that, I'm going to have Dr. Kopp, who is the Senior Fellow and Director of the Climate and Technology Policy Program for Resources for the Future, give us sort of an overview of the European Emissions Trading System. Let me just mention also, and I guess this is by way of introduction, Dr. Delbeke. I'm informed that yesterday was the 50th anniversary of the Treaty of Rome and that was the Treaty that made—that was responsible for forming the European economic community and what was the foundation for today's European Union. So congratulations for 50 years of success with that effort.

Dr. Kopp, why don't you go right ahead?

STATEMENT OF RAYMOND KOPP, SENIOR FELLOW AND DIRECTOR, CLIMATE AND TECHNOLOGY POLICY PROGRAM, RESOURCES FOR THE FUTURE

Mr. KOPP. Thank you, Senator Bingaman and members of the committee.

Thank you very much for this opportunity to speak. Let me say, Resources for the Future is a nonpartisan, non-advocacy research institution in Washington, DC and any opinions I express today, please don't hold against my colleagues or the institution. It does not take positions.

The purpose of my remarks is to provide a brief introduction to the European Union Emissions Trading Scheme, which goes under the acronym, EU ETS, which I'm sure you will hear more and more about.

I also want to discuss some lessons that one might draw from the EU experience. The EU ETS is an emissions allowance cap-and-trade system, similar in many respects to the current system used to control sulfur dioxide and the provisions of the Clean Air Act.

All cap-and-trade systems establish a cap on annual emissions, identify those entities whose emissions will be regulated, and set a few rules. In most contexts, one allowance is required for each ton of emissions and allowances are usually freely transferable. Allowances can be initially distributed in the market through free allocation based on some metric or another, or sold through an auction. The key question each system must address is whether allowances that are not used in the current year may be banked for subsequent years.

So let's turn to the structure of the EU ETS. It began operation in January 2005 and includes 27 countries of the European Union. The program is run in two phases. Phase I from 2005 to 2007 was intended to be a trial period to work the bugs out of the system. However, in all respects, it is a mandatory and binding cap-and-trade system. Phase II from 2008 to 2012 coincides with the Kyoto commitment period.

Specifications regarding future phases have yet to be established, but the program is intended to run indefinitely. The cap covers only carbon dioxide—that's CO₂, although other greenhouse gases may be added in the future. The EU ETS is not an economy-wide cap-and-trade system; rather it regulates downstream approximately 12,000 emissions sources, accounting for half of EU emis-

sions. Covered sources include iron and steel, cement, glass, ceramics, pulp and paper, electric power and refineries. Transport is not included in the system, although the EU will include air transport in 2011.

Each country submitted for approval plans for the allocation of allowances for Phase I. The European Commission is in the process of finalizing allocation plans for Phase II, which by the way, is 2008 to 2012. Allocation plans describe three decisions each country must make. First, how much of a country's Kyoto target is assigned to the sectors participating in the trading scheme and by implication, the remainder of the target must be met by sectors outside the scheme—for example, transportation.

Second, how much of the cap will be assigned to each sector, determining how much of the burden and cost individual sectors will have to bear, and finally, third, how the sector allocation is further divided among individual companies.

Phase I rules allowed countries to auction an upper limit of 5 percent of the allowances. Only Denmark chose to put up for sale 5 percent; the remainder being allocated gratis. More auctioning is likely to occur in Phase II, where the upper limit on auctioning has been expanded to 10 percent.

Emission sources covered by the EU ETS may satisfy their commitments by surrendering allowances in an amount equal to their emissions, or may supplement their EU ETS allowances with credits available under the Kyoto Protocol Rules, including joint implementation and clean development mechanism credits. As a result, the price and availability of these Kyoto credits will have a bearing on the price of EU allowances.

Let me turn now to the market itself. Early in Phase I, allowance trades were handled by brokers outside of formal exchanges. Currently, about half the trading volume occurs on exchanges and the other half over the counter. In 2005, about \$8 billion of trades took place. At the end of 2006, this had grown to about \$27 billion. Trades in the worldwide carbon market for 2006 are perhaps on the order of about \$30 billion. So the EU ETS has the lion's share of those trades.

The current spot price for a Phase I allowance is currently €1, about \$1.30, and this is for Phase I. But the price for Phase II allowances, as reflected in the Futures market, is today €16.35, or about \$21.75 per ton of carbon dioxide.

There are several lessons one can draw from the EU ETS. These lessons can be placed in context by considering three features of the cap-and-trade system that are important when evaluating policy effectiveness.

First, cap-and-trade systems establish a new class of asset—the emissions allowance—and these assets have immediate value once the system is established. Therefore, allocation of allowances is an allocation of wealth. Second, cap-and-trade emission reduction policies impose a cost on society, and once the initial allocation of allowances is made, the distribution of the cost will be determined by the market, not by government policy. Third, the spot price is a visible signal regarding the current cost of greenhouse gas reductions, while the future price reflects expectations regarding future cost, and takes into account expectations regarding government

policy decisions and the future cost of abatement, which is, as we know, closely linked to the availability of new technology.

So turning to the lessons, the performance of a cap-and-trade market hinges on accurate monitoring, reporting and enforcement. At the outset of the ETS in Phase I, many nations lacked reliable data reporting systems, which in part, contributed to some extraordinary price volatility. The lesson we draw from this is quite simple: inclusion of sectors and sources should be preconditioned by the development of strong monitoring and accounting systems.

Second, the ability of governments to distribute the economic burden a cap-and-trade system will impose on the economy is greatest during the allocation stage, and importantly, the manner in which permits are allocated can alter economic incentives, leading to a variety of unintended consequences. The lesson here is rather obvious. Think very carefully about the allocation and keep the allocation rules as simple and as transparent as possible.

Third, allowances are assets that have significant value. Allowances that have fixed lives, like those in Phase I, must have asset values that go to zero at their terminal points. This raises difficult asset management issues for those required to hold allowances, and once again, here the lesson is rather obvious: develop effective banking rules, or at least short-term overlapping rules, from one phase to the next, that in some sense limits this price volatility at the close of these periods.

Fourth, near-term investments in technology needed to radically lower greenhouse gas emissions are likely confined to the energy sector, where these investments tend to be large and very long-lived. Allowance prices are intended to incentivize these investments and must have as little political uncertainty as possible. At the current time in the European Union, there is considerable uncertainty concerning the level of emission reductions the EU governments will actually require post-2012. The lesson again, fairly obvious: governments need to be as clear as possible about emission reduction targets. The commitment periods need to be as long as possible and certainly longer than the Kyoto periods. Allowance banking is an absolute requirement.

Mr. Chairman, thank you for this opportunity to speak.

[The prepared statement of Dr. Kopp follows:]

PREPARED STATEMENT OF RAYMOND KOPP, SENIOR FELLOW AND DIRECTOR, CLIMATE AND TECHNOLOGY POLICY PROGRAM, RESOURCES FOR THE FUTURE

THE EUROPEAN UNION EMISSIONS TRADING SCHEME (EU-ETS): A BRIEF OVERVIEW

by *Dallas Burtraw and Raymond Kopp*

CAP AND TRADE—A QUICK TUTORIAL

EU ETS is an emission allowance cap-and-trade system. All such systems establish a cap on annual emissions (or if banking is allowed, on the annual allocation of emission allowances), identify those entities whose emissions will be regulated, and set a few rules. In most contexts, one allowance is required for each ton of emission. Allowances are usually freely transferable, although in some programs constraints on trading have been imposed. Allowances can be initially distributed in the market through free allocation based on some metric or another, or sold through an auction. A key question is whether allowances that are not used in the year they are issued can be banked for use in a subsequent year.

EU ETS STRUCTURE

- The EU ETS began in January 2005 and includes the 27 countries of the European Union.
- The program is run in two phases. Phase 1 from 2005-2007 was intended to be a trial period to work the bugs out of the system; however, in all respects, it is a real cap-and-trade system. Phase 2 (2008-2012) coincides with the Kyoto commitment period.
- The cap covers only carbon dioxide (CO₂), although other greenhouse gases (GHGs) may be added in the future. (CO₂ accounts for 80% of all GHGs.)
- About 12,000 CO₂ emissions sources are covered by the cap, accounting for some 40% of all EU CO₂ emissions. Covered emissions sources include iron and steel; cement, glass, and ceramics; pulp and paper; and energy (electric power generation and refineries).
- Transport is not currently included in the system, although the EU will include air transport in the EU ETS in 2011.
- Each country submitted a National Allocation Plan (NAP) for approval for Phase 1. The European Commission is in the process of finalizing NAPs for Phase 2. NAPs describe three decisions each country must make.
 - How much of a country's Kyoto target is assigned to the sectors participating in the trading system (by implication, the remainder of the target must be met by sectors outside the system—for example, transport). The EU offers strong guidelines and regulatory oversight to require that at least the major sources such as those listed above be included in the program.
 - How much of the cap will be assigned to each sector—determining how much of the burden and cost sectors will have to bear.
 - How the sector allocation is then further subdivided among individual companies.
- EU ETS rules allow countries to auction an upper bound of 5% of the allowances, only Denmark chose to auction the full 5%, the remainder being allocated gratis. More auctioning is likely to occur in Phase 2.
- Emissions sources covered by the EU ETS may satisfy their commitments by surrendering allowances in an amount equal to their emissions or may supplement the EU-ETS allowances with JI (Joint Implementation) and CDM (Clean Development Mechanism) credits (which are generated by undertaking CO₂ reduction projects outside the European Union in accordance with Kyoto Protocol rules.)
- As a result, the price and availability of CDM credits will have bearing on the price of EU allowances.

EU ETS MARKET PERFORMANCE

- Early in Phase 1, allowance trades were handled by brokers outside of formal exchanges. Currently about half the trading volume occurs on exchanges and the other percent over the counter.
- In 2005 about 8 billion dollars of trades took place in the EU ETS. By the end of 2006, this is thought to have grown to 25-27 billion. Trades in the worldwide carbon market for 2006 may be on the order of 30 billion dollars—with the lion's share owing to the EU ETS.
- Prices March 20, 2007:
 - The current spot price is €1.00, \$1.33.
 - The December 08 Future price (Phase 2) is €15.60, \$20.75.

LESSONS LEARNED

There are three features of a cap-and-trade system that are important when evaluating its policy effectiveness.

1. Cap-and-trade systems establish a new class of asset—the emissions allowance—and these assets will have immediate value once the system is established; therefore, initial allocation of allowances is an allocation of wealth.
2. Cap-and-trade emissions-reduction policies impose a cost on society, and once the initial allocation is made, the distribution of that cost will be determined by the market, not government policy.
3. The allowance prices are visible signals regarding the current cost of CO₂ reductions (the spot price) and expectations regarding the future cost (futures prices). These expectations take into account expectations regarding the policy

decisions determining the required reductions and the future cost of abatement—closely linked to abatement technology.

The performance of the market hinges on accurate monitoring, reporting and enforcement. At the outset of the ETS in Phase 1, many nations lacked reliable data reporting systems, which contributed to the extraordinary price volatility.

- *Lesson.*—Inclusion of sectors and sources should be preconditioned by the development of strong monitoring and accounting systems.

The ability of government to distribute the economic burden a cap-and-trade system will impose on the economy is greatest during the allowance allocation stage.

- *Lesson.*—Think twice, allocate once.

Allowances are assets that can have significant value. Allowances that have fixed lives, like Phase 1 of the EU ETS, must have asset values that go to zero at their terminal points. This raises difficult issues of asset management for those required to hold allowances.

- *Lesson.*—Develop banking rules, or least short-term overlapping rules.

Investments in technology needed to radically lower GHG emissions are likely confined to the energy sector, where they tend to be large and very long lived. In that case, allowance prices are intended to incentivize these investments and must have as little non-market uncertainty as possible. At the current time in the European Union, there is considerable uncertainty concerning the level of emissions reductions required post 2012.

- *Lesson.*—Governments need to be as clear as possible about emissions-reduction targets, the “commitment” periods need to be as long as feasible—certainly longer than Kyoto periods, and banking is required.

The CHAIRMAN. Thank you very much. I think that gives us some sort of parameters and general outline of what it is we’re talking about and I think that’s very useful. Dr. Jos Delbeke, I introduced earlier as the EU Commission Director for Climate Change and Air and the European Commission’s Director General for Environment. Jos, thank you for being here, and go right ahead.

STATEMENT OF JOS DELBEKE, DIRECTOR, CLIMATE CHANGE AND AIR, DIRECTORATE-GENERAL FOR ENVIRONMENT, EUROPEAN UNION COMMISSION, BRUSSELS, BELGIUM

Mr. DELBEKE. Thank you very much, Senator. I would like to highlight three points in my introduction. The first is that the EU ETS is the pillar of the EU’s policy to reduce greenhouse gas emissions. It is the pillar to live up to our commitments of the Kyoto Protocol, and that is –8 percent for the EU as a whole. We differentiate internally that percentage.

Now, the EU ETS covers all major industrial emitters. That ETS system has created an active market for carbon allowances through which one price is being defined for all 27 member states.

The market volume of those allowances in 2006 was approximately \$24 billion for the 27 member states of the EU. That unique price across Europe has indeed attracted the attention of CEOs and Board of Directors in our companies, and those companies now look seriously and pragmatically at emissions reductions. There are good indications that the low-hanging fruit, as we call it, the lowest cost emission reductions, are being reaped. In short, my first point would be that the EU ETS is working because it is cost-effective and it is environmentally effective.

My second point would be that the EU ETS started in 2005 and we have now a rather young history of only 27 months. That’s not very long, but what we learned in that period—and we called that

first period a learning-by-doing period—is that today we have the basic infrastructure in place that we need to live up to our Kyoto Protocol commitments. That is, in time for the start of that first period under the Kyoto Protocol, which is the first of January, 2008. So what we learned was in what we commonly call the “pre-Kyoto” period.

That infrastructure that we have in place now is first a coherent and verified database of the emissions of all industrial installations covered. We had to start without such a verified and coherent database, and this resulted in a relative over-allocation. In fact, only 2 percent was over-allocated, but that over-allocation nevertheless was there and led to a rather sharp fall in prices as we have it today.

That problem is now addressed because those days, and even today, the European Commission took positions on the so-called National Allocation Plans for the member states. We see that the forward prices have picked up and today, the forward price that was indicated is around \$20, \$23.

We have a coherent, verified database. We have also an electronic registry in place, which is the backbone of a trading market. We have a coherent system of monitoring, reporting and verification. Member states and the commission have learned a lot about how to handle market sensitive information, such as the data release and the data of real emissions as they are verified.

We have learned how to do this because emissions trading is very new to Europe’s environment policy. We never did that and we learned, in fact, all our experience came from the United States and the sulfur trading scheme that has been successfully put up.

My third point that I would like to make is: what kind of message emerges from our experience? The strongest message that we would see as the regulator in the European Commission is keep the system simple. Because that gives a maximum of clarity and a maximum of certainty to all those involved—in particular, the private sector companies.

A simple system for us is a mandatory system that covers all major emitters, and we are extending that scope gradually. It is also a system that has absolute caps, because everybody knows before the trading starts what the name of the game is. We have not chosen for reasons of simplicity, for price management, so we are not going to price caps. We are not going into price floors. We leave the market to determine the price and we go for much more harmonized allocation methodologies, because the allocation before the period starts was very much in the hands of the member states, and that led to too-wide variation in the way that was being done.

Our conclusion was that it is absolutely essential to have clear incentives to all private sector players, to leave it to the companies to make or buy decisions, and to minimize every interventionist inference to the absolute minimum. That creates, in our view, strong incentives for the deployment of new technologies in our companies. We also thought that keeping the system simple would create the best guarantee for extending the system internationally, either through offset mechanisms like we have in the Kyoto Protocol, or also through linking with other regional schemes.

Keeping the system as simple as possible and the interference of the public authorities as minimal as possible has been a very strong guidance in the setup of the EU ETS. Thank you very much.

The CHAIRMAN. Thank you very much. I appreciate that excellent testimony. Mr. Per-Otto Wold is the founding partner and CEO of Point Carbon. Thank you very much, and thanks for your help in getting this roundtable organized.

STATEMENT OF PER-OTTO WOLD, FOUNDING PARTNER AND CEO, POINT CARBON, OSLO, NORWAY

Mr. WOLD. Thank you, Chairman Bingaman, Senator Domenici and members of the committee. Thank you for the opportunity to appear before you here today. As requested by your invitation, my statement focuses on Point Carbon's experience and analysis of the EU ETS and other developments relating to the emerging carbon markets. Overall, we would argue that the EU ETS is a qualified success, although we clearly recognize the need for improvements with regard to market design and other issues.

With regard to achievements and what has been done right, we first acknowledge that the EU ETS has led to price discovery and the PAN-European price on carbon has been established. Organizations across Europe are now factoring in the cost of carbon in their business decisions. According to a recent Point Carbon survey, 65 percent of respondents covered under the EU ETS have now initiated internal abatement measures as a direct result of the EU ETS, and this is up 18 percent from last year's survey.

The EU ETS has put a cost—

The CHAIRMAN. What percent did you say have now—

Mr. WOLD. Sixty-five percent of the respondents.

The CHAIRMAN. All right.

Mr. WOLD. The EU ETS has put a cost on emissions and a value on reductions. Second, the expected demand from Phase II of the EU ETS, lasting from 2008 to 2012, is widely seen as the key driver for investments in projects aimed at reducing emissions in 128 developing countries and countries with economies in transition.

According to Point Carbon's estimates, investments in projects under the Clean Development mechanism and joint implementation will deliver real verified emission reductions in the range of 2 billion metric tons of CO₂ equivalent emissions by 2012, around 400 million metric tons per year. This corresponds to approximately 6 percent of total greenhouse gas emission in the United States in 2005.

Third, we argue that market efficiency is satisfactory and comparable to what was seen in the USS 2002 trading program. Almost as important, there are no perceived information asymmetries between the participants. Point Carbon estimates that more than 1 billion metric tons were traded in the EU ETS alone in 2006, with a financial value of more than US\$24 billion. The turnover was 50 percent, measured as the ratio of traded volumes to the total quantity of allowances allocated. It is comparable to what was seen in the second year of the USS 2002 program. We forecast that traded volumes will double again in 2007.

As mentioned, experience has also highlighted a number of areas where there is scope for improvement. First and importantly, it is

critical to get the baseline right. The release of verified emission figures for the year 2005 showed that emissions were around 5 percent below allocated allowances. Although it is likely that some of this is due to actual emission reductions, Point Carbon's analysis suggests that governments in most countries allocated more than what was needed for compliance. Still, it is important to recognize that the EU ETS has produced a consistent set of verified emissions data, which future allocations can be assessed against.

Second, unauthorized leaks of verified emission figures for 2005 in several countries created information asymmetries and undue opportunities for some business market participants. This has highlighted the need for strict rules and procedures for handling of price-sensitive information along the lines that is common in more mature financial markets.

This concludes my opening statement and I'd like to take questions.

The CHAIRMAN. Thank you very much. Mr. Garth Edward, we're glad to have you here again. Thank you.

**STATEMENT OF GARTH EDWARD, TRADING MANAGER,
ENVIRONMENTAL PRODUCTS, SHELL OIL, LONDON, ENGLAND**

Mr. EDWARD. Thank you, sir. Good afternoon, Senators and thanks again for the opportunity to make this submission. I'll be speaking from the perspective of a trading manager for Shell, so not on the legislative side, but from the practicing side.

I'd like to emphasize that Shell believes the EU Trading System has delivered important results in the first 2 years of operation. I think there are three important results to highlight.

First, I'm going to say that the legislative foundations have been laid—clearly this is the case. More than 10,000 installations across 27 countries are now covered by formal emissions trading laws, from Ireland to Estonia, from Greece to Slovakia. That covers also cement, metals, refining companies. They all now monitor, verify, and report their emissions. A registry system is in place and every year, governments ensure and enforce that these companies hold a volume of allowances at least equal to their verified emissions—the first significant step forward.

Second, we believe that the point of an emissions trading system is to give companies the necessary information to allow us to allocate capital in the most effective way to deliver the required environmental results by implementing projects, investments in clean technologies, and so on. This means that we need a price to plug into operational decisions and project plans and investment strategies. The EU Emissions Trading system has clearly delivered this price information and it has not been subject to any price controls.

The market is deep and liquid. Approximately \$50 million per day of allowances trade through several exchanges and brokerage houses, and the forward curve extends out to 2012, which is comparable with oil or gas or power markets. For companies like Shell, this is the critical information that helps us reduce emissions in the most effective way.

The third major step forward has been that the EU Emissions Trading system has driven the development of international market mechanisms. The Clean Development Mechanism and Joint Im-

plementation are what they are known under in the Kyoto Protocol. Shell supports an international approach to emissions trading and notes the strong success of these mechanisms in implementing a wide range of environmental technologies, such as wind, biomass, landfill gas capture, flare reduction, energy efficiency and so on, in more than 120 developing countries.

These projects are expected to reduce on the order of 480 million tons of CO₂ per annum and will flow approximately \$6.5 billion per year to less-developed countries. We note that these international mechanisms finance the transfer of new technology, and they also improve local employment and local environmental standards in developing countries.

But like any school report, there is always room for improvement. For the first phase of allocations, 2005 to 2007 in the EU, annual emissions were capped at an average 2.09 billion tons of CO₂. As verified data have been published, we can see that this cap actually resulted in an annual surplus of about 150 million allowances more than emissions, as Mr. Delbeke has already alluded to.

Supply has therefore exceeded demand and consequently, the market for Phase I allowances now trades around \$1. It is clear though that the next round of allocations for 2008 to 2012 are being tightened based on this experience. The information is there and the allocations and the policies are being adjusted.

Current projections are that cuts of about 335 million tons of CO₂ per annum against business-as-usual will be necessary to steer EU member states on a course to meet their Kyoto targets. The Commission is confident that this is the way things will go.

In order for companies to deliver these results, the European Commission, however, must focus on working with the United Nations to overcome infrastructure delays and to ensure that all registries are operational and connected to the international markets. This is the way that we'll be able to deploy capital in the most effective way to fund emission reductions at the lowest possible cost. Thank you.

The CHAIRMAN. Thank you very much. Next is Dr. Jean-Yves Caneill, who is with Electricité de France. We're glad to have you here.

**STATEMENT OF JEAN-YVES CANEILL, PROJECT MANAGER,
SUSTAINABLE DEVELOPMENT DIVISION, ELECTRICITÉ DE
FRANCE, PARIS, FRANCE**

Mr. CANEILL. Thank you very much, Senator Bingaman and Senator Domenici. I'm quite honored, and also my company, to have been invited to testify before the U.S. Senate with the objective to share with you our views on this instrument that was implemented in Europe early in 2005, the EU ETS.

We've been quite involved in the early days on the definition of that instrument as we contributed to organize the so-called GETS experiments in 1999 and 2000, which is the Reopen Electricity Association of the start of the first discussion in Europe on the emission trading issue.

As a large electric utility group, we have faced different issues in the past years and questions on the effect of ETS on the power

prices and its impact on large consumers, on the relevance of ETS to do the work is intended for.

So I would like to stress shortly here some of the factors I consider as key for price development of an emission trading instrument in the future that can be taken forward by any new system which might come on board, including the revision of the EU ETS. This started to be discussed some weeks ago and in line with my analogies of what is wrong and what is right that I've provided before.

What I will be shortly developing is quite in line with one of the lessons of the simulations we did in 2000. Investments reduce emissions, not trading. Emission trading helped to find the least-cost ways to do them. Therefore, as I will talk on the electricity sector, the timeframe-related questions will be very important.

So I'd like to make three points. The first one, a long time framework has to be considered. Actors need to get predictability in the rules in order to shape their investment decisions in the right way, and looking in the electricity sector, a period of 30 years probably is relevant. The allocation process for allowances might be revisited along this timeframe, which is long, but each allocation period will be at least something like 10 years.

Second, concerning the definition of targets, it is necessary to state something. We have to get a system working and safe for delivering environmental integrity, given the economy reality check. If a cap-and-trade system is going to be implemented, attention has to be paid to the available technologies today and to the future technologies, which are not existing yet.

So the targets have to be set appropriately to the sectors with realistic trajectories for the constraint, taking into account the capital stock turnover of the sector and the investment cycles.

Last point—the devil is in the details, and what we have learned from the first period calls for the following requirements at least progressively, in the allocation process: move as soon as possible to appropriate rules for new projects or new installations. So the rules should be as soon as possible, as soon as we can, no free allocation for these new projects. This is the only one which is economically sound for giving the incentive for investments in the right technologies, taking into account the CO₂ cost and the full cost of technologies, or in our language of electricity, the long-term marginal costs.

In the same time, installations, which could have been given allowance for free at the beginning, with a grandfathering approach, could continue to receive part of them for free, but with a clear indication that they will have to deliver reductions over time to incentives then for future investments. So different methods could be proposed to address these so-called compliance factors in an organized manner, taking into account the age of the installations or use of benchmarking approaches.

In summary, if we give long-term visibility in the framework, realistic trajectories for the targets over time and proper allocation processes are related to the inclusion of the environmental—in the fuel costs, I think we can build the basis of an appropriate framework for taking the right decisions without putting too much stress to the economy. Linking more systems together, taking into ac-

count the role of offset projects, domestic as well as developing countries, and bringing progressively more sectors and gas in the economy could help to build a new international regime at the end of the day. So I thank you very much for this opportunity to speak.

The CHAIRMAN. Thank you very much. Let me—before you start, Dr. Vanderborght, let me just see if some of the members—I know Senator Salazar is going to have to go the Senate floor, I'm informed. Does anybody else have a need to run out, if they want to ask a question before we hear from our final two witnesses?

If not, I guess Dr. Vanderborght, why don't you go ahead? Then Dr. Ellerman, and then we'll open up the discussion.

STATEMENT OF BRUNO VANDERBORGHT, VICE PRESIDENT OF CLIMATE PROTECTION, HOLCIM CEMENT, ZURICH, SWITZERLAND

Mr. VANDERBORGHT. Thank you very much, Senators Bingaman and Domenici. I will talk from the perspective of a large global cement producer, CO₂ and energy-intensive producer with about 15 percent of our emissions in European Union, 15 percent in the United States and 60 percent, the fastest growing in developing countries. So for us, climate change and trade issues at a global level is really the core of our interests.

Going to what is—going well with the European Emissions Trading System, we have to recognize that it is a remarkable political and business achievement. In a very short time, all the legislation, all the regulations are in place in European Union and implemented by all 27 member states.

The monitoring, reporting, and verification of emissions gives us a very sound information basis for building of future reductions. Knowing what we do and knowing what we can do in the future really is of critical importance with this monitoring and reporting.

The CO₂ emissions trading market functions in a competitive environment. All the tools and methodologies work well and we have a good price indication. This has, as a result, that CO₂ emission reductions and energy saving is now very firmly on the radar screen of the CEO, the Executive Committees and the Board of Directors of major energy companies, and that is really the most important driver for change—attention by the top management of the companies.

It also has an influence on our investment decisions in Europe, in the United States, and in developing countries. Now, we may not forget that this is not an emissions trading system. It is an emissions allowance cap-and-trade system and for the energy-intensive industry, the cap on our emissions, the obligation to reduce our emissions is of absolute key importance and is more important than the trading aspects of the allowances.

Here we have some room for improvement of the European system. The current allowance allocation is based on absolute emissions from the past and that is extrapolated to the future, meaning that the more you polluted in the past, the more you have the right to pollute in the future. Early action is punished. The absolute cap based on historic emissions and lower allocation to new investments freezes market change and does not provide a real incentive

for innovation in new investments. It is future investments which will reduce the emissions.

Also, the time perspective that we have at this moment is insufficiently long: 2012 is for a short time and even 2020 is for a medium time.

All these counterproductive rules in setting the allowance allocation has as a result that there is very intense lobbying in different directions from different industry beliefs, all trying to get as much as possible free allowances to start, and this does not help the credibility and the efficiency of the system.

So our most important recommendation for improvement of a system which is already good, but our most important recommendation is to simplify the allowance allocation. We need a long-term, simple long-term target. Long-term means 2030, 2040. Based on CO₂ efficiency performance, so CO₂ intensity of our products multiplied by real production to have an absolute cap-and-trade system.

Having a long-term target, we need a predictable path from current performance to the decreasing long-term target. That will provide us sufficient incentives to improve our emissions through investments in Europe, the United States, and developing countries. Thank you for your attention.

The CHAIRMAN. Thank you very much. Our final witness here is Dr. Denny Ellerman, who is with the Sloan School of Management at MIT. We're very glad to have you here. Go right ahead.

**STATEMENT OF A. DENNY ELLERMAN, SENIOR LECTURER,
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE,
MA**

Mr. ELLERMAN. Thank you, Senator Bingaman, Senator Domenici and fellow Senators of the committee for this opportunity to testify before you.

I speak to you as a student of emission trading systems and of the European trading system in particular. My prepared remarks about what is right and wrong with the European trading scheme are contained in the discussion packet that you have received, and I thought what I do with my allotted time here is to provide an outside perspective at my noting two circumstances in the implementation of the EU ETS that distinguishes it from what might occur in the United States.

These are: first, the very different Federal structure of the European Union, and second, the great haste with which the EU ETS was implemented.

Senator DOMENICI. Mr. Chairman, Mr. Chairman.

The CHAIRMAN. Yes, go ahead.

Senator DOMENICI. I wondered if I might just interrupt for one moment and just make an observation for our English visitors. I think since we are going to soon talk with you, our British visitors, I think it might be well that you listen attentively, because this witness may, in fact, be one that has done more homework than we have, your American inquisitors, because he has just indicated what he is and we are not that. To the extent that we can tell you we have worked hard and studied, we are not students of what has occurred in your countries collectively. You are, maybe but he is for

certain. And that should be noted by you because that to us, is very important. Thank you, Mr. Chairman.

Mr. ELLERMAN. These two circumstances are important because much of what is criticized about the European Emission Trading System results from these circumstances rather than from the inherent characteristics of the cap-and-trade mechanism that has been adopted in Europe and that is under consideration by the U.S. Senate.

Let me expand briefly upon each of these circumstances. The relationship between the member states of the European Union in Brussels is very different from that between the States of the American Union and Washington. The constituent elements of the European Union are sovereign states that have ceded some authority to Brussels, but they retain a degree of sovereignty that Texas, California or New York, for example, could not aspire to attain.

The result for the EU ETS is a highly decentralized form of implementation and the consequent differences among the member states, especially as it concerns allocation, have been strongly criticized. But much of that criticism presumes a political reality that while desirable, does not presently exist. The stronger Federal structure of the United States should allow Congress to avoid many of these problems, although regional differences will, of course, still have to be resolved.

The second circumstance, the haste with which the EUS was implemented can best be appreciated by comparison with the U.S. SO₂ Emission Trading Program, which was, in its time, also a first of its kind. The latter, the SO₂ system, was proposed in April 1989. It was signed into law in November 1990. In the intervening 18 months, Congress decided all of the major features of the SO₂ system, including notably, the cap and the allocations. EPA then had 4 years to issue what were largely technical implementing regulations and to establish the registries through which trading would occur.

In Europe, the comparable authorizing legislation was proposed in mid-2001 and approved by the member states at the EU level 2 years later, in mid-1983. In the remaining 18 months before the system was to begin operation, the member states were to determine the caps, allocate allowances, issue the implementing regulations and set up the registries. When the system started on January 1, 2005, many of the caps and allocations had been completed, but not all. Most of the implementing regulations still had to be put in place and only one registry was operating at the start. Now all of that has been resolved, as you have heard, and these problems have been worked out.

It's important to understand that the underlying reason for this rushed and somewhat ragged implementation was the desire to conduct a 3-year trial period to work out the problems prior to the start of the trading period that really counted with respect to the Kyoto Protocol. In effect, the EU adopted what you could see as sort of a boot camp approach, that there is going to be some unpleasant experiences, but the subjects will be better off after they've been through it.

This was, in my judgment—I think this was a good judgment on their part, given the circumstances, but I would stress that it is a

circumstance that I do not think applies to the United States. Thank you for your attention.

The CHAIRMAN. Thank you very much. Let me just start with a question, and then I'll call on Senator Domenici for any questions he has, and then we'll open it up to any other Senator.

Dr. Delbeke, I think you highlighted the fact that one of the accomplishments is that you now have in place a coherent and verified database on emissions, as I understood what you said. To the extent that we are seriously considering putting in place a cap-and-trade system in this country, I would assume we would need something comparable. We would need good information about where the emissions are, the extent of the emissions in order to be able to set up an allocation system. I'd be interested in any more you could say on the subject of what's involved in putting that together, that kind of a database and the length of time it took to accomplish it.

Mr. DELBEKE. Thank you, Senator Bingaman. I think indeed, it is absolutely necessary to have a good database. I think that the experience we had over the last 2 years underlines that. Now, there is a bit of choice in this. You can either go ahead as we did and take a risk. Good hindsight; we didn't know what precisely the risk was we were taking. We were rather confident that the database we were working on based on the best data around, et cetera, was a good one. But that is one of the lessons that we learned, that the other way around would be to start first in building up a coherent and solid database, and then go into capping decisions and into the trading itself.

Now for Europe, and I guess as well for the United States, the construction of these databases builds a lot on existing regulations, I would assume. That means that major polluters like power stations or cement kilns or petrochemical installations are already subject to procedures on which a lot of information is available. The only thing that was not available in Europe was a knowledge about the precise emissions of greenhouse gases. We knew a lot about NO_x and SO_x and PM₁₀ and all kinds of other emissions and these charges, but not about greenhouse gas emissions. So we started with best guesses, and now we know much better, because what we did was not create an obligation to the public authorities to create a database, but we took the analogy of the financial markets. We asked companies themselves to make a report about their emissions and to have every year such a report made and verified by a third party.

We are in a very different political structure, as was outlined by Professor Ellerman, and I think that explains as well that we could not have gone as fast as we did if we would have had to wait for the 27 member states and the administrations, which are very different in quality and in capability to have that solid and verified database made. So we asked, as an analogy, to the financial markets, to ask the companies to do it themselves, to ask for an independent verifier to check the bills, so to speak, and there is what we have every year now by April, May, every year, we will have a verified database about the real emissions release on greenhouse gases. Thank you.

The CHAIRMAN. Thank you very much.

Senator Domenici.

Senator DOMENICI. Thank you very much, Mr. Chairman. Let me see if I can make sure we clarify a couple of things for the record. If I'm wrong, please just tell me I'm wrong, but from what I understand, the cap that you have is very loose. By that, I mean the price of carbon is very cheap and you couldn't have that as your permanent level and have a program, is that correct? I see nodding of the heads but we're in a forum where we need somebody saying yes. Let's do it this way. Since none of you have said no, I assume you all said yes. That's fair enough, that's the way we do it around here sometimes.

All right. Now having said that—oh, you wanted to comment?

Mr. ELLERMAN. Senator, yes. I guess I'd make one comment. I think there is general agreement that the cap is loose. I mean, how loose is a difficult question to address, and I think a distinction must be drawn between the first period price now, which is quite low, and the second period price in starting 2008, which is €16, a fairly high level, and that results from design features, namely the lack of ability to bank from the first period into the second period. So you've created this—what are now very low prices. They will disappear on December 31 of this year.

Senator DOMENICI. Thank you very much. The fact that I said a while back that you were our expert should not be taken literally. You don't have to answer everything I say.

[Laughter.]

Senator DOMENICI. In any event, that was well taken and we needed that. Now let me make sure that everybody else—we understand a few other things here in America as you talk.

Your agreement among yourselves—that does not include any outsiders like China or India or any comparable countries, is that correct? Please, Mr. Delbeke.

Mr. DELBEKE. Thank you, Senator. It does not include in the emissions trading the link, the formal link with other emissions trading systems in the world simply because they do not exist.

Senator DOMENICI. Yes.

Mr. DELBEKE. But the ETS directive, the regulation itself, foresees such a linkage. But that will have to be subject to a separate decision made by the legislature.

The other element is that the ETS system is open for credits from other parts of the world; that these credits are created through the Kyoto Protocol. They are so-called credits from the Clean Development mechanism and from Joint Implementation schemes and these credits are, in fact, generated by projects—offsets—projects that are being undertaken, to a large extent in China, but also in Brazil and other parts of the world. These credits can be brought into the European scheme and have a value to comply—compliance possibly of companies to use these credits. Thank you.

Senator DOMENICI. Well, I think that's a good answer, but I think that we should make it very clear that—what you're really saying is you have some provisions whereby one might conclude that under certain circumstances, all things being right, you might have one of these countries join, right? But it's obvious to me that they are not overtly speaking as if they would like this, and it

would seem to me that for you to come here and imply that there is, is a misstatement, that they're not interested at this point. They're not interested even in entering into an agreement with the United States in a major way, and we're one of the trading partners that they ought to be most worried about, because they sell us too much in comparison to what they buy. That has a big impact, one way or another, or will have, depending upon what happens to this program.

I want to make two other points and then I'll let you comment further. I want to make for the record another point. Constantly, it is said the United States—and they reply that President Bush—turned down the Kyoto Agreement. I think it should be fair here, although not discussed as such; the President did not turn down the Kyoto Agreement. The Senate of the United States turned down that agreement by a vote of 95—was that the vote? Ninety-five—97 to zero, and the resolution said to the President, don't bother to send it to us because we're not interested in voting on it. So then we got involved in a Presidential campaign and everybody forgot that and they said the President of the United States is the one that turned down Kyoto. Well, not so. The U.S. Senate, Democratic and Republican did.

The last question—last observation and/or question to you all—there is a big difference between what you are doing and what the distinguished chairman, Senator Bingaman, my colleague from New Mexico is doing. He is distinguished, and he is working very hard to try to get cap-and-trade language that might get him a sufficient number of votes to get it out of committee, for which I applaud him. I haven't yet said that I'll go beyond that and vote with him. That's two different things—you can laud your colleague without agreeing with everything they say. I know that, too.

On the other hand, he does his differently. The taxing point for you is downwind, right? You tax at the end of the emissions scheme and he taxes at the upper end, right? So you would be taxing the coal mine that emits coal, from which coal comes and is put into the scheme. You would tax it right there. We understand the European communities are living under a system that does what? Stay with the coal mine. What happens? They mine the coal and then when do they tax it?

The CHAIRMAN. I think the witnesses can answer better. My understanding is, what we're proposing is to regulate the carbon as far as we can, when it comes into the economy, very much upstream. As I understand the European system, you regulate further down at the place where the emission is actually made into the atmosphere. Is that a fair statement?

Senator DOMENICI. Is that a fair statement, sir?

Mr. DELBEKE. I think indeed that's a very fair statement, and perhaps it is explained by the following, why the European system follows the downstream approach, and that is that the system does not incorporate transport. Because we have a tradition in Europe of dealing with transports through a combination of direct regulation, the technical regulation and taxation, and we didn't want to change that system because we found it was effective in having energy-efficient cars and transport systems in place.

May I perhaps take the opportunity of replying also or making a comment to the question on whether we expect other states to join or to link up with the European system, which is quite different. We expect, for example, Norway or Iceland to join the system. That means they are going to be a complete part of the system and will accept the system entirely as it stands. We are looking for other states to link up with our system, which means that it is not necessary that those who want to link up with the EU ETS have to have exactly the same regulatory context. There may be differences. I think the less differences there are, the easier that will be. But it is a possibility that is foreseen by the legislature that we can link up with states like the United States, which is frequently debated in Europe, and with Canada, where there is an active debate going on, even with States like California, who also are investigating our system. So linking is different from joining, but both possibilities exist. Thank you.

Senator DOMENICI. Thank you very much. Senator Bingaman, I'm going to yield now and I'll wait and ask questions at a later date, when the Senators have finished.

The CHAIRMAN. I know Dr. Vanderborght had some thoughts on this issue of how to bring China and India or the extent of their involvement since they do business in those countries.

Mr. VANDERBORGHT. Yes, thank you, Senator Bingaman. Indeed, as I said in the introduction, we have about 60 percent of our emissions in developing countries and it is especially growing in Asian countries. The business opportunities that have been created by the European Emissions Trading System are significant. We have fairly regular contacts with our Asian operations and I can tell you that the interest of Asian companies to engage in the CDM projects and to effectively reduce their CO₂ emissions and energy consumption is very real and significant. I am rather positive of engaging, after 2012, the developing countries, if we could move to a system which rewards efficiency instead of only basing on absolute emissions.

I would also like to take the opportunity, Senator Bingaman, on commenting on the previous question on monitoring and reporting. As it has been discussed, very good quality of information is essential for a successful emissions trading system. So I would recommend to the United States to start as early as possible with mandatory monitoring reporting and verification. I insist on the word mandatory, because we know from experience that limiting ourselves to a voluntary monitoring and reporting system does not provide reliable information, because it will be essentially the leading companies which will participate to a voluntary system, so you will get an over-optimistic view of the real emissions. Whereas we demand that you have the whole industry, and then you will get much more accurate view of the emissions.

Adding to what we do in Europe—in Europe, the monitoring, reporting and verification is only on absolute emissions. It is important to also have information in that system on performance, because only having absolute emissions allows you to build allowance allocation grandfathering, but does not provide you the necessary information to have an allowance allocation on benchmarking or performance, and that is the key for success in the future.

The CHAIRMAN. Let me see if other Senators—Senator Corker, did you have a question?

Senator CORKER. Yes, sir, I do. I have several questions, thank you. Thank you for this great hearing. I appreciate it. It seems to me that if you were going to have one of these systems, that the method that Europe has—not to be critical versus the upstream method that has been proposed—is one that would cause CEOs to actually make decisions as to how they're going to create steel. It seems to me that that's the level at which you'd want those decisions made, versus it coming out of a mine or coming out of another place. It seems to me that the upstream approach is more of a carbon tax than it is an actual trading system. I see people nodding here so I'm going to move on.

The level at which you're trading now, the \$16: is that a level that really creates enough pain for people to invest in technology, or is that a rate that is a fair rate, or is that still way below what causes people to actually make investments in technology?

Mr. EDWARD. The bulk of emission reductions in the EU are made, actually, by coal-to-gas fuel switching and power stations, and any price will start to change the dispatch of power plants and start to change away from coal into gas. It's certainly the case that prices of €16 or \$24 or whatever, will start to change those dispatch decisions.

Senator CORKER. I'll ask one more question. I came from a business where there was an adage that said, "Bought right, half sold." In other words, the deal you made on the front end was where at least half the value if not all of it was made. The allocation of these credits—I just sit here and think about all the governmental relations people we have here in Washington and all the industries. I can't possibly imagine trading the allocation process. You can create one that would actually be fair. I mean, it just seems to me it would be very difficult, and I'd like for you to educate me on this because this seems to be the most perplexing piece to me. In that you have people who have been good actors, meaning they've invested heavily, let's say over the last 20 years to reduce emissions. Then you have people that have been really bad actors. They're just blowing coal out and certainly have paid no attention to that. So you have that discrepancy, and then you have the issue of new industries that don't even exist today and how are they allocated credits? I'd love to understand that if I could.

Dr. CANEILL. Yes, I'd like to respond to that question. This is really the key thing for the future, as I've been trying to state in my initial statement. Looking at the prices we have today, any price has an influence in the electricity sector on the varied order of the plans you are using for delivering the electricity. So when you reach some prices, you can displace coal-to-gas, for instance, and depending on the price of the fuels, you will have a requirement for the pseudo price in order to change the married order. But you cannot go very much with that because you have existing plans. So you have some limitation. The real thing to implement is a system that allows the people to take the right signal for the investment.

So in the future, I need to know what the price signal is that I need to change my investment decision from a coal-powered plant

or to a gas-powered plant or to equip in the future, a coal-powered plant with—so it is important to have the right price signal introducing the full cost of the technologies. So this is very different from the shorter marginal costs of appropriation. I need to have a signal for real investment.

Senator CORKER. But that's not really the question I'm asking. I'm talking about setting it up on the front end and allocating the caps—I mean, it just seems to me that that is a huge undertaking and that smart people—the smart companies are going to make all the money on the front end, if you will, in the allocation process, and create tremendous wealth there. I'm just wondering if you all might know how to overcome that.

Mr. EDWARD. I was just going to come back and say, of course we recognize the point that initial allocations establish winners and losers in the game. Typically, it's spoken both academically and in the marketplace. There are three basic methods by which you can do an allocation. Either you can grandfather, based on historical emission levels or you can issue allocations against some kind of benchmarking level, or you can auction. They all have different merits, different drawbacks, different kinds of political achievability and so on.

Grandfathering in the EU context, had the merits of being able to get the system going in reasonably short order. It's clear that as we move into the next round of national allocation plans, there are now other kinds of allocation being considered, to answer some of the questions that you just referred to, to do with equity of allocation and so on. So it may be that you have a starting point, which is politically achievable and then that there is some kind of transition to other better, more accurate systems, which can be established on the back of real information rather than initial reports. So I think it is a kind dynamic process.

Mr. DELBEKE. If I just may complete the argument that was made, because European Commission had to scrutinize all these national allocation plans that the member states were serving up to the Commission, and in fact, we had a double assessment. The first is a macroeconomic assessment, so what turns out to be the optimal amount for a member state and there is to be taken into account that every single member state has a separate commitment under the Kyoto Protocol that is legally binding. So that already explains the degree of scarcity for every single member state and within that, we have a very different pattern in the European Union of member states industrializing heavily, like the new member states, or member states like the U.K., for example, who are rapidly moving to a service economy. So we use economic indicators to differentiate in the approach in order to make sure that what is being given to companies is fitting together with the Kyoto Protocol, but also the sound economic conditions internally into the EU. That's the macro—the top-down approach, and that is being complimented with the bottom-up approach, which is sector-by-sector at the member state level.

Now there is one element I would like to draw your attention to, and you explicitly mentioned that, what with new entrance. The European regulation is silent on what to do with new entrants. But the member states have all separately invented one element that

is the new entrant reserve. So when new investments are being done, the new investor can ask, according to certain conditions, to the member state, to have a set of free allowances, and this new entrants reserve is increasingly managed by technological/benchmarking criteria. One of the big debates we are going to have for the future is whether we should not forget about the new entrants reserve, once the system is up and running, that it would not be normal that a new entrant is going or is forced to buy a number of allowances on the market—or the alternative is to have a more harmonized use of the new entrant reserve so as to avoid distortions creeping in, not only in system installations but also with the new investors coming into the market. Thank you.

Mr. ELLERMAN. May I add a comment? Let me step back a moment to address your issue about allocation. I think first it must be observed that allocation has been solved in a number of programs in the United States as it has in Europe and this is always the tough issue. It's never easy. The underlying issue is who is going to get the rights to emit that are now being restricted which, in most cases, were freely exercised prior to the policy that is being adopted? This is faced by any environmental constraint, however imposed, and the main difference that makes allocations so difficult in cap-and-trade programs is that the assignment of these rights is explicit and transparent.

It is fundamentally issues of equity on who should receive these rights. In my view those are best resolved in legislative processes whose main job is to resolve issues of equity almost in any laws that you pass. I think in this case, if you want to step back, the major contending principles that we observe here is sort of prior use claim, if you wish, an ecological squatter claim. There are lots of institutions in our society that recognize prior use. There are parties who are exercising this right freely. It's now being restricted. They will continue to exercise that right, and they assert a claim, but there are counterclaims to that. Those counterclaims are essentially what you could characterize as higher social purposes to which the revenues—the scarcity rents being created by these systems inevitably and by any environmental constraint—could be dedicated through auctions such as new technology or return to citizens. I mean, there is a whole series—reduce other taxes—of other uses and purposes.

But I think to step back broadly, it is a problem that has been solved. It is difficult. It is probably one of the most difficult aspects of setting up any system—deciding who gets these rights that we are now going to limit. Thank you.

The CHAIRMAN. Senator Domenici had one question he wanted to clarify, and then he's going to have leave and then Senator Lincoln had some questions.

Senator DOMENICI. Thank you, Senator Lincoln, because I certainly have had more than enough time and I would not want to deny you a chance. I must go to the office now, and so I just have a question because I'm confused about this price of the—how much it is per ton? I understand you've been using €16 a ton. But that's not the price now. That's a future price, right? So my friend from Tennessee who was asking about the price at €16 per ton—let's make sure we know that's not the price now. That's a future price.

They've got a much cheaper price now. But I don't quite understand why. Does it have to do with what we talked about a while ago, that you have that too loose a cap and have done that on purpose? If so, what's the purpose? Why is that? You both look so eager.

Mr. WOLD. In essence, there are two main prices in the market. There is a price for Phase I, which is the 2005 to 2007 price and then there is a price for Phase II, which goes from 2008 to 2012. They are basically two different products and the supply and demand in those two products are different. The supply for the Phase I is surpassing the demand, hence the price is very low, around \$1, around €1.

Then when we get into Phase II, with the allocation plans being decided on currently, the caps are stricter, so the supply is less and the expected demand is expected to be higher than the current supply, and hence, the price is around €16 to €17 at today's levels.

Mr. DELBEKE. There may be a question why we have in the European system, this strong separation between the first period and January 1, 2008 period that is going to start. The real history is the Kyoto Protocol. We were preparing ourselves for the Kyoto Protocol. We know that longer periods would prevent these price differences and in the future, we will have longer periods and we will have also a possibility to bank allowances from one period to the other. But for the learning-by-doing period, this first period we have until the end of this year. We decided to have a kind of rupture, a difference between the two, and so all those who have the surplus allowances can use them to comply with the objectives they have to comply with, but the value of those has faded down to close to nil and that will be absolutely different as of January 1, 2008, where we expect the price level in the order of magnitude of over €16.

So it is more a historical reason. That is, that we did not have any trading system. We wanted to start. We wanted to learn it and we wanted to be ready for Kyoto and that is January 1, 2008. Thank you.

Senator DOMENICI. Thank you very much. I don't know if you had a comment, the American Scholar, on the program? All right. Thank you, Senator Bingaman.

The CHAIRMAN. Thank you very much.

Senator Lincoln.

Senator LINCOLN. Thank you, Mr. Chairman and I certainly appreciate your leadership as well as Senator Domenici's leadership on this issue. You've given us a great opportunity thus far and I know that will continue to really have the in-depth conversation we need, to make sure that whatever plan we come up with is going to be appropriate for us to help reach the goals that we've set for ourselves. So I want to thank you for that.

We are enormously grateful to you all for your time and energy and enthusiasm to come and visit with us about what it is we do need to move forward on and what has worked for you and what hasn't. I don't know who it was but I thought I heard someone say that the reason for the split in those phases was that in the early phase, it was giving the opportunity of investment for infrastructure that was necessary in order to be able to get to the second

phase. I understand the economics you've presented in terms of why those credits are more expensive later on. But it seemed as if there was maybe not a time of investment in terms of infrastructure that was necessary from the industry side of things to be able to get to that point.

I'm not sure if I was understanding you, Dr. Caneill, correctly in that the credits present more certainty than the auction, maybe. Is that some of what you were trying to say in terms of the differences when we were talking about the auction and the credits? I believe it was Dr. Kopp that mentioned the auctioning of credits. You said that Denmark had actually chosen to do some of the auctioning in Phase I. Was that the only country to do that? But you indicated that more countries would be likely to do that in Phase II and I'm just kind of wondering why that auction mechanism creates a more attractive approach in Phase II as opposed to Phase I? Almost all of my questions go back to the issue of the two phases that you've created from 2005 to 2007 and then beginning in January when you move into the next phase.

So the question to all of you would be that if you had it to do over again, would you still create a market with two phases? As I think Dr. Delbeke just mentioned the banking of those credits and being able to move those banked credits across the phases. If that's the case, what is the advantage of doing two phases? If you can bank those credits and use them across the division, that hard division line that you have, what are the advantages of having two phases? Anybody?

Dr. CANEILL. I can start to try to respond to your question about creating an auction. In fact, what was underlying what I said on the treatment of the present installation, the incumbents, which are at the start of the scheme and the ones which will appear on the way, the newcomers, the new projects. Those should be treated differently and that appeal for a certain degree of auction in the system at a point. So in the European system, the possibility was given to the member states to have a certain percentage of auction in the allocation. But it was not used by most of the countries in the first phase. In the second phase, some countries have indicated that they will have a certain percentage of auction on the board in the limits of the directive today, which is 10 percent in the second phase.

But what I said on the dynamics of the allocation: the way you are treating those who were before the scheme is starting who discovered that there is a new regulation, and the ones which will come in some years, where the regulation will be there. They know that there is a regulation, so there should be some auction process in the system in order to give the right economy signal to those access. So I think it is not contradictory. I think if you design a system over time with more auction, you don't need to have 100 percent auction at the beginning. But giving the sign that the auction will be progressively increased in the future, this is quite compatible with the economy signal you have to give to the actors which build new installations.

Senator LINCOLN. Is there a reason why Denmark participated in Phase I with the auction? I mean, is it something about how they produce their—

Mr. DELBEKE. Well, on auctioning, we have in the first phase, four member states that went into auctioning and for the second phase, we expect half of the member states going into auctioning, with more significant percentages. So auctioning is becoming more popular. I think that one of the reasons is that when you are not auctioning, you are giving out the allowances for free. So politically, that becomes a very difficult process. The more you give for free, the more that people are interested to get for free. So allocation problems are being avoided to a large extent, in going to auctioning. Of course, the other side is that auctioning gives some revenues. Some member states may find that interesting, also for the purpose of reduction of emissions for stimulating new technologies in the renewable energy sector, et cetera.

I just wanted to come back as well on the two phases. I do not want to complicate further but in fact, there are three phases in the EU ETS. That is, the phase we have now, coming to an end at the end of the year. Then we have the Kyoto period, which is from January 1 of next year until December 31, 2012. Then the third period is going to be after 2012, presumably running until 2020. Given that our heads of state have taken decisions on emission reductions in that time perspective, that is going to be the perspective in which we are going to work as of now. The perspective is 2020.

Banking will be allowed between Phase II and Phase III. So I can see that now that we have better data, we will have the market developing, driving to emission reductions, those who want to save emissions reductions, who will store their allowance and use them in the third period. In my view, they will certainly be allowed to do that.

In the first period, between period 1 and 2, that is not allowed, because we were in a learning-by-doing period and that monitoring and reporting problems that we had seemed to indicate that that was a wise decision. Whether we would do it exactly the same way, I don't know, but I would assume that with what we know now, that people would say when you start, make sure that you have first a solid database of monitoring of verified data. That is not what we heard when we started and we were developing the legislation, but with hindsight, I'm sure that would be a very important element in the debate today. So we solved it historically through the learning-by-doing phase, but perhaps people would then say, let's monitor and verify first, and then go into the real transactions and trading. Thank you.

Mr. ELLERMAN. Senator, let me try to address your question about Denmark. I say this to report the results of actually a series of studies and a book that is about to come out, of which I was one of the co-editors. It's on allocation in the European Commission Trading System, and Denmark was one of the countries that we did study, and how they went about allocating their allowances. As Dr. Kopp had said, it was the only country that chose to allocate the full 5 percent. There were three other member states who chose to auction varying amounts that were 2.5 percent, 1.5 percent and .075 percent.

The Danish reason for doing so is interesting in that it was essentially competitive considerations on the part of the power indus-

try. It gets a little complicated, because many of the inner-country differences in allocation are created by what's called the European Burden Sharing Agreement, whereby the overall burden for Europe is allocated among the various member states. And the fact of that agreement is that Denmark had a much tougher target than say, Germany, with whom Danish generators competed. They felt and they wanted to provide a signal to people to auction more because they felt they would be less disadvantaged by auctioning than if they were grandfathering, because they would get less because of Denmark's more strict limits under the Burden Sharing Agreement.

It is also interesting to note that in the second round, Denmark has chosen to auction no allowances. So they've moved; whereas there are more countries auctioning and most have gone from a lower number to a higher number and such, Denmark has done the reverse. Others here may have more of a feel for that or reasons for that, I'm not sure. I suspect it has to do with Denmark made a very severe cut in their total cap in the second period and it's probably easier to take allowances away from the auction than it is from the parties to whom they're given.

Mr. KOPP. Senator, can I just? One comment again, on auctioning versus grandfathering, and this is strictly just an economic argument. Dr. Delbeke has already pointed out some of the important political considerations. When you allocate gratis permits—that is, for free, whether they are based on past emissions or on the basis of past output or on the basis of an updating procedure, where you're looking at future behavior and allocating emissions on the basis of an efficiency standard or an output standard, you bear the risk of changing economic incentives in ways that may not be fully recognized. You're going to be changing incentives for firms' investment behavior. Certainly output-based updating is one of those things that, in some sense, artificially keeps the price of electricity low, if its in the case of an electricity sector, expands output and raises the social cost of attaining any particular cap.

At auction, on the other hand, is one of those things that really maintains the incentives in their right place. You cannot go wrong by auctioning. I think you can bring 100 economists in here, and while economists agree on very few things, I think if you all pose them the same question, if you had the choice between auctioning and some sort of gratis allocation, which is the cleanest, most transparent, most economically efficient way to go, it would be auctioning.

It also has the benefits of generating revenue that if you recycled it through the tax system, you could expand the economy, you could use it for a variety of different purposes. But setting that aside, it's really one of those mechanisms that tries to leave the incentives essentially unchanged and reduce your susceptibility to a lot of unintended consequences, which will prevail with a lot of gratis-type allocation schemes that have interesting little tweaks to them, but really change incentives for future behavior.

Senator LINCOLN. Thank you, Dr. Kopp. Thank you again, Mr. Chairman.

The CHAIRMAN. Senator Sessions, did you have some questions?

Senator SESSIONS. Thank you, Mr. Chairman. I don't think that we're dealing with a small matter. I think this is a very big matter and one that deserves very serious thought if we were to head in the line of a major cap-and-trade system that Europe has done. Mr. Chairman, I'm not sure I know the full answers at this point either, but I think there is some simplicity in your approach.

I think that to alter an old phrase, "Oh, what a tangled web we create, when we first start to regulate." Regulations beget regulations like the tax code. People figure ways to get around it. You close that off. It grows and it becomes an exceedingly complex thing requiring, if it has integrity, monitoring and so forth.

I think in talking about our trip to the moon, Norman Mailer said, "There's a razor's edge between a hero's endeavor and vain glory." Being heroic is one thing but creating something that is not going to work for us is another.

Now with regard to CO₂. There are other issues that relate to CO₂. Relevant issues for a nation that are important to them—for example, pollution. Pollution is not controlled, I understand, with the trading system in Europe—particulates or other matters that are pollutants. But pollution isn't a relevant issue for a nation to desire and it can be important for the world because it can be worldwide-distributed.

Also, the national security of a nation—its ability to sustain itself even if hostile forces were to deprive it of energy sources worldwide: I couldn't help but think the transfer from coal to gas for Europe makes Europe more dependent on Russia.

Then there is another factor. I do not think it should be our goal to raise prices. I think our goal would be to reduce emissions and our goal would be to have a healthy economy, which requires, where possible, reducing costs, not increasing costs of basic energy.

So those are factors to me. I see a weakness here in the sense that the trading system would focus on one issue, CO₂, and not other issues that may be more relevant or as relevant to the Nation that's adopting the system. Would anyone want to comment on that?

Mr. DELBEKE. Thank you very much, Senator, for your comments. I think that it is very important to underline that perhaps one of the most important drivers for the Europeans to decide on this cap-and-trade system was not to prescribe the technology or the way we would reduce our emissions. So we leave it to the companies, the entrepreneurs in their companies to decide how to do it. So some will switch from coal to gas. Others will improve their energy efficiency. Others will elaborate and build further on their nuclear installations.

Renewable energy sources will be driven into the market. We see that as a very important element. And also through simple—sometimes, very simple—managerial decisions, energy efficiency and carbon reductions can be realized, the so-called low-hanging fruit.

So we are not prescribing to anybody how to realize those efforts. Further, we don't know, we in the public administration, how to do it in the companies, but having a price signal makes it beneficial for the companies to look at these things. They all come up with very different answers and very creative answers, because the

scope for emission reductions is scattered all over the value chain, also in very different economic sectors.

Senator SESSIONS. But my question to you would be: simply I guess, yes or no? It focuses simply on CO₂ emissions, is that correct?

Mr. DELBEKE. It now focuses on CO₂. It will incorporate in the immediate future, in the next 5 years, all greenhouse gases. So also methane, NTO and the fluorinated gases.

The CHAIRMAN. Let me just clarify. Now, Europe has done the same thing we have done in this country though, with regard to other pollutants. That is, we've adopted the Clean Air Act, which is direct regulation to try to control other pollutions. EPA does that. But that does not cover greenhouse gas emissions in this country or in Europe. So that's why Europe decided on this other cap-and-trade approach to deal with the greenhouse gases, is that correct?

Mr. DELBEKE. That's absolutely correct, Senator, yes.

The CHAIRMAN. Excuse me for the interruption.

Senator SESSIONS. Well, that's important, but I guess if you can get two or three benefits from the same regulation, that would be preferable to just getting one benefit. As we write it, I think that's a matter we ought to think about.

I'm thinking about France also, Dr. Caneill. You have a strong commitment to nuclear power. First, do you feel like France was adequately recognized for its major CO₂ savings as a result of having done that previously? That's just a brief response to that. Second, if a power company were to decide to build a nuclear power plant, when would they get any credits? Would it be as you noted when the investment is made? I believe it may be vendor-brought—suggested. Is it when the investment that you want or it is some time in the distant future? Because one of the difficulties in a nuclear power plant would be the up-front cost. How does it work now?

Dr. CANEILL. Thank you very much, Senator Sessions, for these questions. So I will try to answer them and try to come back on your previous question as well.

On the nuclear power side and our commitment in France, you asked first if we were recognized of our previous commitment, early commitment in nuclear generation in France. So the first thing I would respond is that when France designed its nuclear power program that started many years ago, the carbon issue, the climate issue was not on board. So we didn't build these nuclear power plants for solving the CO₂ problem. However, when Europe—

Senator SESSIONS. If every nation had done what France had done in Europe, you'd be far ahead today, would you not?

Dr. CANEILL. Yes, okay, you're right. But the concern at the time was more national security of supply than the climate issue, which was not on board at this time. So, when Europe divided the -8 percent that Dr. Jos Delbeke mentioned at the beginning, the Kyoto commitment—this number has been divided between the different European countries, it was 15 at this time. So the targets that France got in this agreement was stabilization of emissions from 1990 up to 2012. So we can say that the fact that the genera-

tion in France is mostly nuclear has been recognized in the Burden Sharing Agreement.

So now for the future, if we are building a new nuclear power plant we get credits for that. Along with what I've developed before, we will not get credits. If I would get credits for building a nuclear power plant and taking as a baseline of coal power plants, so I would add emissions in the environment. So the important thing is to ensure that the price, pseudo price, I will see on the market is sufficiently stable, in order that I can secure this investment in the long term. This was the reason I prone in my development that we need a long-term signal. We need a safe trajectory in order to have development of the price that allows an actor to take a decision on such an investment.

Senator SESSIONS. Briefly, but so therefore the benefit from the credit that would occur would be over the long term. It would not help finance the building of the plant up front. Is that correct?

Dr. CANEILL. You cannot build the finance with something you received, but when you decide the finance of your investment, you are taking into account the avoidance of CO₂ and the fact that you will not have to buy any CO₂ allowances in the future. So I think if you make the economic calculation, you can take that somewhat into account.

So I'd like to just come back shortly on your first question. I think the two things you were mentioning, the national security of supply and financing and also the increasing of the price, are two issues that are important. You asked if the EU ETS was addressing directly these concerns.

I would say the EU ETS is addressing an environmental problem, which is this CO₂ emission reductions. So we have to be careful what we want, that the system is addressing directly too many questions. We can come up with distortions of the rules in order to try to adapt the system in order to have the national security of supply concern and the price allotment. So if a country has a national security supply of energy question, it has to be addressed appropriately with right measures, and try to study what will be the interaction with CO₂ regulation for the prices now.

Yes, it is for sure that in the long term the CO₂ allowance prices will have an influence on the electricity price. We saw that in the short-term in the first phase. If you have a price signal of the market for CO₂, it will be taken directly in the short-term economy of the electricity generation, because you cannot store electricity. You have to produce electricity every second. So the price issue is important.

What is important to ensure that you develop the constraint with the base trajectory in order that the development price can be afforded by the economy. We have to build something like a safety valve—not directly a safety valve of the price, but you could do it correctly by designing the target and the constraint over time, in order that this price can be afforded by the economy.

Senator SESSIONS. Mr. Chairman, I would just note that I think nuclear power is three stars. It reduces pollution, it increases our national security, and makes us less dependent on foreign sources. It is, I believe, will prove, and is now proving, to be less expensive than any other source. So we could simply enhance nuclear power

perhaps and get more—as much benefit as anything else that we might do.

Or we might emphasize the production of natural gas, which we have offshore and other places in large amounts, which in itself would be a major move for our country that would also reduce pollution and keep our wealth at home and reduce our dependence on foreign energy. So there are things other than a massive, complex cap-and-trade system, that I don't doubt can work and every regulator I've seen that's been a part of a regulated system usually likes it, and figured if they just had a little more regulation, they could make it even fairer and less of a problem.

So I think we should be open to this issue. I think CO₂ does represent a potential threat to our environment and I'm glad you had this hearing, but I do believe that we should be cautious as we go forward. Thank you.

The CHAIRMAN. All right, thank you very much. Let me just ask if any of you have last-minute points you wanted to make that you think were obviously missing here. There are probably so many you don't know where to start. But yes, let me call on Dr. Vanderborght for a final comment from him.

Mr. VANDERBORGHT. Yes, thank you, Senator Bingaman. I would have been happy to be able to comment on the question of Senator Corker about the short-term interest and winners and losers. It's for sure that when you will discuss allowance allocation, you will be lobbied by all industry sectors and lobbying will go in all directions. It is also clear those who have not taken the necessary actions until now, that they will prefer grandfathering, while those companies who have an efficient production at this moment, will prefer the other allowance allocation based on benchmarking. So you will be faced with tremendous lobbying in all directions.

Then I would give the legislators maybe three pieces of advice. The first being that make the difference between lobbying for short-term vested interests and the long-term objective of climate change being long-term, reducing the emissions through investments.

Second, if society wants to reduce emissions, then at the same time, foster economic and social growth, there is only possibility, and that is improving the efficiency of our products and of our consumption. So the core of the incentives to industry should be efficiency. So when thinking about lobbying, think about including efficiency of production of products and consumption into the system. Last but not least, the allowance allocations should be simple, objective and transparent. Thank you.

The CHAIRMAN. Well, I think all those are very good points and I appreciate that very much. Let me just go ahead, since we're to the 4 o'clock hour, I'll just conclude the roundtable discussion. I thank all of you for coming. I think it has been very useful to hear your comments. As you can see, there is a lot that we need to learn about what Europe has experienced, and hopefully incorporate that knowledge and information into anything we're able to do here in this country. I think this roundtable has helped us to do that. So thank you all very much and again, thank you for coming.

[Whereupon, at 4 o'clock p.m., the roundtable was adjourned.]

APPENDIX

RESPONSES TO ADDITIONAL QUESTIONS

CARBON DIOXIDE TRADING IN THE EUROPEAN UNION

The European Union Emissions Trading Scheme (EU-ETS) is the world's largest tradable permit system for carbon dioxide and the cornerstone of the EU's strategy to meet its Kyoto emission target. The first phase the program began more than two years ago, in January 2005, and will be followed by a second phase commencing in January 2008.

This discussion will provide an overview of the trading system and will focus on lessons that have a bearing on the design of a CO₂ trading system for the United States.

Participants were asked two questions: "What was done right in the EU Emissions Trading Scheme?" and "What was done wrong in the EU Emissions Trading Scheme?" Participants answered each question in one page or less. Background on the EU-ETS and the responses are compiled here.

RESPONSES OF JOS A. DELBEKE

RIGHT

- A mandatory cap-and-trade system was put in place, based on absolute emissions levels determined in advance. It is a multi-sector scheme covering installations that are major emitters across the 27 countries that are members of the European Union. Today, the system covers some 45% of total CO₂ emissions. In 2006 the volume of allowances traded over-the-counter and at exchanges is reported at some €18 billion [approx. \$24 billion (rates March 19, 2007)]. By giving large installations flexibility, it engages them in finding least cost approaches to reducing greenhouse gas emissions and can spur innovation.
- Harmonised emissions monitoring and reporting requirements were set, building on work carried out in this area by industry.
- The private sector was used for verifying greenhouse gas emissions.
- Stringent penalties were set for non-compliance, to ensure that the environmental integrity of the system is maintained (from 2008, €100/tonne plus making up any shortfall).
- A straight-forward and secure electronic allowance transfer system was set up, enabling companies to transfer allowances across the EU. The Commission is considering licensing this system, developed with U.S. expertise, to third countries and regions to ensure that the global carbon market develops smoothly at the technical level.
- Market operation was left up to the market. The private sector quickly developed services (trading platforms, daily price quotes) needed for smooth operation of the allowance market. There is no 'price-cap'. The market is allowed to function freely, setting the right signal to invest in cleaner technology and efficiency improvements to meet the target (cap). Price-caps would inhibit the linking of emission trading schemes to form a global carbon market.
- As from the start-up period 2005-07, the EU ETS is open to least-cost global emission reductions, by accepting—with qualitative and quantitative safeguards—most types of credits generated from project-mechanisms in 169 countries worldwide under the Kyoto Protocol, and by foreseeing linking to emissions trading systems in other developed countries that have ratified the Protocol. The Commission is currently considering widening its linking provisions to include links to systems in other countries and regions.
- The system was set up for an unlimited duration. The initial 3-year learning period has proven to be extremely valuable to put in place and fine-tune the infrastructure needed for a trading system and for the collection of sound and

verified data on which 2008-12 will be based. The learning period means that both regulators and companies are much better prepared for the trading period 2008-12.

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- The lead-time from the entry into force of the Directive (October 2003) to the start of the system (January 2005) was too short.
- When setting caps for the 2005-07 start-up period, with hindsight, the EU had insufficient historic emissions and other data for participating installations. As a result, some Member States based their allocations on projections and estimates rather than actual emissions. The resulting inaccuracies resulted in insufficiently ambitious levels for emission reductions, and a significant drop in the market price for allowances when this became apparent. This shortcoming is now corrected for the second period running from 2008-12.
- Auctioning was limited to 5% of allowances. As a consequence, Member States which wished to auction a higher proportion were not able to. The limit on auctioning is raised to 10% for the second period running from 2008-12, and no limit is set beyond then.
- Despite commonly agreed criteria for allocation, Member States proposed caps that varied widely in stringency. The Commission needed to take corrective action for most national plans. This shortcoming should be overcome through greater harmonisation in terms of setting caps from 2013 onwards.
- Differing national approaches were taken in respect of the EU ETS's scope in the 2005-07 start-up period, resulting in some combustion installations being covered in some Member States and not others (e.g. crackers). This shortcoming has been overcome by a common approach being agreed between the Commission and Member States on the precise scope.
- Not all significant emitters were initially included in the EU ETS. This shortcoming is being addressed during the 2008-12 period through unilateral extension of the EU ETS by Belgium, France and the Netherlands to other greenhouse gases (N₂O), and by the UK to carbon capture and storage installations. From 2011, the Commission has proposed to include aviation, where this is not covered by other States' emissions trading schemes. Further extensions are under consideration.
- Relatively small installations were included whose emissions might more appropriately be addressed through alternative policies. This potential shortcoming has been addressed by simplifying the EU's monitoring and reporting rules for small installations. From 2013 onwards, the Commission is considering whether further action is needed, for example through enabling small installations to be 'opted-out' of the EU ETS if they are covered by alternative policies.

RESPONSES OF PER-OTTO WOLD

RIGHT

Financial Market Efficiency

- A trusted market-wide price on carbon was established quickly and distributed widely in the market.
- The market price responded from the start to changes in supply and demand, with fuel prices influencing supply and weather influencing both supply and demand.
- A market with reasonable liquidity has been established. More than 1,000 million metric tons were traded in the EU ETS in 2006, for a value of €18bn (\$23bn). The market turnover, measured as the ratio of traded volume to the total number of allowances allocated, has been about 50%. Point Carbon estimates trading volume will further double in 2007.
- Infrastructure for international emissions trading is in place and functioning. This includes registries, accredited verifiers, market places (exchanges and over-the-counter) and other market intermediaries, such as information providers, project developers and financial institutions.

Environmental Effectiveness

- The cost of carbon has been absorbed as part of operational decisions for thousands of installations across the European Union. By early 2007, companies participating in the EU ETS had to a large degree (65%) initiated internal abatement measures (Point Carbon survey—Carbon 2007). This compares to 18% in a similar survey a year earlier.

- The EU ETS has been a key driving force behind investments in project-based mechanisms (CDM/JI) in 128 countries and a range of project types. Point Carbon estimates that investments in CDM/JI projects will provide reductions totaling more than 2 billion metric tons of CO₂ equivalent emissions by 2012.
- The start of the EU ETS produced a consistent set of verified emission data across more than 10,000 installations in 25 countries. The European Commission made “extensive” use of 2005 data in assessing allocation plans for Phase II.

Policy Efficiency

- The EU ETS represents the first international emissions trading scheme to date. Lessons learned from the “test phase” (2005-2007) are providing valuable experience for stakeholders ahead of the start of the first commitment period under the Kyoto Protocol, from 2008-2012.
- Although uncertainties prevail with regards to international framework conditions for the post-2012 period, the EU ETS Directive secures the continuation of the EU ETS beyond 2012, which is critical for investor confidence.
- The EU ETS Directive provides an opportunity for linking to other national or regional emissions trading schemes (U.S., Japan, Canada and Australia). Along with the indirect links via offset markets (CDM/JI), this provides a path for convergence and towards a truly global carbon market.

WRONG

Financial Market Efficiency

- The timing of demand and supply is important, but was not fully understood:
 - The demand from utilities, which were generally under-allocated, was present from the beginning of the market. Utilities manage their current and future combined exposure to carbon, fuel and electricity risks on a daily basis;
 - The supply from companies in energy-intensive sectors, who were generally over-allocated, typically came to market later and episodically.
- The difference in timing of demand and supply largely explains why prices increased above €30/t in April 2006, despite the market being fundamentally over-supplied.
- The unauthorized leaks of market sensitive verified emission figures for 2005 created information asymmetries and “undue” opportunities for some market participants.
- The implementation of registries was delayed in many countries, most notably Poland and Italy, likely preventing market access and impairing liquidity.

Environmental Effectiveness

- The release of verified emission figures in April/May 2006 showed that the market was over allocated by about 5% (100 Mt) in 2005. Although some abatement is likely to have taken place due to high carbon and energy prices, the long position is in our view largely explained by over-allocation and lack of consistent, historical data.
- Uncertainties about Phase II (2008-2012) and the post-2012 period have made investments in more energy-efficient capital stock uncertain.

Regulatory Risk and Policy Efficiency

- A number of factors are specific to the EU and its principle of subsidiarity and are therefore more unlikely to carry over to the United States:
 - Distributed responsibilities for allocation processes at national level led to countries opting for favorable allocation to domestic industries.
 - Lack of harmonization in monitoring, reporting and verification procedures.
 - Different rules and procedures for treatment of new entrants.
- Grandfathering penalizes early action.
- The EU ETS extends beyond 2012, but there is a lack of clarity about rules due to ongoing review process and international negotiations.

Distributional Issues

- Free allocation by grandfathering has created windfall profits for utilities.
- The principle of opportunity costs was not fully understood or anticipated amongst policymakers:
 - The pass through of the cost of carbon into power prices is seen by many as unduly favoring the power industry and thus a challenge for the integrity of

the scheme. This pass through was, however, anticipated in a few countries, notably the UK, as highlighted in their National Allocation Plans;
 —Perception of fairness will affect the support for and sustainability of the EU ETS and international emissions trading.

RESPONSES OF GARTH EDWARD

RIGHT

- *Coverage.*—10,365 installations in the electricity, cement, metals, and refining sectors are covered by the EU-ETS Directive and the relevant national legislation.
- *Registries.*—Each installation is connected to one of the 27 national registries which then communicate through the Community Independent Transaction Log. These registries are operational and provide the basic infrastructure for assessing compliance as well as operating the market. Registries enable allowances to be issued to companies, transferred between companies, stored, and redeemed for annual compliance.
- *Compliance.*—Verified emission statements have been obtained and submitted by companies in line with the reporting and compliance timelines. Essentially all installations have demonstrated annual compliance by holding a volume of allowances on their registry accounts that is equal or larger than their verified emissions statement.
- *Establishment of a market price.*—Significant trading takes place with a daily market turnover in the EU-ETS of approximately USD\$50m. Approximately 50% of volume transacts on exchanges such as Nordpool, Powernext and the ECX. While the balance of trading activity takes place through brokers. The forward curve extends from spot out to 2012 and this provides a long term price signal comparable to oil or power markets. This price signal is integrated into electricity dispatch decisions across the EU with companies deciding to run gas or coal plant on the margin depending on the price of allowances.
- *Development of the international Clean Development Mechanism (CDM) and Joint Implementation (JI) markets.*—The demand generated by the EU-ETS has driven the quick development of international project credit markets. CDM now has 517 registered projects with a projected flow 2008-12 of 761m CERs. At an average of USD\$13.3 this represents a capital flow from rich to developing countries of USD\$10.11bn up to 2012. A further 3,831 projects are in the UN approval process representing another 2,147m CERs and USD\$26.7bn. This pipeline is being added to daily. JI (Joint Implementation) is picking up speed now as we approach 2008 and 271m Emission Reduction Units (worth approx USD\$3.59bn) will be generated from projects currently undertaking approval with the UN. This pipeline will be added to considerably over the coming year as Russia and Ukraine build the necessary institutions. In summary we can say that CDM/JI will flow approx USD\$6.65bn per year into developing countries from now till 2012. Alongside this flows technology transfer, improved local employment, and better local environmental quality.

WRONG

- *Delays in infrastructure.*—Some governments were late in establishing their registries which meant that issuance of allowances were delayed and some installations were held off of the market.
- *Delay in connecting to the UN International Transaction Log.*—The EC has not yet connected to the ITL which means that the Certified Emission Reduction (CER) credits flowing from CDM projects cannot be physically imported and used for compliance.
- *Auctions.*—Some EU Governments have chosen to auction EU Allowances, either as part of their primary allocation process or as a distribution method for surplus allowances left in New Entrant Reserves (e.g. UK, Ireland, Hungary, Denmark). These auctions have been frequently delayed as governments have found that auctions require significant logistical organization.
- *Inconsistent allocation methodologies across the Member States.*—This meant that the definitions of installations were different, monitoring and verification guidelines were different and baseline periods were different. As a result, the same kind of installation (refinery, power plant, cement plant etc) would have very different allocations depending on its jurisdiction.

RIGHT

Setting the scene.—Implementation of the EU Emissions Trading Scheme (hereafter EU ETS) was proposed after about three years discussion (that involved all stakeholders), which started in 1999, and continued to its final adoption. Although we can consider that this time duration is short for the implementation of a new economic instrument, it was done in a way, that made industry and power sector, faced with the reality of the carbon constraint. The EU ETS allowed immediately for the setting of a single allowance price for CO₂ throughout EU in early 2005 when it started effectively.

Simplicity.—Making a decision to consider “direct emissions” and not base the ETS on “indirect emissions” was also a wise decision to take, although discussed strongly at the beginning among the different stakeholders. Including both would have complicated too much the design at the and simplicity of the approach was an essential feature for having a prompt start of the scheme. This does not mean that one cannot make more complex the scheme over time, but it should have to be done cautiously and in a progressive manner.

Learning by doing.—It was clear at the beginning that use of such an instrument was very new for European actors, and such, the fact that a learning phase was proposed (the years 2005/2007) was important. This allowed different constituencies to discover the instrument, its potential advantages, as well as its difficulties. In a sense the period has largely been used to monitor accurately the perimeter of action that was defined, and perhaps a recommendation one can take from that experimental phase is that it is worthwhile to start by the monitoring and assessment of the perimeter covered by the ETS regulation, before starting the allocation process and the real trading.

Reducing the costs.—As soon as the ETS Directive was adopted, Commission prepared the so called “linking directive” devoted to allow actors to use credits generated by the CDM and JI mechanisms, allowing more flexibility for complying with the environmental objectives. Although there was a lot of discussion on the way these mechanisms should supplement actions “done at home”, one can consider this achievement as an important one in the design of the economic instrument itself. It allowed to embed the EU ETS system in a larger perspective, in line with the international agreements, recognizing in the same time, that reducing the costs of compliance was an integral part of the process.

Monitoring emissions.—Articulation of the flow of information between the company, national and EU levels, as far as the building of the CO₂ emission registries, have been an important piece of the functioning of the scheme. Together with the monitoring, reporting and verification procedures that were put in place, these features helped to build the necessary framework for gathering the necessary data to monitor compliance, and allowing transparency requirements for future allowance distribution process.

WRONG

The EU Emissions Trading System is a regulation that has been adopted through a compromise between the Commission, the EU Council and the EU Parliament. Although some of the features discussed hereafter were not part of the first proposals discussed, some of them were part of the compromise and it is worthwhile to mention them, as they seem to me critical for the design of a well functioning emissions market.

Length of the commitment period.—The relevant time frame of the EU ETS regulation had two major drawbacks: first the overall time frame was too short, second the period was decomposed in a trial period and the commitment period corresponding to the international agreement. Although one can understand that the trial period was necessary to start the system, the margins that were led to the EU Member States in deciding some implementation rules led to counteractive proposals, namely: no banking provisions from period 1 to period 2, except for two countries (that are now in the process to abandon it), re-opening of the discussion of the distribution of allowances between the two periods. One can discuss the reasons for this status of play, but it is important that in any future design, actors get a stronger visibility and predictability: longer time frame and predictability of the rules. As a matter of fact it is important to favor right conditions for future new investments.

New entrants and closures rules.—EU ETS directive specified that these provisions should be defined by the Member States in their national allocation plans. This led to different treatments of installations over EU, and behavior that could lead in the long term to non appropriate decisions as far as the reduction of emis-

sions are concerned. For instance, very often an installation which is going to be closed has to give back allowances non used (in an emissions trading system, keeping the allowances non used is an incentive to close an old installation and build a new one); a new installation should get allowances for free (on the basis of a new entrant reserve), often on the basis of its needs. These provisions were decided by Member States, because of the short time frame, and to avoid disputes based on competition arguments between incumbents and newcomers. However in the future, and on the basis on longer allocation periods, incumbents should be given the signal that they have to reduce their emissions on the long term (in the case they get free allocation, they should get less over time), and new projects (and/or new entrants) should have to pay their allowances, in order that CO₂ signal appears in the full investment cost, for taking appropriate decisions aligned with the environmental goal.

Reflecting the costs in the operations.—Many factors concurred to the fact that spot electricity prices reflected immediately the CO₂ price that appeared on the market. Although quite normal, this feature was not enough recognized by the actors at the start of the scheme and generated strong misunderstanding. Inherent volatility of the carbon price due to imbalances of allocation between the industry and the power sector, and differences of behavior between the two communities in front of this new market, led to a significant increase of the power prices. To alleviate this situation, one should pay strong attention to the realism of the targets set to the different sectors over time (in line with the investment cycles) and proper and harmonized allocation rules, especially to the new entrants.

RESPONSES OF BRUNO VANDERBORGH

RIGHT

The objective of the EU Emissions Trading System is to reduce CO₂ emissions from industry in a cost efficient way while fostering economic development and employment.

The EU ETS may form a solid foundation to this end:

1. The necessary European legislation and regulations are in place and implemented by all Member States;
2. Monitoring, reporting and verification of emissions provides reliable quantitative historical information;
3. The CO₂ market systems and tools are in place and operate in a competitive environment;
4. The CO₂ emissions trading market functions;
5. Reducing CO₂ emissions and improving energy efficiency are now firmly embedded in business strategies and risk management.

WRONG

Despite this solid foundation, the EU ETS building is not yet completed, therefore not yet sufficiently delivering to its objectives.

The main deficiencies are not so much related to the Emissions Trading Directive but rather to the method of allocation of emission allowances.

1. Allowance allocation based on absolute historical emissions by installations rewards pollution and punishes efficiency and early action;
2. There is no predictability for the medium-and long-term objective;
3. The international coverage is too small;
4. An absolute cap based on historical emissions and lower allocation to new installations freeze market share and inhibit innovation, investment and growth of economy;
5. The counterproductive allocation method causes intense lobbying, undue distortion of competition between sectors and companies and affects the credibility of the system.

What we need to make the ETS an effective and efficient system is:

1. A clear, simple, long-term (i.e. ~2030) objective for each industrial sector, equitable to the technical and economic potential to reduce emissions;
2. Based on CO₂ or energy efficiency performance, i.e. CO₂ emission per unit of output;
3. With a predictable path from current performance to the long-term objective;

4. With linking to similar CO₂ performance objectives and market systems in countries with developed and emerging industrial economies.

The global and regional burden sharing should be based on an international sectoral rather than on a national approach.

RESPONSES OF A. DENNY ELLERMAN

RIGHT

1. *An Initially Modest but Effective Constraint.*—The most important achievement of the EU Emissions Trading Scheme (EU ETS) is that a constraint and a price have been placed on about half of the CO₂ emissions from a region of the world that accounts for a significant fraction of global economic activity (about 10% of global CO₂ emissions). The initial ambition is modest, but the real achievement is putting in place a policy structure that can deliver the CO₂ emissions reductions that may be required. From the perspective of global climate policy, this is only a start but it is the most significant and promising development to date in a domain where grand ambition has often thwarted achievable result.

2. *A Multinational Trading System.*—This achievement is the more impressive in that it has been adopted by all 27 members of the European Union despite significant differences among the member states in economic circumstance and commitment to climate policy. The federal structure of the EU is far weaker than that of the U.S. and the differences among the EU's constituent nation-states are far greater than those among U.S. states. In fact, the East-West axis in Europe bears many similarities to the global North-South divide. As such, the EU ETS is a proto-type multinational trading system from which many lessons can be drawn concerning what attracts participating nations and how participation affects economic and environmental performance.

3. *A Replicable Approach.*—In placing a constraint on CO₂ emissions, the EU has chosen an instrument, cap-and-trade, that is more likely to propagate to other nations and thus to create a global regime for controlling greenhouse gas emissions than other instruments, such as taxes or assorted other policies and measures. The cap-and-trade approach is more promising because it allows the issues of equity and efficiency created by a CO₂ constraint to be dealt with separately at global and national levels and because the trade in the financial instruments thereby created closely resembles existing investment flows and trade in goods, services, and capital. This is not to say that propagation will be easy; only that it will be easier than by any other approach.

4. *Openness to Equivalent External Credits.*—In placing a price on a significant fraction of EU CO₂ (and greenhouse gas) emissions, the EU has recognized the essential equivalence of emission reductions in any part of the world through the linkage provisions of the EU ETS. This openness to equivalent external credits has provided a great impetus to project-based emission reductions in key developing economies, such as China, India, and Brazil, through the Clean Development Mechanism. In addition to familiarizing these nations with the requirements and institutions of emissions trading (and thus of what will ultimately be required of them), this openness to external credits provides the means for indirect linkage and eventual formal mutual recognition among the independently developed, “bottom-up,” national trading systems that may emerge.

WRONG

1. *An Incomplete Cap.*—The EU has chosen to apply the cap-and-trade approach to large stationary sources and to adopt other policy measures to deal with CO₂ emissions from mobile and small stationary sources. While multiple instruments can in theory be equivalent in cost, they rarely are in practice so that their use is inevitably inefficient. Even worse, alternative “command-and-control” measures have a tendency to overpromise and to under-deliver thereby adding ineffectiveness to inefficiency. Consumers who bear the ultimate burden of CO₂ limitation are unlikely to prefer to pay more for the abatement measures associated with their driving than for those affecting the electricity they consume at home, or vice versa.

2. *Repeated, Sequential Cap-setting and Allocation.*—In conformity with the Kyoto Protocol, the EU ETS has been set up in discrete commitment or trading periods in which the cap for the next five (or x) years is decided along the way. For instance, the cap for 2008-12 is currently being decided and the cap beyond

2012 is unknown. While there is not much doubt that the system will continue, this circumstance has created considerable uncertainty about longer term reduction requirements with consequent effects on investment. Also, the possibility that future allocations would be based on current period emissions may lead some firms to abate less than they would otherwise. A better approach would be to establish a longer term cap or schedule that is subject to review but which, barring later adjustment, would be the operational default.

3. New entrant and closure provisions.—A novel feature of the EU ETS is the set of provisions whereby new installations are endowed with free allowances from a new entrant set-aside and closed facilities forfeit allowances granted to them. While perhaps understandable from an equity standpoint, these provisions distort long-term investment decisions and create over-capacity. Older facilities that would otherwise be closed (and which are usually inefficient) are kept open if the value of the allowance endowment is greater than the losses incurred by continuing production at the minimally acceptable level. Endowing new facilities with a free allocation compensates the investor for all or most of the carbon costs that will be incurred and thereby keeps the investment criteria largely what they were prior to the start of the program. In addition, both provisions will tend to create excess capacity in the affected industry.

4. Limit on Banking.—The carry-over of unused allowances from the 2005-07 period into the 2008-12 period is prohibited and this provision has created a significant price disparity between 07 and 08 allowances that will lead to strange abatement behavior around the turn of the year as firms and traders arbitrage this price difference. Aside from this restriction, the EU ETS does allow complete intra-period banking and borrowing. This has resulted in very stable price relationships among years in each trading period and efficient abatement within these periods.

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