THE BROOKINGS INSTITUTION

DESIGNING A CAP-AND-TRADE SYSTEM FOR THE UNITED STATES

Washington, D.C.

Wednesday, November 4, 2009

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P R O C E E D I N G S

MR. EBINGER: Good afternoon, ladies and gentlemen. I'm delighted to have you here late in the afternoon. I'm Charles Ebinger, the Director of the Energy Security Initiative. We are very fortunate today to have some of the most distinguished climate change modelers and other skills that are at the cutting edge of the debates going on on Capitol Hill and will undoubtedly be critical issues as we hopefully move toward climate change legislation in the post-Copenhagen period.

I'm going to briefly introduce the speakers and then turn it over to Bryan Mignone who has been the director of this overall effort and is much better to tell you all of the intricacies of what the various scholars undertook than perhaps I am.

Let me first introduce Bryan. He is our former colleague from Brookings. We were very sorry to lose him, but he had the opportunity to become a Senior Policy Adviser in the Office of Policy and International Affairs at DOE. Previously he served in the Senate with Mr. Bingaman. He has an established background on evaluating market-based climate policies as well as modeling the efficient design of how we might ultimately have a U.S. carbon market. Then we also have today with us Carolyn Fischer who is a Senior Fellow at Resources for the Future. Carolyn has a most distinguished background writing on a wide array, you have the handout so I won't go into all the details, but writing on

a wide array of environmental and climate change issues. She has particularly investigated the implications of different designs for emissions trading programs particularly with respect to allocation schemes, and has also conducted research on CAFE standards, renewable portfolio standards as well as a wide variety of energy efficiency programs. Dick Morgenstern hardly needs an introduction having I think been mister environment and climate change adviser as well as many other distinguished posts in the United States government. He has a distinguished academic background as well being a tenured professor at City University of New York. He's taught at Oberlin, at Wharton at the University of Pennsylvania, American University and other institutions as well. Our colleague from Brookings Adele Morris is a Fellow and Policy Director for Brookings' Climate and Energy Economics Project. She is an expert on the economics of policies related to climate change, energy, natural resources, public finance, and has held distinguished positions in the U.S. Treasury Department and on Capitol Hill, and she was the Senior Economist for Environmental Affairs at the President's Council of Economic Advisers during the whole development of the Kyoto Protocol. Finally, Craig Pirrong is a Professor of Finance and Energy Markets and Director of the Global Energy Management Institute at the Bauer College of Business at the University of Houston. He was previously Watson Family Professor of Commodity and Financial Risk. Professor Pirrong's research focuses on the organization of financial exchanges, competition

between exchanges, commodity markets, the relation between market fundamentals and commodity price dynamics and implications of this relation for the pricing of commodity derivatives. If he can explain all that in the time he has, I will be delighted to be so well informed.

We again want to thank all the panelists for taking time to work on this project in terms of the formal research papers they have produced as well as their participation this afternoon. I will now turn it over to Bryan to continue the session.

MR. MIGNONE: Thanks, Charley for the introduction. I want to start off by acknowledging a few other people and institutions, again Charley, but also to Lea Rosenbohm who is our Project Manager at the Energy Security Initiative and to a variety of other folks who really made this event possible and got the papers to us in time so that you have them to read. And last but not least, the Energy Foundation that supported this work from its inception.

I should say a word about my role before I launch into the substance of this project. As Charley mentioned, I've been a Fellow at Brookings since 2006, but I recently as of September have taken a leave to go work at the Department of Energy, but I'm very thankful to them for allowing me to be here in my personal capacity today and to spend the afternoon with you sharing some work that I completed when I was at Brookings. Hopefully it's clear that what I'm saying today is not reflective at all of the Department of Energy.

Just a few words about the scope of the project. I want to say a word about what it is and what it isn't. We envisioned it as sort of a fresh look at many of the issues related to cap and trade design from a "academic perspective." I know sometimes that's a derogatory term in policy circles where it can mean useless, but hopefully you will not find that to be the case. What I mean by academic in this case is independent. Brookings as an institution does not take views, so this is an independent view of different issues from a variety of distinguished scholars on this issue.

How did we choose the topics? We focused on those that we thought could benefit from more independent analysis. Again, we're not representing the environmental community or the regulated industry community, we're essentially academic scholars here, so we wanted to focus on things that we thought could benefit from more of that sort of analysis. And of course we wanted to focus on things that could be or would be broadly relevant, and I'll talk about in the next slide the papers and topics that we chose and I think you'll agree given all that's going on on Capitol Hill right now that we guess pretty well in terms of what was going to be relevant. Finally, all the papers were written by the authors independently without any attempting among us to try to harmonize those views so that this is not a consensus strategy on what cap and trade policy should be. That's essentially what it is not.

Lest you think that this is an incoherent collection, I think it's a pretty good and quite coherent collection of papers. In my view they fit into two broad categories. On the one hand, you have the broad carbon market design features and that's the set of issues that go into establishing a carbon market. Then on the other hand, if you're successful in getting that market, it could perhaps be worth hundreds of billions of dollars annually, what does that for how you deal with the revenues and what does that imply distributionally? How do you manage that from a policy perspective? In terms of the ones in the first category, you'll see three papers available. One of them is about emissions reduction goals themselves. From a market perspective of course that defines the size of the market, although presumably it's derived from more fundamental environmental policy concerns. Secondly, the set of topics that are often lumped together into the idea of cost containment and I'll say more about that in a minute. You can think of this as a set of compliance flexibility provisions that are built in to policy. The paper out there is written by me as well. Finally, the third one in this category would be Craig Pirrong's paper on oversight of the derivatives market, and this is of course about the rules governing derivatives trading and how derivatives can be used to hedge price risk in carbon markets. Then in the final category, the allocation of allowances obviously is the major challenge so that Adele will talk about the incidents of carbon policy and the policy levers available to manage that. We've given the challenge of trying to present all of this in

10 minutes or less. Finally, a subset of that is specifically the design issues related to trade and competitiveness and how U.S. industry will fare under a cap and trade system. We'll go roughly in this order. I'll use my remaining 5 minutes to introduce my papers and then I'll hand it off to Craig, and Craig will be followed by Adele, and then finally we'll hand it off to Carolyn and Dick Morgenstern.

To introduce my first paper which is on emissions reduction goals, I think it's safe to say that there are a variety of perspectives on how to think about this. The paper takes a practitioner's perspective. It starts from the basic goal laid out in the 1992 Framework Convention in which it stated that the goal of international policy is stabilization of greenhouse gas concentrations at levels that would prevent dangerous interference with the climate system, the key words there being stabilization of concentrations and dangerous interference. That dialogue has not proceeded for many years. If you want a snapshot of where we are today, I would point you to the G-8 leader's summit from June of this year in which the leaders reaffirmed the goals of the Framework Convention and also committed to limiting the global rise in temperature to 2 degrees C above pre-industrial values.

The next step then is to try to translate that broad goal into something that looks like a global emissions path and ultimately a national set of emissions reduction pathways. The paper goes through the different steps that would take you from that broad goal to something more

actionable. I'll say a few more words about that today and then advise you to read the paper at your convenience. The point is that a 2 degree target, if you look at the science and you make some judgment about things like climate sensitivity, you can translate that global goal into a global concentration goal, in this case 450 ppm CO2 equivalent. There is of course some climate sensitivity, but that's a plausible translation from temperature to concentration. You can then do a similar thing going from concentration to emissions and that would get you something like a 50 percent global emissions reduction below 2005 and that's in fact what was also included in the G-8 pledge. There was one additional pledge for the G-8 countries to go to 80 percent below 2005 levels, or current levels.

I'm going to leave the rest of that for your own reading, and I want to introduce in my last 2 minutes the cost containment paper. This is obviously a topic that gets a lot of attention in legislative circles. In a broad way there's a point that's often made that I think is quite good which is that cap and trade as an instrument is in itself a mechanism of cost containment when you compare it to other possible ways of controlling emissions like command and control, and I think that's a viable and useful starting point. But when we talk about cost containment with respect to particular bills on the Hill we're talking about addressing a set of fairly specific market performance concerns, and in my view if you listen to the rhetoric that's out there you can lump them into two different categories. On the one hand, there are concerns over excessive price volatility in the

market, another is a broader concern related to the overall cost of policy and the uncertainty in that cost that we have going into a cap and trade program. You can couple that with the set of proposed mechanisms that are out there, things like banking and borrowing, offsets, price triggers of various sorts, and those are all papers in their own right, but the key question here is how do we take this set of mechanisms and map it on to the various objectives that we might want to achieve? That is the subject of my paper and it does that mapping step by step. I talk a fair bit about banking as borrowing as one way to shift compliance across time and to mitigate discrete cost shocks and to spread those shocks over time so you can think of this as perhaps the most straightforward way to deal with some of the price volatility issues in the main compliance market. Banking and borrowing are rough complements in this sense. One is there to deal with upside and one to deal with downside risk, but they are entirely symmetric from a policy perspective because borrowing obviously needs to be constrained in some way and so if you look to the bills, there are various ways of doing that that are listed there.

Then finally on the cost viability, I want to list some of the things that have been proposed. Obviously the safety valve is the one that has the longest history, but there are a lot of other ideas that have come up more recently and getting a fair amount of air time including the price collar and the reserve auction. The point here is that there's a fundamental tradeoff between the amount of price protection offered and

the amount of quantity protection and you need to tailor your mechanism to where you want to be on the spectrum, and then of course it's a separate question about the precise number that one might choose for such a price trigger. Again this is a taste of what's in the papers and I encourage you if you have time to read them and if you have questions that you contact me at my Brookings account and I'd be happy to follow-up with you offline about that. With that I'll turn it over to Craig and he'll pick up on the carbon derivatives theme.

MR. PIRRONG: Thank you, Bryan, and I'd also like to thank Brookings for including me in this project, it's very interesting, and also the financial support of the Energy Foundation was also very much appreciated.

What I'm going to talk about, surprisingly, my paper which has to do with derivatives and particularly carbon market derivatives and how to regulate those, what are the potential problems that might come up in these markets and what is the best way to deal with them.

First of all, just to talk generally about derivatives and what they are, I think you should have scary music or something come on whenever the word derivatives comes up, because they frequently have a very sinister connotation about them. First of all, they've been around for a very long period of time. There are examples of them in the Bible, for instance. But what's more, they're straightforward financial tools at root that are used to essentially allocate risk. One of the things about the

creation of a market, particularly a market for CO2, is going to be that that's going to create a price for something and it's likely that this price is going to be particularly volatile. It's going to be driven by a variety of different factors, overall economic conditions and so on, and so just like we see volatility in other commodity markets, energy markets, grain markets and things of that nature, we can anticipate that there will be considerable price volatility in carbon as well, and this is going to create a demand to manage those price risks. This is something that would arise in a CO2 cap and trade countries that wouldn't arise in a carbon tax system, so if you decide to go with cap and trade, then you're going to price risk and as soon as you create price risk you're going to create a desire to manage those price risks, reallocate those prices risks, and that's where derivatives are going to come in. Derivatives can come in at all degrees of complexity and in a variety of different dimensions. You can have very vanilla sort of plain standardized kinds of products, but also you can have relatively complicated products that are intended to achieve different objectives.

What I'm going to say here and what I say in the paper is directed specifically at carbon derivatives, but all of the issues that I discuss in this paper are a matter of considerable debate in policy circles right now in derivatives generally. Whether it's carbon or credit, the same sorts of issues are being grappled on the Hill in various pieces of legislation right now.

Let me briefly overview some of the main conclusions that I derive in the paper. First of all, I've already stated one of them, to create a market for CO2 where CO2 prices are going to vary and that's going to lead to a demand to have derivatives on those things. What are some of the potential legal and regulatory market performance problems that might occur if we have a derivatives market? The two that are most likely to come to mind are manipulation and speculation, and although frequently these things are considered synonymous in this town, that's not necessarily true. I think manipulation and speculation are distinct things and should be handled distinctly.

First of all, let's talk about manipulation. Manipulation typically is going to involve either the use of market power or fraud to distort prices in some way. This is a realistic concern in every derivatives market. People have manipulated markets through market power and fraud since these markets have been around. The Chicago Board of Trade started trading grain futures in 1866, in 1867 somebody tried to manipulate the market. This has been not unusual in derivatives markets. So that raises the question, first of all, are carbon derivatives going to be subject to manipulation, and second of all, what should we do about it? In terms of the markets being susceptible to manipulation, although some of the kinds of factors that make manipulation possible are not present in carbon markets. For example, in something like corn or copper you can exploit transportation costs for example to manipulate a market. That's

obviously not going to be a case with carbon. But nonetheless, there are frictions in the marketplace that could be used or exploited in order to manipulate. The extent to which this is going to be important is going to depend in some respects on market design. For example, borrowing and carryover are going to be factors that affect the susceptibility of the market to manipulation. How frequently permits are issued is also going to be a factor that affects the market's susceptibility to manipulation. But under any market design it's likely to be the case that market power manipulations in particular could occur.

There are two ways to address that. You can try to prevent them or you can try to deter them after the fact. What I've argued in my academic research for the past 15 years or so and which I echo, I haven't changed my mind, in the paper here is that prevention is inefficient and that ex post deterrence is the efficient way to go because manipulation leaves telltale tracks in the market in prices and so on that can be used to reliably detect whether a manipulation occurred, determine who done it, and under the appropriate legal regime and legal rules impose penalties that would deter this sort of conduct. I think for a variety of reasons this is an economically efficient way to go. It's like you reduce the type 1 and type 2 errors, false convictions and failing to get the people who did do something wrong, and also economizes on the resources needed to reduce this kind of conduct.

In terms of speculation, again it's quite commonly believed that excessive speculation is rife in commodity markets. I happen to be a skeptic about that. I'm doing a lot of research on that subject right now because it is a relatively hot topic. My conclusion is that a lot of the arguments about excessive speculation are logically unfounded, and besides that, they don't really comport with the evidence. So I think that it would be better to avoid focusing on that and instead focus on other kinds of issues that are more likely to be relevant such as manipulation.

Other important issues relating to market design are how should the products be traded. I think that this is extremely important because right now again derivatives are under something of a cloud in the marketplace and there is a great deal of suspicion about derivatives in general and particularly relatively nonstandardized customized kinds of derivatives. If you look at a lot of the legislation that is pinging around including the climate change regulation, but not just that, the kinds of things that are being written in the House and Senate Ag Committees that have responsibility over futures markets in the United States and in the finance committees, there is a strong desire to put as much trading as possible on exchanges, formal centralized markets as opposed to over-the-counter bilateral markets, and also to mandate various sorts of risk-sharing arrangements, particularly what's called clearing which a way of sharing the performance risk or counterparty risk that's inherent in any derivatives contract.

I think that the important thing to recognize is that particularly when you're talking about the kinds of risk exposures that folks are going to want to manage in carbon markets, it's highly likely that relatively nonstandardized customized products are going to be very important and that these are going to be necessary in order to achieve an efficient allocation of risk. This is important from a broader policy perspective because if you constrain the efficient allocation of risk, that's going to make the cost of CO2 mitigation higher which is not necessarily beneficial unless there is some offsetting benefit and I really don't see that in this particular instance. So I think it's generally the case that for carbon kinds of things in particular we're going to want to see risk extend over long periods of time, there are going to be interactions between different kinds of risk, for example, energy price risks and CO2 price risks and due to the inherent nonlinearity of many risk exposures, standardized kinds of products that are readily traded on exchanges are not going to be particularly useful for a lot of market participants. One thing that I think is particularly problematic are various regulatory proposals and legislative proposals that would penalize the development and trading of these kinds of products and that's why I'm skeptical in general and particularly in a climate derivatives context about imposing exchange trading requirements or clearing requirements or other things that make it more difficult or these sort of customized risk sharing arrangements to work. So that in a nutshell what I say in the paper and I encourage you to read it. Thanks.

MS. MORRIS: Thank you. It's a pleasure to be here today to talk to you about allowances and how to allocate them. This is to me one of the most interesting parts of cap and trade and probably one of the issues that could use a little more consideration of the underlying economics of it. As long as we're talking about economics, you have to have somebody showing a curve and talking about marginal this or that, so I don't want to disappoint you. This is an illustration of what's going on, why are allowances valuable and what determines how valuable they are.

This red curve right here that's sloping up is a marginal abatement cost curve and moving to the right is abatement relative to some business's usual projection. On the top is a dollar per ton of that abatement in carbon dioxide equivalent. So when you have a cap you're limiting how many emissions are allowed, and that's my green arrow there. How much abatement is really necessarily depends on what emissions were going to be without the cap. You never really know that for sure, but this is a way to illustrate that way of degree of stringency. So the amount of abatement that's going to happen as a result of that cap is the blue arrow there.

The total cost of abatement is going to be the area under the marginal abatement cost curve and that's the area of this blue-gray triangle right there. In the early years when your abatement is relatively small compared to the amount of emissions that's left, your allowance value is really high compared to the total direct cost of abatement. That's

what's going on in the early. When people up on the are arguing for allowances, they're arguing for their cut of this green rectangle which is how many allowances there are times the price of allowances. So the price of allowances reflects the cost of abating that last ton of emissions and the price of allowances is this P over here. I'm going to refer to these graphical elements several times in my talk, and by the end you'll be sick of it.

The key thing about allowance allocation and allowances in cap and trade in general is that the law says that firms have to surrender these allowances to EPA to cover their compliance obligations. That's the statutory incidents of the program. That's what the statute requires. But the economic incidents can be completely different. The economic incidents is who actually ends up paying the price on carbon and all the economic evidence suggests that that hot potato is going to land in the laps of consumers. Many in the short run shareholders might bear some adjustment costs especially if there is some capital that's not fully mobile, but consumers are going to bear that cost in large part right from the get-go. How is that going to happen? That's going to happen because the price on carbon is going to get passed along up and down the supply chain until there are the folks who don't have anywhere to go. Particularly in the short run it's hard for consumers to adjust their behavior and their spending patterns so that that hot potato lands on them. Shareholders may bear a hit particularly in the short run before capital can adjust, but I

would say that shareholders bear all sorts of risk. I think we've learned that in recent months. So the fact that shareholders bear risk, is not by itself an argument that you need to compensate them. They're not compensated for all sorts of other things that happen to them as residual claimants so that there may be some hit there. Estimates indicate that less than 15 percent of all allowances would need to be allocated to firms to make shareholders completely whole. But in the long run, capital markets are going to adjust, labor markets are going to adjust. This idea that workers are going to be thrown on the streets and it's going to be that way for the foreseeable future just simply doesn't comport with the way labor markets work. But the lesson in all of this is to keep in mind the long run and try to form expectations, start modestly, allow both capital and labor markets to adjust to you don't experience unnecessary short run disruptions. The more predictable you can make this policy the less you're going to have those disruptions.

As I said, firms are going to pass along those costs, but they're going to pass the value of carbon irrespective of what they pay for their allowances. If you think about, I was just in New York City yesterday and I took a taxi and it made me think of the medallion system for taxi drivers. There is a limited number of taxi licenses in the City of New York. To drive a taxi you have to have one. It's like you have to have an allowance if you're going to emit. If a taxi driver inherits their medallion, are they going to have an incentive to charge less for their taxi rides than

somebody who had to buy their taxi medallion? No. So what you're going to charge in the open market for energy and other retail goods and services is not going to be a function of what you pay for the rights to emit. You're not going to hear that story very loudly on the Hill. I think you're going to hear a lot of people saying they need the rectangle because they bear the blue triangle, but they may not bear either one actually.

There are a couple instances where firms aren't going to be able to pass that hot potato. One is if they're not allowed to, and I'm going to talk about that a little bit later. And the other is if they can't rise their prices because they have direct foreign competition and we're going to hear about that in the next talk.

The ultimate economic incidents depends on who gets that green rectangle. What can you do with it? You can give the allowances away free. That's going to benefit shareholders, and you could give it households, you can auction it all and give rebates to households. You could reduce taxes or you could reduce the federal deficit. Or you could just use that money to fund additional government spending.

How much allowance are we talking about? I showed you the green rectangle in the first slide. That represented the early years of the program where the allowance value greatly outweighed the direct abatement costs. This is what you get a little bit later in time. Abatement is a very significant share of businesses' usual emissions, so your blue triangle is much increased in size and your allowance value is also bigger

so that these values shift over time. You can see that as the cap gets really, really small, the allowance value is going to start shrinking and the direct abatement costs are going to be greatly expanded. EPA found this very phenomenon when they analyzed the Waxman-Markey bill, that's HR 2454. In the early years the allowance value increases as the carbon price goes up, but a certain point around 2035 to 2040, the total value of allowances given out each year hits a maximum and then it starts to go back down again. Even though the carbon price is going out, overall allowance starts going down because there are a lot fewer of those allowances and that shrinking quantity dominates the higher price of each individual allowance.

I just showed you the EPA results for allowance prices. I'm not going to pick a single value and tell you the allowance value is X dollars in present value and that's because there is a wide range of allowance values that have been estimated by modelers. So the EPA is down here. They have some of the lowest estimated allowance prices for the Waxman-Markey legislation. These are estimates. This is the Heritage Foundation, this is the National Association of Manufacturers. These ones in the middle, that's CBO, MIT and Charles River. Who's right? It depends on how things turn out and what materializes, which of the assumptions of these various modelers turns out to be correct. Whatever happens, unless you're at the EPA numbers down here, that

allowance value arc I just showed you is likely to be amplified and generally higher if carbon prices end up being higher.

If we want an efficient cap and trade system, that's means as Bryan said we need to choose the caps that balance the cost of action and the environmental benefits of action. I'm abstracting from that part of it. But you do want to minimize the cost of achieving the caps that you just picked and those come in two categories of cost. One is that blue triangle I showed you, the direct abatement cost. The other I didn't show on my chart and that's because I haven't figured out how to draw a picture of it. It goes like this. As that price of carbon goes into the economy raising the prices of all kinds of goods and services, the raises the real price level and real prices go up. That means the real wage has gone down. We already have taxes on labor so when you depress the real wage it interacts with existing distortions in the labor market and that creates an additional disincentive to work. That's called the tax interaction effect. It works on capital too. So this additional incremental distortion in the incentive to work and save that the carbon price induces on top of existing distortions actually can be really significant and it can almost double the overall cost of the program. So the blue triangle is not the whole story. This additional drag on the macroeconomy as a result of higher prices matters a lot too.

The good news is that we can do something about it, not that there has been much interesting shown about doing much about it. You can take that allowance value. If you auction the allowances, you've got a

fiscal resource. What are you going to do with it? You can use that to reduce other distortions in the economy. You can reduce other high marginal tax rates. We have economic evidence on what that incremental distortion is for different tax instruments. Or you could reduce the federal budget deficit, thereby reducing future tax burdens to service that debt and eventually repay it. The evidence suggests that if you recycle the allowance value in a way that reduces these other distortions, you can reduce the overall cost of the program by up to 70 percent. That's a significant opportunity to lower the burden to the economy of cap and trade. So I think Congress needs to pay a little bit more attention to that.

One problem though is who is going to benefit from those tax reductions? It's the people who pay taxes. Who are the people who pay taxes? It tends to be higher income individuals so that you have this issue about equity versus efficiency. You could give the allowances away free and require firms to pass that benefit on to consumers, and that's exactly what these bills do with the free allocations to the energy distribution companies, LDCs. The challenge though is doing that in a way that doesn't blunt the incentive of energy consumers to conserve energy. It's tricky. Energy bills are very complicated. I don't know how many of us really know what's a fixed cost and what's a marginal cost on our energy bills, and passing that benefit in a way that doesn't distort those incentives is tricky.

To conclude, I think probably the best approach is a portfolio as you use some of the allowance value to benefit the poor, protect them from higher energy costs that they can't afford. Use some of the allowance value to reduce those highest, most distortionary taxes. Use some of the revenue to fund research, addressing another market failure. And given our high budget deficit situation, use most of those allowance revenues to offset the budget deficit. That's my proposal.

MR. MORGENSTERN: Carolyn and I have been writing about the question of competitiveness and leakage and we have several pieces we're going to talk on. One is the nature of the problem, the other is the nature of the solutions, and in particular how some of the current legislation deals with the problems. So we've drawn straws and I do the problem part and Carolyn does probably the more fun part which is the solutions.

What's the problem? The problem is that when you put a price on carbon it's going to cause declines in certain sectors which could include lost jobs and output, and it could lead to increases in imports and/or foreign production. The energy-intensive import-sensitive industries are in fact the ones that are most vulnerable and that's because putting a price on carbon is going to increase their costs which is going to lead to a variety of market adjustments.

This isn't only about fairness and equity because you have the concern about leakage, and that is to say our goal here of course is to

reduce carbon emissions and if all we do is shift production from say the United States to some other countries, you really haven't achieved the environmental objective and of course we've imposed a lot of pain here in the United States. So the challenge is to figure out a way to be effective, efficient and fair in designing a carbon policy particularly as addresses the question of competitiveness.

I put this chart up here because there are three different carbon policies on this chart, but so far no matter how big you make it, I haven't been able to see the three lines. This is an EIA estimate and this is showing that the GDP effects of some reasonable package of policies are very small when you consider the aggregate. But in the same EIA report if you look at the impact on manufacturing, of course there is an impact and that's the problem. The problem is that some part of our economy is more adversely affected than others and hence this whole debate about carbon-intensive import-sensitive industries.

There's a lot of modeling that's been done on it. I've done some with some other folks, Carolyn has done some and various other colleagues have done some, so I'm going to report on a number of results here. Just about every model that's out there that disaggregates the economy can find that there are differential impacts on different industries so we can't ignore this problem because it's a real problem. The more you disaggregate the analysis and the more you look at the finer pieces, you find that some impacts are quite large, and the more you average it of

course the impacts are smaller. In general the short run impacts tend to be larger than the long run because in the long run firms have an opportunity to invest in new capital and new technology and new production processes and you see that the magnitude of the output losses or job losses, et cetera, tend to decline. Interestingly, profits in some of the work we've done recovery remarkably quickly so that that is kind of one set of findings that's out there.

This is a chart that shows you a reasonably disaggregated set of manufacturing industries. What you see is these are the output losses and as you can just take a quick glance, there is a lot of variability out there where some get hurt a lot more than others.

The nature of the impacts is in fact quite an interesting story and there are two different types of impacts that we care about. One is the effect that arises from lowered domestic consumption of products and this arises from conservation for example or shifting to less carbon-intensive substitutes, and the other is the effect on competitiveness and this is the idea of shifting to foreign production and this is what is typically involved in leakage. This is some work that was done by our former colleagues Joe Waldy and Billy Piser, but just about every paper out there shows very similar effects. That is to say that the effects on consumption are actually much larger in these energy-intensive trade-sensitive industries than the effects on competitiveness, and this is one particular set of results which is indicative. On the question of carbon leakage, it's

the increase in foreign emissions that is associated with the decline in domestic output, so if output goes down domestically and foreign emissions goes up, that's what we're defining as leakage. There are several sources of this leakage. One is the changing economic activity, changing production, and the other is the change in global energy prices. If you just think about this for a second in the case of oil markets, what happens? The U.S. emits less carbon and uses less energy. The international price of energy is going to do down, oil prices are going to go down, other fuel prices are going to down. That's going to encourage the use of more energy, more carbon-intensive energy in those economies which have not taken carbon abatement policies. So there's an effect that U.S. action itself while trying to lower U.S. emissions can actually increase foreign emissions through the use of the international price mechanism.

This is a chart from work that Carolyn has done that is very interesting. It shows that the bottom half of the chart, the green part, is the effect that we have from production changes, and the upper part, the red or the red striped part is that associated with changing production intensity. What you see is that for these energy-intensive manufacturing sectors there is a higher proportion of intensity change and a lower proportion of production change. And you see at the very top where you have the red stripes that there is a concern about the change in the foreign intensity of production which can be thought of this energy price mechanism.

At this point we've put together a list here which is the types of tools that are available to deal with this problem. On the top line we have what we call the best one which is global action, everybody acts simultaneously and in fact this is a very effective way of dealing with leakage. It's the most effective way. The next best category in fact includes the types of policies that are embedded in legislation that Carolyn will describe in a moment, but some form of border adjustment or some form of what's called output based rebates for the regulated entities and there are issues in each of these which she is going to go through.

Another element relates to containing costs and making sure that the policies are efficient. Bryan has already touched on that to some extent and of course other options which would involve for example exemption some people altogether or weakening the targets cut into the environmental integrity quite obviously of what's done.

I'm going to stop there, I think I'm within my time limit, and turn it over to Carolyn who is going to take you through probably the most interesting part of the story.

MS. FISCHER: Thanks, Dick. Dick started on some of the solutions, and I'll talk about the solutions and then some of the problems with the solutions.

Looking at this slide though, what we'll be focusing on are the two main alternatives that we've been talking about, the boarder adjustment proposals and the output based rebating for trade exposed

manufacturing. An important point to make is that with all of these alternatives here we an only deal with the leakage that arises from production shifting. There is nothing that we can do about the energy price related leakage short of getting a lot more people onboard and that's why it's so important to continue focusing on global agreements.

We see a lot of these proposed solutions in the legislation and the House bill under ensuring real reductions in industrial emissions, these are the policies targeted at the energy-intensive trade-exposed sectors. But we also see a lot of these other cost containment mechanisms so you have less worry about leakage and competitiveness if your prices are lower and your policy is well designed. We see a few things that do this. One is the heavy reliance on offsets which tends to keep the carbon prices quite low compared to trying to achieve those targets all on our own. Another is the allocation to the electricity sector that Adele mentioned, by keeping electricity prices low that's going to reduce some of the cost effects on manufacturing, and the other cost containment mechanisms that Bryan has highlighted in his paper. I should also point out that the complementary policies of R&D and investments in making it easier for us to meet these targets are also a cost containment mechanism and will limit the effects on competitiveness and leakage. I'm going to focus on the top point.

First, the emission allowance rebate program. This is a program that gives rebates in the form of allowance, allocations to eligible

energy-intensive trade-exposed sectors, and what's important to note is that these rebates are offered on the basis of production. They are not grandfathered lump sum like Adele was mentioning, they are given in the form frankly of a production subsidy, the more you produce the more you get. The eligibility requirements are trying to target those energy-intensive and trade-exposed sectors, so you have to be at least 5 percent energy or carbon intensive and 15 percent trade intensive or very energy intensive. The refining sector is excluded from this program.

The rebates are based on a sector average benchmark based on average both direct and indirect emissions for the industry. So they're trying to figure out what is the average cost increase in this sector going to be due to the carbon pricing and let's rebate that back. But importantly it's not based on a specific firm cost because you want to make sure that the firms still have that carbon price incentive to be innovative and find ways to reduce their own carbon intensity, and then they get a rebate purely based on their production and not based on their emissions behavior. Then the program is designed to phase out and is limited at about 15 percent of the cap. According to the EPA analysis, this program is effective and our analysis shows that it is likely to be effective, so they did a scenario with and without the output-based rebates here and we see that with the rebates we see a slight increase in the early years in production in the trade-exposed sectors so that it seems a pretty effective way of coping with the competitiveness, maybe even a little too effective if

we production going up as a result of the regulation. Of course it gets more stringent as we go along.

What are some of the controversies here? Because these output-based rebates are designed to support production, they're also reducing any incentive that you would have to achieve emissions reductions via conservation or finding less-emitting substitutes, so you have to be very careful to make sure that they're appropriately targeted. It it's overused then it's going to drive up the cost of the cap because to the extent you're not getting reductions through conservation, you're going to have to find them elsewhere and so other sectors are going to need to find them and their carbon price is going to be driven up. Our analysis indicates that just looking at the trade-exposed sectors there isn't that much influence on the price of the cap, a relatively small share of the cap and of output so that it doesn't have as big as an effect as the allocation to electricity. So one question is is eligibility even defined appropriately? Are we really targeting only the sectors that we need to? One point that we make in the paper is that energy intensity is actually a much looser criteria than CO2 intensity, and the latter is really what you want. You want to know how are their costs going to go up as a function of the carbon price. Energy intensity could include spending on natural gas as well as coal and those have very different carbon intensities and I think for almost all of the industries they meet that energy intensity long before they

meet a 5 percent carbon intensity. So their costs are going to up at least 5 percent, they would be eligible and you want a CO2 intensity criteria.

There are definitely practical challenges as well. The industrial classification is at a 6 digit level and that's fairly refined but there are still a lot of different kinds of products that are involved there and you have to be very careful because you're offering a subsidy based on whatever your definition of that product is. That's not something that's in the bill and that's going to be a big challenge for EPA to do it in a way that doesn't distort incentives.

One issue that could be fixed in the legislation is that the benchmarking is currently expected to be updated over time. I think part of the idea is you want to know that these industries are improving over time and have that reflected in a tighter benchmark. What the problem is is that some of these industries are so small, they're very concentrated and these firms are big enough to know that if I reduce that's going to affect my benchmark in the next 2 years and you don't want that. A much better way of doing that is to do it once based on historical data, get it done and then phase it down over time. You can expect energy-efficiency improvements over time, there's a phase-out anyway because of the 15 percent limit on the cap and the cap is being ratcheted down, so I think it would save a lot of time, energy and improve efficiency if the benchmarks themselves were not updated.

Are the allocations too generous? We saw output going up in the analysis and this may pose an issue for our trade partners. If the subsidies we're offering already were allocating 100 percent of average emissions, that means half the firms in any industry are go be getting a net subsidy from the program, that may not in trade circles, so it may be at least in early years a little hard to justify and you may make yourself vulnerable to WTO complaints.

The final question is is 85 percent of your trade partners engaging in climate policy the appropriate threshold to trigger a phase-out of these allocations? Again recall that you're trading off some efficiency by using rebating to try to level the playing field at home and abroad. If more of your trade partners have their own carbon pricing, then even much reduced rationale for engaging in this kind of policy and the question is is 85 percent really the right threshold. Just to give you a sense for these industries, the bottom two countries are NAFTA and then Europe, so already 60 percent or more of our trade partners are likely to be engaged reasonably soon, and then we have other annex 1, so it's really just the top countries, so the dark purple is Brazil, India and China which I think is what most people have in mind, but they're are only a fairly small share, they're significant, but they're not the lion's share in any of these industries.

Then the idea is gradually to phase from the rebate program into border adjustments, the idea being that with border adjustments we

can just target the countries that aren't doing anything rather than give rebates to everything we produce. Just to point out a few things, the International Reserve Allowance Program doesn't start until later and you gradually phase into it and it affects the same industries that would be getting their rebates, so it's not for every product, it's targeted toward the same energy-intensive trade-exposed sectors and there are a variety of ways that countries would be exempt from these products.

Of course, this program has its own controversies as well. WTO compatibility is not assured. There has been a lot of writing lately on speculation on whether this would be WTO compatible, a lot of people think it will be, a lot of people think it won't, and there may be a lot of conditions to meet, so we just don't know and it will have to be tried for anyone to find out. It's very unpopular in the trade community and it's not really clear whether it would function as a stick to encourage countries to participate or as a spoiler in negotiations and have them throw up their hands and walk away. We've seen evidence probably of both reactions.

But it also has practical challenges, trying to figure out the carbon content of foreign-produced goods, so when it's not in your regulatory jurisdiction, trying to figure out what that is is going to be hard, plus average emissions in a foreign sector could be very different from the emissions of a firm that exports to the U.S., and is it fair for a relatively clean exporter to be burdened with its country's poor average emissions intensity? There are a lot of open questions. The other point is that if

you're only adjusting for imports, you're not adjusting the playing field for exports either, and the U.S. is only market in the world that we compete in.

The final question is what is comparable stringency? Countries have a number of ways of getting out of the import adjustment and one of those is to be party to an agreement and to have targets of comparable stringency to those in the U.S. Does that mean a 17 or 20 percent by 2020 reduction target? Does that mean a comparable price? That's probably what the economists would argue for because then you're looking at comparable cost burdens. But how do we reconcile this with the notion of common but differentiated responsibilities since these policies are really targeted toward the emerging economies that aren't necessarily expected to have the same responsibilities in terms of climate mitigation? So how do we reconcile that in our policies? There are a lot of open questions here. I'm probably running short of time so maybe I'll skip over this but just point out that dealing with refineries is not an easy question. Right now they're getting a lump-sum allocation so that compensates them but that doesn't really do anything for competitiveness because it doesn't affect marginal costs. Maybe this is a sector where you want border adjustments to deal with competitiveness because it's really important to make sure that you send the right conservation signals to your transportation sector.

Finally, in the longer term, we have the questions of what to do now in the transition to make sure that our industry and our consumers

and our workers are not excessively harmed in the transition, but we have to keep looking for the long term because eventually all the major countries need to adopt some sort of meaningful climate mitigation policies. One option though is if economy-wide approaches aren't viable in all kinds of countries especially emerging economies, sector-specific policies may be an option, but then there are a lot of questions that will still need to be addressed in terms of evaluating the credibility of such approaches. Sector agreements are one way of exempting yourself from the border adjustments right now, so there is a lot of thought that still needs to be put into the design of such policies and measures. Thank you, and I guess we're going to panel discussion next. Thank you.

MR. EBINGER: I'd like to ask the panelists to come up. Bryan because of his official position has said he will not join the panel but would be delighted to be available for informal discussions after the session breaks up. We have about 20 minutes. Because of our limitation I'm not going to ask the first question. I'm going to go immediately to the audience. All we ask is that you please identify yourself, and if possible direct the question to one or several panelists, but try to be as specific as possible to who you would like to address the question.

MR. BAYER: Adil Bayer. I guess my question would be to Carolyn or Adele. The question is what about the verification mechanism. How do we make sure especially in post-Kyoto in your opinion to be able to count and verify all those quotas and all those emissions for all those

different countries and make sure that what they report in terms of their emissions is actually what it is and therefore their quota is calculated accordingly?

MS. MORRIS: I can take that. The Intergovernmental Panel on Climate Change has developed emission inventory methodologies that have been used for quite a long time report under the Framework Convention, and under the Kyoto Protocol they've been refined and there's an account system for emissions under that treaty. I think the inventory guidelines are pretty good and they're very clear, and there are oversight procedures where review teams come to each party and review how they've done their emissions inventory. So I think in general at least for developed countries the data is pretty good and there are reasonable checks and balances of ensuring the emissions inventories are solid. There are some countries that need facilitation. I think some of the developing countries have struggled with the data requirements of comprehensive emissions inventories, but I think the capacity has been building there for a number of years.

MR. BURDEN: My name is Jeff Burden at Georgetown University. When I was working in the Senate I worked on the acid rain provisions and Richard also I believe wrote on those. There was an op-ed in the "Post" a few days ago by a couple of EPA lawyers which was kind of interesting, and they were saying that the cap and trade made a lot of sense for acid rain because you were trying to get those emissions

reduced at the lowest possible cost, but in the case of climate change what you want is the price of carbon generated-electricity to go up. So how does cap and trade fit into that situation? And wouldn't a regulatory approach like renewable portfolio standards really make more sense if you're trying to increase the price of electricity that's generated by fossil fuels?

MR. MORGENSTERN: Don't forget we want to get a lot of tons reduced. That's the key point. So it's the cost per ton that we want to keep down, but we want to get the quantity of tons reduced to meet our established targets. I don't see any inconsistency between that. I think that if we end up paying too much per ton we're not going to be able to get as many tons reduced as we want to get.

MS. FISCHER: The component of the proposed legislation that would prevent electricity prices from rising is the allocation, so the question there is should we not have the large allocation to the electricity sector that prevents this price incentive for conservation. I should also point out that a renewable portfolio standard only encourages renewables. That doesn't distinguish between different sources of fossil fuel generation, so you really need that carbon price to signal the relative cost of coal versus natural gas and other alternatives.

MS. MORRIS: Finally, for every cap and trade program there's a price that emerges, for every tax there's a quantity of emissions that emerges. There's a pretty direct duality between the price and the

abatement, so they have different features, but I don't think you can say that you have to have a cap and trade to lower emissions and you can't say that you need a tax in order to affect prices.

MR. EBINGER: Yes, sir, in the blue shirt.

MR. YUTKIN: Joel Yutkin, High Road Strategies. This is going to be addressed to Carolyn and Richard on the competitive industries. Some colleagues have done some work on looking at competitiveness impacts of climate policies and we're still doing some stuff looking at Waxman-Markey and it's pretty compatible with your own findings although I think we work a little bit more at a disaggregated level at a handful of industries.

I have one question that Carolyn you raised when you talked about the concerns about the growing production and that might be encouraged, but in fact so far these caps start getting more stringent around 2020 and they start going down pretty rapidly, and after that if the industries keep on producing at a projected rate maybe driven by GDP or other demand which from the point of view of the industries here and the jobs here, this is a good thing and not a bad thing. Then you're going to start seeing a rapid rise in costs unless there are a lot of investments that take place in the meantime. I don't see how that becomes an issue if in a handful of years at the beginning the emissions rebate was designed to allow time for these industries to adjust because the investment that's required in these industries is not something that can take place right

away. It's going to take time before they can make the kinds of improvements in their efficiency that can offset sufficiently. I was wondering about your comment on that.

MS. FISCHER: You're right, it's more of a nearer term issue. I think primarily it does leave us vulnerable to critics in terms of WTO compatibility of the subsidy if what's being given is actually more than what's being asked of the industries. You're right, in the longer run it does start hitting a lot harder, but the expectation is that there is time to invest in new technologies and production methods, and also the expectation is that more of our trade partners would be engaged in similar policies so that the relative competitive effects wouldn't be as significant.

MR. YUTKIN: (inaudible)

MS. FISHER: Right. There's an important distinction there. The European option has been to grandfather allowance, so that is going through a benchmarking exercise but the allowances are not going to be given lump sum and not on the basis of production so that you'll have compensation for shareholders and stranded assets, et cetera, but it wouldn't affect variable costs or what generally determines your competitiveness. If you think in a longer run sense, firms there would lose their allowances if they completely shuttered, so there is a certain disincentive to moving the plant abroad. But it's a difference incentive mechanism. It's less likely to be passed on to consumers, but also it's less generous. It's not 100 percent of emissions.

MR. MORGENSTERN: By the Europeans have been reluctant to move in the direction of output-based rebates for a number of reasons. One can speculate what they are, but it does appear as if the way they've allocated the allowances or the revenues from the allowances at least up to this point have gone to the member states and that's made them more reluctant to move into this scheme which would have somewhat of an unpredictable outcome as to where the money to go, whereas with grandfathering it it's determined in advance.

MR. EBINGER: Yes, in the yellow?

SPEAKER: I'm just an interested citizen. One of the things that I think motivates a lot of Americans about this issue is our dependence on foreign oil, but if you just have a price on carbon, the carbon content of coal is much higher than it is for oil. Have we looked at the impact of just a blind carbon price on potentially making this country even more dependent on foreign oil even though we have coal?

MR. MORGENSTERN: There's been quite a bit of work done on that. Models have looked at different elements of that, and of course fuels, you mentioned coal and oil, but of courses there are other fuels that are less carbon intensive than oil like gas for example or renewables or a variety of others so the net effect is to move toward lower fuels. It's also true that oil at least as it's currently configured in the United States isn't really competing in direct use with coal so that oil is competing with other fuels. There is a theoretical concern and I think you're rising an

interesting point, but when you net it out in the modeling world, it's been shown to be pretty clearly leading to a reduction in emissions as well as oil imports.

MS. MORRIS: You can look at the EPA analysis of Waxman-Markey and what you'll see is that the vast preponderance of domestic abatement comes from the electricity sector. There's a teeny tiny slice of abatement that derives from oil so that the rhetoric around cap and trade as a way to reduce our dependence on foreign oil I think is completely overblown. There is no empirical substance to it transforming our dependence on oil in the lifetime of the policies. Part of that derives from the price and elasticity of demand relatively speaking for oil. It's a very efficient fuel for transportation, so what you're going to see is substitution away from coal into other ways of producing electricity and you're going to see efficiency before you're going to see a substitution out of oil according to these model results. You can argue with the model assumptions and so on, but if you look at that data that's what you'll see. If your primary concern is our oil dependency, I don't think a price on carbon is where you need to necessarily look for your solution. You might be arguing for an additional price on oil per se as opposed to other fossil fuels over and above a carbon price. That's a function of what you think the market is around that oil dependency.

MR. EBINGER: Yes, sir, over in the corner?

MR. DILLON: Robert Dillon with the Senate Energy Committee. Have you looked at the combined distortionary effect of the international and domestic offsets along with the banking and borrowing ability in the bills we've seen so far to actually incentivize not hoarding and not lead to actual cuts in the combined effects of those two together?

MS. MORRIS: I wouldn't call offsets a distortion. They're a cost-lowering tool. If you look in the early years in EPA analysis we spend depending on which model results you look at it more than six times as much on international offsets as we do on domestic abatement in the very early years according to EPA analysis. Of course, over time we're spending more on both and domestic abatement expenditure starts going up and eventually surpasses our spending on offsets. I think the way I look at offsets is as long as these offsets are credible and environmentally sound, we're reducing those emissions, we're just not doing it at home. It's a way of importing abatement, if you will. Is that a distortion? I wouldn't call it an economic distortion, I would call it a gain from trade. There might be other issues with offsets, but I think there is an important efficiency role for them.

MR. EBINGER: May I ask if we have any specific questions for Dr. Pirrong who hasn't been involved? Is there any specific question for him? If not, we'll continue. Yes, sir.

MR. HOPKINS: Jeff Hopkins from Rio Tinto. Not say that I didn't appreciate your talk. I think it is very important, but my main interest

is competitiveness. The statement about differentiating the consumption impacts versus the loss of domestic production impacts that you talked about, this is for Richard Morgenstern, the study you cited, the RFF study, I have a question on whether the models that we are using, that was an econometric analysis and I'm wondering if the adage general equilibrium models are sufficiently rich enough to tell us about the heterogeneity of some of these sectors where you have different costs for production in the U.S., different costs of production overseas. It seems to me that the leakage phenomenon is all related to can you pass your costs of production on. It seems like if you could help us to understand the difference between output-based rebates versus a border adjustment in the context because with an output-based rebate, it seems like in contrast to the border adjustment, with the border adjustment you're going to have a higher domestic price for a commodity. It pretty much allows you to pass your costs on, whereas an output-based rebate is saying you can't and here's compensation for your additional costs. The world price may not move and if the world price doesn't move, what's the impact going to be on consumption for that commodity? Probably none. In the context of this consumption effects versus production effects, it seems like output-based rebates and border adjustments will have very different impacts on domestic consumption because you're allowing the commodity price to shift.

MR. EBINGER: Let's get some comment on that.

MR. MORGENSTERN: There are couple of parts to your question. Maybe Carolyn will take one part of it, but one part that I'll start with, you asked about specifically the model results that I put up there that were the econometric results. In fact, some work that Carolyn and colleagues have done with the CGE model and some work I've done as well comes to a very similar conclusion so that there is this clear difference that most of the impacts in these energy-intensive industries are in fact associated with reduced domestic consumption. That's a pretty consistent result across several different modeling frameworks.

The second point you raised was the degree of disaggregation, and I tried to touch on that perhaps a little too briefly. That's a huge issue but it has small impacts. That is to say that the deeper you look into these sectors you find that there is some subsector that is having much larger effects. Some work I did a couple of years ago found that if you disaggregate at a 6 digit level as opposed to a 2 digit level that the differential impacts can vary by an order of magnitude so that there are huge differences out there.

On the output-based rebates, I'm going to let Carolyn take that one because she's a genuine authority on this issue. Do you want to jump in on that?

MS. FISCHER: First I'm going to disagree with you a little bit on the first one. Our modeling which is arguably to a high level of aggregation shows more variation and so for certain of the trade-exposed

industries the competitiveness is bigger than the consumption changes. So looking at a more highly refined sector level I think it's arguably quite possible that there are some sectors that really can't pass on costs so you wouldn't expect a consumption charge and the competitive impacts can be relatively large.

MR. MORGENSTERN: It does by vary by sector. I agree with that.

MS. FISCHER: The distinction between the output-based rebates, you're right. The point there with these rebates is they keep domestic prices from rising on those products. You're giving a subsidy to offset the cost increase and so you're trying to hold the price fairly constant so you're losing that incentive for consumers to conserve and find other substitutes and that's really the tradeoff. With the border adjustment, you allow prices to rise so that you incentivize your consumers to find other things. One of those other things is not going to be cheaper imports because you make sure that the imports are going to be just as expensive. So that's why there is economically a lot of attractive properties to border adjustments over output-based rebating because it allows you to maintain more efficient pricing at home. The problem is you don't have the export rebating you're not keeping the playing field level abroad and then you have thorny trade law issues that you arguably have less with the rebating. It also really depends over time. As the U.S. is going forward early without a lot of other folks besides the

European Union engaging in carbon pricing, then rebating can be a reasonable way of getting through the transition, but in the longer run when you have more partners, it may be inducing more distortions than it's fixing.

MR. EBINGER: Sadly I think we've reached the end of our session. I want to thank all the panelists for very provocative presentations and thank you all for coming today.

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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