FEDERAL TRADE COMMISSION

ENERGY MARKETS IN THE 21st CENTURY

COMPETITION POLICY IN PERSPECTIVE

SESSION 1

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P R O C E E D I N G S

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MR. SEESEL: Good morning, everyone, and welcome to the Federal Trade Commission's Conference on Energy Markets in the 21st Century: Competition Policy in Perspective. I am John Seesel, the FTC's Associate General Counsel for Energy, and I want to extend a warm welcome not just to those in this room today, but to all of you watching this conference on our webcast.

I especially want to say how honored we are to have Secretary of Energy Bodman with us this morning. We look forward very much to your keynote address, Mr. Secretary.

I will be uncharacteristically brief, as we have a very full program over the next three days with many fascinating speakers prepared to discuss a range of topics of critical importance to competition policy and consumers in the energy sector. Whether your main interest is the price of gasoline for your car, the price of electricity for your home or business, the many interesting directions that energy research and development may take, or the security of energy supplies for the United States and the world, just to name some of the topics we will cover, we expect the next three days to generate an absorbing and thought-provoking dialogue that may yield valuable insights into where the country should go in a number of key areas.

Before I turn the microphone over to Chairman Majoras, I just want to express my heartfelt gratitude to the stellar group of moderators and speakers who have contributed their time, talents and expertise so generously to this conference. I also want to thank all of my FTC colleagues who worked so hard to get ready for this week. Despite your very busy schedules, you all gave outstandingly of your time to organize the energy conference and to work with our moderators and panelists.

It is now my privilege to introduce Federal Trade Commission Chairman Deborah Platt Majoras, whose inspiration was the spark for this conference. With her strong interest in energy policy issues, and her dedication to continuing the FTC's historic function of exploring issues of significance to competition and consumers, the Chairman recognized that the Commission could use a conference such as this to allow a broad range of groups and individuals with a stake in U.S. energy policy to share information in one open forum.

As she stated when the FTC announced this conference, few issues are more important to American consumers and businesses than the decisions being made about current and future energy production and use. This conference will provide a forum for informed discussions and data sharing that will assist in fact-based decision making. I expect that we will hear many such discussions between now and Thursday.

Chairman Majoras?

(Applause.)

CHAIRMAN MAJORAS: Well, good morning, everyone, and thank you so very much. John, I appreciate everybody gathering at what is an early hour for Washington, I recognize. I want to welcome our participants, our live audience, and by all means those of you who are joining us through our webcast.

Many FTC staff members and most of all John Seesel, from whom you just heard, have put much effort into developing a program that addresses a wide spectrum of issues that are vital to energy markets in the United States and our consumers.

I am very grateful to our impressive line-up of speakers and moderators who have agreed to share their insights on the challenging issues we wish to explore, and I, too, extend my very special thanks to Secretary Bodman of the Department of Energy for being here to deliver our keynote this morning.

We focus together at this conference on a set of complex, multifaceted, and interconnected industries under the umbrella of energy. We are a nation on the move, and the energy industry is as essential to American consumers' way of life as perhaps any other. Energy issues permeate the decisions we make in virtually all aspects of our lives, where to live, what kind of home to buy or rent, what kind of car to drive, where to work, what products to use, where to take a vacation, how to do our parts to protect the environment.

In recent years, consumers have experienced the sting of price increases in gasoline, diesel fuel, home heating oil, electricity, leading some to conclude that we have a fundamental imbalance between supply and demand for energy products. And in the wake of the September 11th, 2001 terrorist attacks and major hurricanes, like Katrina and Rita, Americans have become acutely aware of the United States' reliance on the energy resources of other nations, some of them unstable, and even war torn, to sustain our way of life.

As Daniel Yergin, Chairman of Cambridge Energy Research Associates and one of our panelists today said when he testified before the U.S. House Committee on Foreign Affairs last month, energy security "requires us to look beyond the ups and downs of market cycles, both to the reality of an ever-more complex and integrated global energy system and to the relations among the countries that participate in it."

Dr. Yergin emphasized, however, that markets themselves should be regarded as an important element of energy security, and he cautioned that "governments would do well to resist the temptation to respond to short-term political pressure and micro-managed markets."

The recognition of the importance of markets to this vital sector of our economy brings us here today. The FTC is, of course, first and foremost, a law enforcement agency, charged with protecting consumers from unfair, deceptive or anticompetitive practices, and we have devoted significant resources to energy markets.

For the past 25 years, the Commission has reviewed all major petroleum mergers, for example, identifying over 20 that it believed would have reduced competition and harmed consumers, challenging them and obtaining appropriate relief.

During the past year, the FTC challenged and obtained relief for EPCO's proposed $1.1 billion acquisition of TEPPCO's natural gas liquids storage businesses, and for a proposed $22 billion deal whereby energy transportation storage and distribution firm, Kinder Morgan, would be taken private by KMI management and a group of investment firms.

Most recently, on March 14th, the Commission voted to challenge Equitable Resources' proposed acquisition of the People's Natural Gas Company, the sole competitors in the distribution of natural gas to nonresidential customers in certain parts of Pennsylvania.

And our recent settlement with Chevron of a case we previously filed to challenge Unocal's conduct saved consumers, we estimate, about $500 million per year.

Given the vital nature of the petroleum sector, we do not wait to receive notice of mergers or complaints about conduct. Since 2002, the Commission's economists have monitored wholesale and retail prices of gasoline to identify potential anticompetitive activities that might require greater investigation, and today this project tracks retail prices of gasoline and diesel in some 360 cities and wholesale prices in 20 major urban areas. And when requested by members of Congress and others, we examine retail pricing trends in other areas as well.

Our mission, though, extends beyond law enforcement. It is our responsibility to stand up for markets and champion competition, the surest path to ensuring consumer welfare. So, this requires two areas of additional action.

First, we engage in competition policy research and development which ensures that we base our policies on market facts. And second, we advocate for governmental policies throughout the federal government and in state governments that enhance competition and benefit consumers, rather than raising barriers and preferring special interests. It is unacceptable to, on the one hand, challenge the private sector for violating the antitrust laws, while on the other hand saying nothing while our own government considers implementing policies that potentially could do just as much harm to competition.

Last May, we delivered to Congress a report on whether gasoline prices had been manipulated in the years prior, for example, through tightening of refining capacity, and we also looked at whether gasoline price gouging had occurred after hurricane Katrina. Examining multiple levels of the petroleum industry, including refining and bulk distribution, we investigated various means by which oil companies might have manipulated the supply of gasoline to increase prices. We found no evidence that companies were engaging in this behavior.

As for post-Katrina price gouging, we identified

15 instances in which gasoline refiners, wholesalers or retailers met the definition of gouging set forth by Congress in the Appropriations Statute that mandated the investigation, but in all but one instance, local or regional competitive circumstances appeared to explain the price increases imposed by these firms.

That report followed on additional recent efforts that included a 2005 report on the factors that collectively determined gasoline prices, a 2004 petroleum merger report by our Bureau of Economics, and the Commission's midwest gasoline and western states gasoline pricing investigations from a few years ago.

What is critical is that we then used what we have learned in making appropriate enforcement and policy decisions.

After we released the 2006 report, critics dismissed the Commission's basic conclusion, that market forces, rather than illegal conduct, appeared to explain the bulk of pricing in this industry-clinging to the assumption that large oil companies must have been acting anticompetitively, but without providing us with any countervailing facts.

We will always pay careful attention to our critics, as we must, but without alternative facts, we cannot change our conclusions. And, of course, if we had found that illegal conduct was responsible for the price increases, that in many ways would have made things easier because we could just challenge the conduct, remedy it, and presumably fix the problem. But to have done that would have meant ignoring the facts and potentially harming competition to the detriment of consumers.

Our duty as responsible enforcers is to conduct thorough investigations and then present those results accurately and dispassionately. The challenge is that we have to distinguish between markets corrupted by anticompetitive conduct and markets that are functioning competitively, even when they are producing results that we may not always like.

In all of this work, the focus must remain steadfastly on the consumer. No consumer wants to pay more for gasoline or power, and it is tough to stick to a budget when energy prices go up and down and the bills fluctuate. But as the many consumer communications I received in the past year indicate, consumers can handle the truth about energy prices and supply, they just want to know what it is.

In the midst of last spring's run-up in gasoline prices, we augmented our Oil and Gas Industry Initiatives webpage with a recurring column in which we speak directly to consumers to try to help them understand what is going on in this industry.

Gasoline columns have addressed topics like the risk premium that world events can add to crude oil and gasoline prices, the impact of the hurricanes on supply, the way consumers can face different prices because they live in different places. We have seen a dramatic increase in the hits on our webpage since we added the column, and I raise it because, again, we have to focus on our public, and this conference, which is open to the public and accessible via simultaneous webcast, gives consumers a view as experts examine critical energy policy issues, and we hope that some are taking advantage. I know that Sara Razi's parents are, so at least we have got that.

As we explore the energy markets for our future, the stakes for consumers are high. As our economy expands, our population grows, our standard of living increases, our demand for energy inevitably increases as well. Some experts have estimated that over the next 20 years, U.S. oil consumption will increase by roughly a third, natural gas consumption by 50 percent, and electricity demand by 45 percent. And, of course, in rising demand, we are not alone as other rapidly expanding economies like China and India have developed correspondingly increasing energy needs.

And while markets typically respond well to demand, we cannot ignore the fact that energy markets are uniquely impacted by geopolitical considerations and federal and state government actions, like regulation and taxation.

The program we have designed for the next three days covering energy history, government policy, new technologies, consumer protection, global security of supply concerns, electricity restructuring, and more, reflects how many crucial and complex energy issues we face.

Several months ago when the FTC staff were planning this, we asked some prominent academics in this field to take a look at our agenda to see if they thought we were on the right track, and each said that they thought the agenda appeared quite timely, but somewhat ambitious. One professor who teaches a course in energy markets submitted that we were trying to cram his entire syllabus for a semester into three days time, but he then went on to add two more things to the agenda that we should put on that we forgot.

So, we know our agenda is broad and ambitious, but it is intentionally so. It increases the possibilities for insight and learning on critical issues, which I hope will enhance our understanding and analysis, including our understanding of future work that needs to be done. We want to assist policy makers beyond our own agency, if we can, and above all, provide information to the American public, as we tackle the policy challenges in energy markets in the 21st Century.

So, now it is my great privilege to introduce this morning's keynote speaker. Samuel W. Bodman was sworn in as our nation's 11th Secretary of Energy on February 1st, 2005, after unanimous confirmation by the Senate. He leads the Department of Energy with a budget in excess of $23 billion and over 100,000 federal and contract employees. Previously, Secretary Bodman served as Deputy Secretary of the Treasury, beginning in February of 2004, and he also served as the Deputy Secretary of Commerce beginning in 2001.

A financier and executive by trade, with three decades of experience in the private sector, Secretary Bodman skillfully managed the day-to-day operations of both these cabinet departments before coming to this department. By training and experience, the Secretary has brought an important set of credentials to his leadership. Solutions to the most formidable energy challenges facing our country and the world require highly and skilled dedicated people to confront problems in the realms of science, technology and finance, fields in which the Secretary's extensive grounding superbly qualifies him for this position.

I am grateful to him for his service and grateful that he has agreed to share our views with us today. So, with that, Mr. Secretary.

(Applause.)

SECRETARY BODMAN: Thank you, Deborah. I appreciate the chance to be here. I also congratulate John as well on the outstanding agenda that is before this gathering. I think you are all to be envied. I am sure it will be a real experience to participate in this event.

By working to ensure an open and competitive marketplace, the FTC promotes the twin objectives of protecting consumers and promoting choice. They do that while ensuring a fair and level playing field for American business. These are two paramount goals of any well-functioning economy.

Of its many important functions, the one at the forefront of my mind today, and probably in the forefront of everybody's mind today, and one certainly evidenced by this conference, is the FTC's long history of disseminating clear, useful and timely information to the American people, information that we all use to make decisions that impact our safety, our health, as well as our financial well-being.

As our economy continues to grow larger, as it continues to become more complex, and more globally integrated, the function of the FTC will only grow in importance, and in my view, it is particularly important in the energy arena.

Today, Americans have many choices when it comes to how to heat and cool their homes, how to run their businesses, and more and more, how to power their vehicles. They have many choices as well as how to improve the energy efficiency of their homes and their offices. And those choices should multiply over time, as new technologies and new and improved fuels enter the marketplace and offer cleaner, more affordable choices for consumers.

In fact, it is not really enough to say that we should expand or we should diversify the energy options that are available in this country; in reality, we simply must do so.

As the President has stated, the United States must take steps now, some of which are already underway, to ensure a future energy supply that is clean, that is affordable, that is reliable and secure. Such an outcome would undoubtedly benefit individual consumers, families, and businesses, but it would also benefit our national economy, the world economy, and our Earth's environment, and perhaps, more importantly, our national security.

In short, our energy security is inextricably linked to our national interest, and so, we must look to improve our energy security in the most rapid, most efficient and most equitable way possible.

As we have seen throughout the history of the last century or so, energy markets function most effectively and ensure the best results for the American people when they are open, when they are transparent, well regulated, and competitive. From domestic production quotas in the thirties and the forties, to import quotas on oil in the fifties, to price controls in the seventies, in my lifetime, we have experienced the negative consequences of meddling in the competitive marketplace when it comes to energy.

But, of course, we have also experienced the benefits of numerous policies that do work, energy efficiency standards for consumer products and vehicles, for example; a long history of successful energy research and development programs; and targeted tax incentives to support new technology development and to encourage commercialization.

I think it is fair to say that energy policies work best when they stimulate American innovation with positive reinforcement. I would argue that this is true on a global scale, as well. The United States, after all, operates in the world energy market. In order to increase global access to energy, be it from conventional or alternative sources, we need stable regulatory framework, we need open investment climates, we need adherence to the rule of law, transparency in decision making, and market-based pricing of energy resources, as we have seen moves to restrict foreign investment and increase the reach of state-run energy industries, limit access to capital and to the necessary expertise to access resources.

While this type of behavior may garner some short-term advantage for certain nations, in the long run, it deprives countries of productivity and prosperity. And let me be very clear about one additional point today: Attempts by market suppliers to interfere with or threaten to interfere with free markets and the free flow of energy in order to circumvent the role of the free market to set prices are unwarranted and inefficient.

These kinds of actions will hurt not only those nations that depend on the supply, both developed and undeveloped nations, but also in the long run will damage the interest and the global standing of the producing nations themselves. In order to effectively and efficiently settle issues of supply, demand and price, we need markets that are fair, open, and free of collusion.

In short, domestically, and internationally, an open and competitive market for energy trade and investment is essential to increasing energy security all around the world.

These conditions, not coincidentally, fuel the investment and innovation in the private sector that has always been necessary to solve our world's most fundamental challenges, and the energy arena is no exception.

Now, I am not suggesting that governments do not have a role here, they do, and quite a clear one. After all, energy is not just another product or commodity, as I said earlier, a stable, secure and clean energy supply goes directly to our well-being, our competitiveness, and our environmental health. In the effort to ensure this supply, the role of government is necessary, it is even critical, but in my judgment, it is not sufficient.

What governments can do is twofold: First, governments should supply the substantial funding needed for basic research and in some instances create incentives to push along the most promising technologies to commercialization; secondly, governments must provide the right policy environment to encourage investments at all parts of the energy supply chain and stimulate new research in the private sector.

To this first point, over the past several years, the President has proposed a dramatic set of increases for federally-funded research in the physical sciences. Aptly called the American Competitiveness Initiative, the President has proposed a doubling of the Energy Department's research budget over a ten-year period.

The Department of Energy, many people are not aware of this, is already the largest funder of research and development in the physical sciences in the world. The ACI should make us that much stronger. The initiative recognizes two fundamental truths: The first is that in order to maintain this country's economic preeminence, in an increasingly competitive world, we simply must maintain our scientific and our technological superiority; and the second is that doing so requires a substantial and sustained investment from the federal government.

At the same time, the President has laid out an aggressive strategy to reduce our nation's dependance on foreign oil by expanding the availability of clean, affordable, renewable energy. Known as the Advanced Energy Initiative, our goal is to identify the technologies that could have the greatest impact on the marketplace in the relatively near future, and then really to go after them with increased resources and aggressive timelines.

These are things that are already in the pipeline, and as a matter of sound public policy, need to be pushed more quickly to the marketplace. Let me provide a couple of examples. Just last month, I had the privilege of announcing the first two sets of federal investments under the Advanced Energy Initiative. They will advance our nation's alternative energy goals in two key areas, cellulosic ethanol and solar power.

First, the Department announced that we will invest up to $385 million for six biorefinery projects over the next four years. When fully operational, these biorefineries are expected to reduce more than 130 million gallons of cellulosic ethanol per year. They are right at the cusp of becoming commercial.

This product is ethanol made from a wide variety of non-food plant materials such as switchgrass and industrial plant waste such as sawdust or corn stover.

It is important to point out that this federal investment will be bolstered by significant industry cost sharing. The total investment should be more than $1.2 billion. This project will help our nation meet an important goal, making cellulosic ethanol cost competitive with gasoline by the year 2012.

Under the second set of grants, 13 projects focused on accelerating the commercialization of solar photovoltaic systems. These were awarded up to a total of $168 million in federal funding over the next three years. Again, I would note that these awards really embody the definition of public-private partnership. Over 50 companies, 14 universities, three non-profits and two national laboratories are involved, all of these organizations reside and operate out of 20 different states throughout our country.

And the industry-led teams will contribute over 50 percent of the total funding and expected investment of $189 million over and above the federal commitment. So, we are anticipating a total investment of more than $350 million over three years in solar power, a clean, abundant and renewable energy source.

And this is just the start. There are many more such projects underway. And I look forward to working with the Congress to aggressively push forward with these important programs. These examples illustrate one of the critical functions of government that I mentioned earlier, setting the right policy environment and incentivizing private sector investment in energy.

To that same end, let me provide a slightly different type of example. In his State of the Union address earlier this year, the President announced a plan to reduce projected U.S. gasoline consumption by 20 percent in 10 years. The so-called 20 in 10 Program. As a part of the plan to achieve this goal, the President called for increasing the renewable fuel standard to displace 15 percent of America's gasoline consumption by the year 2017, up to the equivalent of 35 billion gallons of alternative fuels.

Some have questioned whether this type of regulatory proposal is overly ambitious. Can the United States really produce that much alternative fuel in the next decade? To that I say, that is precisely the point. This is the definition of an aggressive challenge, and one which I believe we have a very good shot at accomplishing.

If we are to truly expand our energy horizons, then we must act and set the bar high. We must bet on technology, and we must signal to private investors that our policy environment supports sustained investment in renewable and alternative fuels.

So, government has a role, to be sure. And an essential element of that role is the active recognition that the real breakthroughs are likely to happen in the private sector. They always have in the past. In fact, I would argue that the possibility that private investment on the scale that is required, that it will not happen, is perhaps the biggest threat to our world's energy future.

Personally, I believe that that investment will occur, and we are already seeing results on that. As was mentioned, I have spent a good part of my career in the financial sector, and I can honestly say that for the first time in my lifetime, we are seeing the venture capital community of our country put sizeable amounts of money into energy. This is very substantial sums of funding, to the tune of more than $2 billion in the first three months, in the first quarter of this year. They are betting that clean, safe energy represents a new innovation frontier. They are not doing it for Sam, let me put it that way. They are doing it because they believe that there is a real opportunity to make money here.

In my view, when it comes to making public policy decisions regarding our energy security, the bottom line is this: The key to unlocking our energy future is ensuring that the innovation cycle continues at a rapid pace. And that will occur most efficiently and most effectively and most quickly when open competitive markets are functioning well, and supported with sound public policies that encourage the development of breakthrough technologies.

We must leverage the tremendous power of the private sector, while also making smart public policy decisions to unleash the world's best scientists and engineers on this problem. As I said at the start, this is not a question of just what we should do, this is a question, in my judgment, of what we must do.

We cannot let energy become a variable, a risk, a question mark in our nation's or the world's economy and security equation. We must take steps to ensure a reliable, affordable, clean and secure energy future. And I, for one, believe that we will do so. In fact, I believe we are already well on our way.

I want to thank the Chairman for this opportunity to come before you this morning, and I congratulate her and her colleague, John, on getting a terrific agenda set up for this and I am sure you will have a very productive conference. Thank you very much.

(Applause.)

MR. SEESEL: I want to thank the Secretary of Energy and Chairman Majoras for excellent opening and keynote speeches, and I would like to say right now we are going to take a short break of about 15 minutes and then at about 9:25 or 9:30, we will begin with our panel Lessons from History. That will begin at 9:30 and we will have a break until then. Thank you.

(Whereupon, there was a brief recess in the proceedings.)

MR. SEESEL: Hello, everybody, and welcome back. I would like to now take the opportunity to introduce our first panel of the energy conference, and it is my pleasure to introduce the panel on the subject of Lessons from History: How Did the United States Deal with the Energy Crisis of the 1970s? What Did We Learn?

For this panel and all of the others to follow, I will give the names of the panel members in the order in which they will speak. The moderator for this panel to my immediate left is Darius Gaskins who, among other things, serves as Chairman of the Energy Policy Research Foundation, previously served as Chairman of the Interstate Commerce Commission, and a number of other prominent government posts, and at one point, was the Director of the FTC's Bureau of Economics.

Joining Dr. Gaskins on the panel are Daniel Yergin, the Chairman of the Cambridge Energy Research Associates; Gal Luft, the Executive Director of the Institute for the Analysis of Global Security; Douglas Arent, the Director of the Strategic Energy Analysis Center at the National Renewable Energy Laboratory; and James Bushnell, the Research Director of the University of California Energy Institute.

Darius?

MR. GASKINS: Thank you, it is a great pleasure to be here, and I think I am the moderator of the panel because I am the oldest person in the room and actually lived through much of the seventies struggles over energy policy. We are going to hear from a distinguished group of four people today, with different perspectives on the problems that we face today and their relationship to problems of the past.

I have asked each speaker to talk about 20 minutes, with their presentation, and then we would like to entertain questions for about ten minutes on that presentation, so the audience gets a chance to interact when the material is fresh in their minds.

We will start off with the eminent guru of energy policy and energy history, Daniel Yergin.

MR. YERGIN: Thank you, Darius.

Ladies and gentlemen, I am very pleased to be here this morning to join this conference. I want to thank the organizers, particularly John and Chris, for putting together the program and putting together this particular panel, which does give us the opportunity to look and put a historical context around the issues that we are going to be talking about today.

I think, looking at the agenda, we recognize the importance of this conference. Energy is a big question. There is a recurrent history of disruptions, in the past, and no doubt in the future, that set the context for a lot of the controversy that surrounds energy. And so, to use this few days, as I think the Chairman said, to put a whole semester into three days is very useful for all of us.

The Chairman underlined the role and the importance of the FTC in the energy questions, with its focus on competition, ensuring competition, and protecting consumers. That is why it is particularly appropriate to bring this perspective to bear.

The Chairman's remarks also highlighted the importance of this agency in ensuring competition and protecting consumers. In addition, markets are economic systems that, unlike other kinds of systems, actually depend upon confidence. They depend upon trust, they depend upon credibility, they depend upon the quality of markets and how they work. And, so, it is very important in terms of energy markets to address these questions.

I was also struck that the Chairman put the international context around it, which is the kind of growth that we are seeing in the world. There are so many different ways to look at it. Today, about 40 million barrels a day of oil move around the world in tankers. Within 15 years, that could be almost 70 million barrels a day.

At CERA, we did a new study, called Gasoline and the American People, which has a lot of the numbers that cover the whole history of gasoline. But one set of numbers really seemed to me to summarize the global challenge that we are in, and that is the number of cars per thousand people. In the United States, we have achieved a state of nirvana, we have more cars than people to drive them. We have 1,148 cars for every thousand eligible drivers.

The other industrial countries are up there. Japan has about 600, France has about 700, Brazil has 137. India has 11 cars per thousand potential drivers, and China, nine. So, that tells you something about the growth in global markets and what an important factor that will be, and thus, why we need to keep that in mind and think in a global context as we look to the future and not just think in terms of the United States.

The underlying question for our panel is about markets, how well they work or do not work, how they function, and particularly in terms of energy, particularly in terms of oil, and to what degree can we rely on the workings of markets. These have been questions of acrimony and debate for many, many years. So, what we are going to try and do this morning, in our panel, is look at history and say what have we learned from history.

The Chairman pointed to some of those lessons of history and the FTC studies that underline them, and when I talk about the importance of the FTC, we recognize the importance of its role and the contribution and the dedication of the FTC staff to meeting this mission.

When we look to the history of energy markets, we can observe that actually markets are pretty effective, they respond pretty fast. The political response, however, can hinder economic responses. You pay a price that may not be immediately visible to consumers, but it is a significant price. There is much to be said for letting markets resolve problems. Yet it is often politically very difficult to resist the imperative or the pressures for intervention, and that is part of where part of this whole tension comes from.

Why? Why the recurrent focus on energy markets in particular? I think part of it just has to do with deep suspicion, suspicion of markets of supply and demand, how it works. You see that again and again. When I was writing The Prize, the history that I wrote of the oil business, I would see these same patterns repeat themselves again and again. And yet at the same time, I would see the power of supply and demand. There are, I don't know, hundreds, those who have read it, maybe thousands of characters in the Prize, but sometimes I think the only two characters who really count is one named supply and one named demand, because you see that that drives the situation.

But why the recurrent focus? Because of crisis, because of scale, because of size, because of international links, because the upstream operates to manage risk through consortia around the world, and further, and the Chairman underlined it this morning, the centrality to the economy, the ubiquity of energy, indeed, the visibility.

So, let's think about the historical context. A good place to begin is with the most famous antitrust case in history, and that, of course, was the antitrust case that was brought against the Standard Oil Trust, the very emblem of monopoly. It was on May 11th, 1911, in an somnolent, stuffy, oppressively hot courtroom not far from here that Chief Justice Edward White delivered the famous decision breaking up Standard Oil, applying the rule of reason. He said that the trust indeed engaged in restraint of trade and should be broken up, and indeed it was.

But what is interesting, this was actually before the age of gasoline, and certainly before the era of the gasoline station. Gasoline at that time was sold out of general stores. And what people do not know or often forget is that Standard Oil became this great trust, this great monopoly, as a lighting vendor. It sold lighting, and in fact, that business was in the process of being put out of business by the arrival of electricity.

In the years immediately after that is when we got into the age of gasoline, and it happened really fast. In the U.S., in 1914, there were 1.2 million vehicles; six years later, there were 9.2 million vehicles. Gasoline demand went up really fast. The earliest Congressional investigation of gasoline prices that I could find was in 1923 after a run-up in prices.

The Committee Chairman, Senator Robert "Fighting Bob" La Follette, predicted that if a few great oil companies were permitted to continue to "manipulate" oil prices for the next few years, the country would soon be paying a dollar a gallon.

As it turned out, within four years, motorists in Los Angeles were paying ten cents a gallon. Markets worked, and the country was on the way to a great surplus.

Let's fast forward now to the 1970s, and what happened, and what lessons to draw from it. Let me offer a clue, and that clue is comparing 1967 and 1973. In 1967, during the Six-Day War, the Arab oil exporters said, we will use the oil weapon, we will have an embargo. They implemented an embargo and it flopped.

Just a few years later, 1973, another war, embargo, prices quadrupled. What changed? What changed was supply and demand. What set the stage for the crisis? An extraordinarily rapid growth in global demand, a very tight market. By 1973, people were switching to oil because it was a fuel for economic growth, in Japan and many other countries. Also, by the way, for environmental reasons. Consolidated Edison in New York switched from coal to oil, wanted that clean oil from Nigeria to get away from dirty coal, as it was then.

So, you had a very tight market. In late September 1973, the Japanese prime minister said, we will have an oil crisis within ten years, he was convinced, and it came within ten days, and that was a famous shock. But it had two overlays that added to it. One was what today would be called resource nationalism, then maybe north/south confrontation, but the desire of the resource-holding countries to take back ownership of the concessions and to, also, change dramatically the revenue split.

The second thing, of course, was the Arab-Israeli conflict and the use of the oil weapon. So, as I said, prices went up, they quadrupled, and then just a few years later, the Iranian Revolution, it seems about every 25 years there is a crisis in Iran, 1979 and 1981, and oil prices doubled again.

What was the result? The result was what the head of the Federal Energy Office called a "one-time supply curtailment", otherwise known as gas lines, the iconic gas lines. And I think sometimes as we see the film on TV whenever prices go up, we see the footage of gas lines, that people remember the gas lines even who were only toddlers at the time, or may not have even been born, they had become so iconic.

And yet, and research by the U.S. Government including a report by the Justice Department, established that these gas lines were self-inflicted. They were the result of allocations and price controls. The Nixon administration put price controls on the general economy because inflation had reached 5 percent, and then kept them on oil and gas. So, what you had is gasoline in parts of the country where you did not need it, like the countryside, but not in the cities, so you could not buy the gasoline in the cities to get to the countryside.

So, what did you get? You got panic, you got the feeling of tertiary inventories, otherwise known as your gasoline tank in your car, and people went around from having one-third of their car tank filled, to two-thirds. States said, oh, you can only fill up with $5, so that meant people spent more time in lines. Some people, when they just were a little bit down, would go out and buy a dollar worth of gasoline so that the lines got longer. It turned out that gasoline lines begat gasoline lines, because you used seven-tenths of a gallon of gasoline to wait an hour in a gasoline line. So, you added another 150,000 barrels a day to the demand.

You had panic buying by companies as well. As one company said, 'We are bidding for our lives'. You had the rumors and the suspicion that there were tankers circling in the waters offshore. And you had innumerable investigation. And yet, how fast those markets shifted. The combination of market responses and policy decisions, fuel efficiency, the Alaska pipeline, the two big things, fuel shifting in the utility sector around the world and companies stepped up their hunt for non-OPEC oil.

It certainly left, though, that concept of gouging, "taking advantage of markets" -- not understanding the problems of service station owners who have to worry about buying fuel next week or next month.

Now, another example from the power side is the California crisis of 2000-2001. Here, too, we see the power of supply and demand. It is not the customary narrative that you may hear, but what happened? California was a state in a state of waiting for a crisis. It had estranged deregulation, deregulation of wholesale market, but not the retail market. It was set up in 1994 during a recession when people did not think about growth. Then you went into a period of very high growth.

California's economy grew by almost 30 percent, electricity demand by about 25 percent. But there were no new power plants, they could not be sited, and there were no economic signals to build them. And then you had the rest of the west and Canada being used as an energy farm, which is fine until the drought hit. So, it was a situation waiting for a crisis anyway, driven by supply and demand.

Now, what I want to do, in the last part of my remarks, is talk about a contrast that shows markets working and what we can learn from it. And that is not long ago. That is the summer and fall of 2005, Hurricane Katrina, Hurricane Rita, knocked out 21 percent of U.S. oil supply, 19 percent of natural gas supply, pipelines were down, refineries were down, electricity was down, and gasoline prices spiked steeply twice after the hurricane.

And the expectation, even for those who had not lived through them, was that the iconic gas lines were going to come back. There were rumors of shortage, a building of panic. We saw the pictures on TV of gasoline stations, lines beginning to build up. One of the ambassadors here from one of the Asian countries called me and said that she needed to leave the country and she heard that Dulles Airport was about to run out of jet fuel and how to get out of the country. I am not sure what I was supposed to do about it, but I said, do not panic. And what happened? There was surprisingly quick adjustment to what was, in fact, a major disruption.

The International Energy Agency's sharing mechanism, which was not designed for disruption in the United States, but was used for that, was used. Not in a big way, but enough to send a message, a clear message. "Do not panic". Two regulatory relaxations were made, one about the Jones Act and shipping, and the other about boutique gasoline. Supplies started to move around, decentralized decision making worked, and prices came down much more swiftly than people would have expected.

So, let me suggest the lessons: There is a lot to be said for not letting short-term regulation, ill-considered regulatory intervention, get in the way of markets responding with the ingenuity that they can bring.

So, one lesson is, in fact, the importance during disruptions or crisis of regulatory flexibility. We have to deal with the question of what is price? Price goes up, it is a packet of information, it tells people, "bring forth more supply". It tells other people to maybe car pool, consolidate your trips, take some of the pressure off demand, and maybe even think about what vehicle you buy next.

The FTC has to deal with it, the question of, well, what does this word "gouging" actually mean, and do you want to let prices in markets send signals or do you want to, in fact, accentuate disruptions?

There will be shortages and disruptions in the future. So it is important to have an institutional memory. I think it is important with appropriate antitrust safeguards to permit the exchange of information to understand where supplies and where disruptions are so that people can respond.

As the Chairman said, large, flexible and well-functioning markets are important for providing security by absorbing shock and allowing supply and demand to respond. And it is good to resist the temptations to intervene quickly, despite the intensity of political pressure, because these interventions, these pressures can backfire and slow the adjustment that you so urgently need during a disruption.

In conclusion, let me say, we will have future disruptions. We have a system, an international energy system for energy security that was developed in the 1970s and refined since then. We need to make two big changes. We need to bring China and India into it because of that global growth dimension, and we need to pay attention to infrastructure and we need to pay attention to the supply chain.

In this period now with high prices, there is a sense of vulnerability, because markets are tight, although not as tight as they were in 2004 and 2005. 2004 and 2005, they were tighter than they were on the eve of the 1973 crisis, but oil prices have less leverage over the economy.

We have had good growth, which would not have been expected necessarily a couple of years ago. There is a lot of geopolitical risk out there, and will continue to be. We have seen it with Iran. Iran probably in the two weeks after they took the prisoners of the British sailors and Marines, plus some changes in the U.S. gasoline market, tightness as the spring approaches and summer, Iran probably made an extra $200 million because of price going up during those two weeks. And there probably will be more crisis with Iran, or with other countries.

I want to stress that there is risk there, and that is why it is very important to have this conference and to be thinking about these questions.

But as a final point, will these market conditions last forever? We can point to the China factor, which is a very powerful factor on all commodity markets, and will be followed by the India factor, and that that is something that is going to be a very major part of the overall global equation for some time.

Something I do not agree with, which is this kind of spirit now of the end of technology, that this time it is over. I have heard that before. We heard Secretary Bodman so effectively talk about the drivers of technological change in the energy picture. But there is this sense, too, that people feel markets will not respond. But when I look out and see what I have called the "Great Bubbling", all of the effort that Secretary Bodman spoke about, in terms of new technology, all along the energy spectrum, I think that that will have more of an impact. Shirley Jackson will be speaking about it in her remarks and it is something that she has focused on. That is a very hopeful sign.

So, when people say we are where we are and markets are not responding and we are in an era of permanent shortage, I think of two things: I think of history, the history that I have just outlined. And I think about how markets work. And so when people say markets will not respond, I wonder.

Thank you.

MR. GASKINS: Now we have time for some questions specifically to Dan. As the moderator, I want to ask him the first one, and that is --

MR. YERGIN: I thought I could sit down.

MR. GASKINS: You can stand there or you can sit down.

My question is, given your historic perspective, how would you evaluate the various government policies that we now have towards corn-based ethanol? Do you think that this is a program that makes sense in terms of the history?

MR. YERGIN: Is that a leading question?

MR. GASKINS: No, I would not say that, it is just an honest question.

MR. YERGIN: Okay, okay. Well, it turns out there is a long history here, too, a much longer history than I think people know. I think you know very well it is driven by a number of different imperatives. At the end of the day, ethanol has replaced NTBE in the gasoline pool, and I think that we will get up to about 10 percent of gasoline coming form corn -- based ethanol. But there are very definite limits in terms of corn-based ethanol.

You see it with livestock growers and dairy farmers, you see it in the tortilla crisis in Mexico. And so, the boundaries are there. Markets respond sometimes faster than you think, and we are getting a pretty fast response on ethanol, corn-based ethanol, and I think getting up to the limits. We can sort of see about 10 percent of the gasoline pool is probably about as far as we can get. Maybe about a million barrels a day.

One hears ethanol described in terms of billions of gallons a year, and I would urge, to get it into a comparative framework, to divide by 365 and 42 to get it into a million barrels a day, to kind of see the impact, and we are probably, what, this year we will have, maybe half a million barrels of day of ethanol in the pool. But there is absolutely no definite limit there, and as with other things that happen with markets, it may be coming faster than might be thought.

DR. JACKSON: Dan, as usual, excellent remarks. Can markets themselves help to restrain or mitigate geopolitical risk?

MR. YERGIN: The question is, can markets themselves help to restrain or mitigate geopolitical risk. I think so. I think if they are large, flexible liquid markets, that can absorb the body blow, and then adjust to it, yes. If markets are more balkanized, there is less flexibility, more rigidity, it is harder for them to adjust.

It is a question, we will need to ask, as the

LNG market grows larger, and as we go -- although talking about energy independence -- from importing about 3 percent of our natural gas demand in the form of LNG to maybe 25 percent by 2020. That will be a question that we will have to ask. But I would say the flexibility of markets, the ability to move supplies around with ease, if you are going to be part of global markets, is part of the insurance policy of those markets.

AUDIENCE MEMBER: Dan, one of the interesting phenomena that has taken place over the last couple of years is an attempt, both by the Congress, the so-called NOPEC, and also these various court cases that kind of extend the U.S. antitrust philosophy of views towards sovereign countries to go after OPEC or various entities, and I am just wondering whether you have given any thought to what the implications of these things they are attempting to do are.

MR. YERGIN: I think the relations and the importance of the relationships with exporting countries that are part of this global market is something important. The quality of our relations with those countries is also part of our energy security. It is a part of our overall formulations. And I think the courts have ruled that these are sovereign countries, and therefore, you cannot apply this in an extraterritorial fashion.

I think it is complex to, at one time, be pursuing these issues in courts, and at the other time, asking these countries to invest, expand capacity, open the door to further investment. So, I think these kind of initiatives really do have to be seen in the context of the overall relationship. There is a reason for sovereign immunity because of complexity of the overall relationship.

In the back?

MR. SLOCUM: Hi, Mr. Yergin, I am Tyson Slocum Director of the Energy Program at Public Citizen. You indicated that the problem in California was an issue of supply and demand and that had only California liberalized the retail sector as they did the wholesale sector, then I think the crisis would not have happened.

MR. YERGIN: Well, that is only part of what I said.

MR. SLOCUM: Well, the City of San Diego actually was fully exposed to the wholesale market for several months, and so, if you had a wholesale liberalization of the retail market and you had the manipulation of the wholesale market by companies like Enron, that were intentionally taking power plants off-line, do you think that is an adequate pass-through in a functioning market?

MR. YERGIN: Well, as I said, I think that you should start with supply and demand, which is a state when you have your electricity demand grow by almost 25 percent, no new capacity, you cannot build plants and no price signals to encourage the construction of plants, very difficult to site plants. Therefore, the strategy is rely on the rest of the west to solve your problems, and then the climate intervenes and you have a drought, you are going to have a problem.

So, I think people extrapolate from what is happening at that particular time, and in 1994, there was a sense of recession, and no one really thought very much that there would be the very rapid growth.

Yes, sir?

MR. GRAMLICH: Rob Gramlich, American Wind Energy Association. I wonder if you agree with the view I have heard Thomas Friedman express, the New York Times columnist, that the democratic movements globally move sort of in a negative correlation, I guess, to oil prices, and so, now we are seeing higher oil prices, we are seeing reverses from the democratic movements in places like Russia and other countries.

MR. YERGIN: There are many factors that go into that. I think you can look at other parts of the world as well. There is an economic cost to high prices, there is also a geopolitical cost, and I think we are seeing that geopolitical cost. We do not have to look only to the eastern hemisphere, we can look to the western hemisphere and see that.

There is quite a spectrum among countries that are exporters of oil and gas, and so, I find it a little hard to generalize, just as I find it hard to generalize about national oil companies, which people are doing, because it is a whole spectrum. But, look at Iran. Iran made $19 billion from oil exports in 2002; in 2006, they made about $60 billion. Clearly what happens with prices affects their international posture.

AUDIENCE MEMBER: Just picking up on that question, and this is not a political question, but an economic question, a lot of focus obviously on the war in Iraq, and withdrawal and withdrawal dates, et cetera. Can you tell us your view from the perspective of the oil markets, the impact of the present war in Iraq, the impact of potential withdrawals in the very near future, military withdrawals, and what that all means for world oil markets.

MR. YERGIN: Well, I have not looked in a few weeks, but I believe Iraq's output is, and maybe somebody in the room knows, it is still below what it was --

MR. LUFT: 2.2.

MR. YERGIN: 2.2. Its output and its exports are 1.9, something like that.

MR. LUFT: Yes, exports, 2.2.

MR. YERGIN: So, there were expectations in some circles that Iraq would be six million barrels a day, you know, very high numbers, and I think even if there was security there and large scale investment, there are long lead times there. And some of the fields have been damaged over many years and would need to maybe even have their output brought down before they can be brought back again.

So, Iraq is not on the side lines, but its reserve position is much greater than its position in the marketplace.

AUDIENCE MEMBER: So, does that argue that really would not be, from an oil perspective, an international market perspective significance?

MR. YERGIN: There would be great interest once one could invest with security and put one's people in with security, and I think you would see companies from all over the world, in very interesting groupings, coming in together to try and develop that.

I think the Iraqis are advancing in terms of their oil law, but they will be wanting the same kind of terms that other countries want as well and are seeking.

So, I just think you are not likely to see a quick spurt in output, you might see some increase, but it really needs a five or six or seven-year investment time horizon to start to achieve a kind of potential that it has not achieved really for many, many years.

AUDIENCE MEMBER: And if I could follow up, there is no significant impact on the flip side? If let's say we withdrew and the security situation got worse and that affected the oil fields, would that have any impact?

MR. YERGIN: In Iraq -- and Gal maybe will address this -- if there was a chaotic situation and output went down, that would be reflected in the market. There are several things you could point to.

If you are saying what is on the agenda to watch, it is Iraq, Iran, Nigeria, and of course, what happens with hurricanes. Those would be what would be among the top risks.

MR. GASKINS: Take one more question.

MR. GOLDBERG: If you fast forward 20 years from now, are we going to be facing a natural gas OPEC?

MR. YERGIN: That's in today's news. You do not have to look out 20 years from now, and maybe we will get into more discussion. I think it is a different market. I think you will have, in one way or another, an association of gas exporters. They already have it. It is inevitable that they will do it.

One thing that is different between LNG and the oil market is that LNG is a very capital intensive business. Out of, let's say, a $6 billion investment over $5 billion would really be in the upstream and in the tankers. And, so, I think that creates a constraint of its own.

Also, you have a lot of pipeline gas around the world. So, I have trouble envisioning an OPEC-like structure, but I think the gas exporters, as we move towards global prices, they will all be paying attention to what their competitors are offering.

One thing that is also worth noting, you may have seen, I think it is in today's paper, the story that windfall profits are kind of dissipating that were much talked about, and again, this is kind of how things respond, which has gotten much less attention, and this is affecting oil along with everything else, is that while prices have gone up, costs have gone up dramatically, too, to develop an oil and gas field, a major project today. We at CERA and IHS have created a new index, and those costs are 64 percent over the last 30 months. So, I think that the timing of LNG developments and many other things are affected by these increases which reflect a tightness and a shortage of people and equipment, and which will also take some time to respond and bring forth those kind of new supplies. So, thank you.

MR. GASKINS: I think that the last two questions are a good segue into Gal's presentation. So, Gal Luft.

MR. LUFT: Good morning, everybody. Thank you again for this production. When you talk about history and the relevancy to the future, it seems that nothing is really changing. I remember just before the invasion of Iraq, comparing the newspapers back in 2002 and '03 to those of 1916, and the same questions of who is going to control Kirkuk and Mosul, and now you read the newspapers today, threats against oil shipments in the Strait of Hormuz and resource nationalism, and it makes you think that things do not really change that much, particularly when it comes to oil, because as long as we are dependent on oil to the degree that we are, and we will be dependent for a very long time, we will be interconnected with the peculiarities of the Middle East.

I know that a lot of people have invested a lot of efforts to pacify this region and to make it more stable and more secure, trying all kind of methods. All of them really came to some very poor results, and we are today then experiencing in Middle East that -- I do not think anybody could make the argument that the Middle East today is more stable, more secure, more hopeful than it used to be.

So, to me, perhaps the main lesson that I could draw from the 1970s is that we need to almost factor in, into our future calculation, that the Middle East will continue to be a problematic area. I think that particularly in the past five years, and there is no question that our relations with the Muslim world today leave much to be desired, that really have an impact on energy, our energy behavior, energy needs, because by the end of the day, almost 75 percent of the world oil reserves are in the hands of Muslims, and that is not going to change as long as we are dependent on oil.

Now, the Middle East and the Muslim world are changing, and I am being asked all the time, you know, what does it mean, for example, for the world after the energy market, that the Sunnis and the Shiites are killing each other and they do not like each other and all these divides that we see happening? There is a subtext there as well, and even though Sunnis are the majority and Shiites are only about, what, 15 percent of the Muslim world, if you zoom into the Middle East, you see that -- or to the areas of the Muslim world which really matters, which is the Persian Gulf, you see that the Shiites are 75 percent of the population.

Furthermore, if you look at the control over reserves, or, in other words, you see the places in the world with Shiites actually happen to live, they live on top of 45 percent of the world's oil reserves. So, all these things that happen geopolitically are important, and the subtext here, when you have a growing divide between Sunnis and Shiites and a Shiite order is threatening to challenge what we call the Sunni order, there is an economic subtext there, and we need to understand that this subtext will have some impact on us as well.

One other thing I think that has happened since the 1970s is that energy producers have sort of gotten a taste of their own medicine in the sense that they lost their appetite to use the oil weapon the way that they did in 1973 and 1974, which was with the exception of Russia's latest gambit, we did not see any attempt since 1973 to use the oil weapon in a way that it was used in the form of an embargo, a prolonged embargo. Even though there were some very nasty things happening in the Middle East, 1973 was not the last Arab-Israeli war. There was an invasion of Lebanon; there was an infantada; there were all kinds of some very tense moments, and yet we did not see any attempt by Arab countries to re-use the oil weapon.

Now, what does it mean for the future, I am not so sure, because energy markets are all unfortunately not free markets, and unfortunately, when we talk about the old seven sisters, you know, today we know that they are the seven dwarfs, and the real players in the oil market are the governments, and governments have this nasty tendency, as Barbara Tuchman very eloquently wrote about, have a tendency to act against their own self-interests sometimes, including our own U.S. Government from time to time, but that is something that we need to sort of almost take as a given, that from time to time, countries may decide to do things that we look at it and say, "How could they be so stupid?"

Even if they do this, I think that the implications for the oil market will not be as catastrophic as they were before, particularly because countries that sell oil need oil revenues, and they are heavily dependent on these revenues to sustain a very large body of very fast-growing population.

What I am much more worried about is the emergence of a new cast of characters that are beginning to play a more important role in global energy markets, and these are the non-state actors. These are the characters that did not exist back in 1973. In 1973, we had a bunch of governments that sat on the spigot, and they decided that from a certain point, there would be less supply, and they did it, and if they kept it going for a while and then they resumed production, and that was all history.

What we are seeing today is somewhat a very different phenomena, and Dan Yergin just raised the issue of Iraq. I want to tell you that one of the reasons that Iraq is not producing the 5 or 6 million barrels of oil -- and there is no real reason why they shouldn't, because Iraq, after all, sits on a huge pile of conventional crude, there is no problem of reserve, most of the country has not even been explored -- but the reason that we see such poor performance coming out of Iraq is because we have had a sustained campaign of sabotage against the country's production facilities, pipeline, refineries, and pumping stations, you name it in an attempt to make sure that two things do not happen to them.

Number one, that the country does not attract investment, and without investment you cannot really do anything; and number two, to make sure that production is kept low so that oil prices continue to remain high. What I'm referring to is the tendency of the Jihadist movement today to look more and more into using economic tools, what they view as economic tools, to advance their agenda.

I'm saying that based on hundreds of communications that we have intercepted from Jihadist website, from bin Laden, Abu Musab Al-Zarqawi, you name it, all of the membership of the Jihadist movement talking day and night about the fact that part of the strategy to prevail in what they see as the war against us, against the west, is to use what they call economic Jihad, and the notion of economic Jihad basically says that if you want to bring down a super power, you go after its economy.

Now, one of the things that they tried to do on 9/11 is to fly planes into economic targets. That becomes very difficult today with our security, with the INS and the FBI and everything that we have done since 9/11, but what is very easy to do is to go after oil targets. All you have to do is just pack a few pounds of explosives and get a few camels and go to somewhere, some pipeline out there, and blow it up, and then you see the next thing, you have oil prices go up, and you get sort of instant gratification.

When we looked at the world market, I think it was end of 2005 -- or just beginning of 2006, sorry, and we looked at how much oil is actually being lost as a result of politically motivated sabotage? These are not thefts; these are not things that happen in Africa when somebody goes and steals a few barrels of oil just to sell it on the black market. This is politically motivated sabotage.

The numbers then were at times edging on 1 million barrels a day, as in 1 million barrels a day that was lost from the market, because people who were politically motivated made sure that this oil would not reach the global market. It served them very well in the sense that it drives all the prices up, so when oil prices go up, more money flows to a government or countries where you have a large constituency that support the Jihadist causes, and then the money sort of filters down their way, and more important, the west is getting weaker and poorer, and our economy is bleeding.

Now, I am saying this is not a fringe phenomena, and it is something that we can live with today, but I want to take you to one of those moments in history that the world could have held its breath, and that was in

February of 2006. In one week in February of 2006, the week started with a declaration of war in the Niger Delta by a group called MEND, the Movement For Emancipation of the Niger Delta, took about 200,000 barrels off the market, a series of attacks, kidnapping, et cetera, and that was the beginning of the week.

Two days later, there was an attack on the al-Askari Mosque in Iraq, the Golden Dome Mosque, which is arguably one of the most holiest of places for the Shiites, and the thought at the moment was that this is going to spark a civil war in Iraq, and even the 2 or 2 and a half million barrels that Iraq is producing might disappear from the market.

Then happened something very interesting, which I believe was not coincidental, the choice of the date that it happened, because it happened a day after the attack on the mosque in Samarra. Two suicide trucks drove into Abqaiq, a processing facility in Saudi Arabia, in an attempt to damage the facility, and Abqaiq is one of the largest processing facility or the largest processing facility in the world. It is a strategic location in Saudi Arabia, and Saudi Arabia is the source of our spare capacity. It is an important producer, and if something bad happens there, it affects the entire market.

Now, why am I so interested in this case? Not because of the fact that there was a terror attack against an oil installation; it happens all the time. I am interested in this case because these were actual suicide bombers. These were people who were willing to sacrifice their lives -- not to kill westerners, not to kill Saudis -- they were willing to sacrifice their lives to take oil off the market. These were economic Jihadists, these were oil kamikazes, who were willing to do something that we cannot even understand for an economic motivation.

Now, we were very lucky that week, but what would have happened if we had had a successful attack against a place like Abqaiq or Rastinora or any of the big facility in the Gulf? What would have happened instead if one of those Boeing 747s that crashed into the World Trade Center, we would have had today a Boeing 747 crashing, taking off Dubai or, I don't know, one of the near airports, and crashing into Rastinora, for example?

That tells us that we are dealing with a very different type of threats. It is no longer the government actors as much as the non-state actors that are calling the shots today, and it is true for the oil market, it is true for anything else, it is true for, you know, a guy like Hassan Asmala, you can make -- or Osama bin Laden, you can make the case that they are making Middle East policy more than the King of Saudi Arabia or Hosni Mubarak or Oyo El-Dormid or even George Bush.

That is something that we need to realize is going to be with us as long as the motivation is there, and we need to find ways to protect ourselves in the sense that we create alternative liquidity mechanisms to those that we have today, and we have not done that, with the exception of the United States has built itself a pretty robust strategic petroleum reserve, which is one of the good lessons of the 1970s that we have some cushion in case something happens, but the rest of the world needs to follow suit.

I mean, it is not enough that we have the reserve if the rest of the world -- particularly in the developing countries. I mean, we often forget about the developing countries, they are the ones that are suffering the most when something bad happens in the oil market, and many of those developing countries still have debts that go back to the 1970s that they have not recovered from.

We need to realize that we have some responsibility in building this kind of liquidity mechanism, and we cannot only look out for ourselves. You know, I applaud President Bush for saying that he wants to double the strategic petroleum reserve and increase it from its current 700 million barrels to about 1 and a half billion barrels in about 20 years, but what I need to hear more is how do you see things work for the rest -- are we going to use this reserve to help Nicaragua or other countries in our neighborhood? Are we going to -- how is it going to work? And this whole notion of global responsibilities I think is what we need to see more of, in the sense of it is one thing that we need to protect ourselves, but we need to also remember that we have a role in stabilizing global markets as well.

What probably we will see is that as countries take note, they will see that, well, you know, nobody wants to be underinsured, and more and more countries will invest in their own strategic reserves and begin to buy oil and put it in the ground, and hence, creating additional demand in a market that is already quite tight. China is beginning to do it; India is beginning to do it; the Japanese are expanding; the Europeans; everybody is now getting quite nervous. Now, it does not look like a lot of oil, but when it adds up, when each country buys a little bit of oil to stick it underground, it adds up to quite a lot.

There are things that we need to do other than that to increase our ability to sustain the kind of shocks, because, you know, it is not that shocks are going to stop our way of life. There is always a cost to these things, but you need to have a certain level of stability, and you need to have also an ability to sustain what we call the American way of life, which is so heavily dependent on oil. I mean, if you think about your carrots and your cucumbers and your food, everything is so energy-intensive. You know, any food item on the table travels about over a thousand miles, using petroleum.

One of the things that really amazes me that we failed to do since the 1970s, if you look at our electricity sector, one of our great achievements is that we almost do not produce electricity from oil today. We did in the 1970s. So, when Jimmy Carter said, you know, wear a sweater or turn off your air conditioner, it really made sense. You saved oil. If you saved electricity, you saved oil. This is over. We have willed the power sector for oil.

Therefore, by the way, a lot of people, when they talk about, "Oh, we need to reduce our dependence on oil, and, therefore, we need to build more solar panels or wind turbine," this is nonsense. These things have nothing to do with oil today, totally separate. If you want to displace coal, that's a good idea; if you want to displace gas, that's a good idea, but solar and wind and all these things that are talked about are very nice, but not in the context of oil, even if, by the way, we move to electric cars.

So, the important thing is that what we do today is to begin to move to a transportation sector that is less oil-intensive, and if we produce cars today that can only run on gasoline, which is exactly the cars that we are putting on the road today, and assuming that the car today that comes on the road and will stay on the road for about 17 years, that is an average life cycle of an American car, that means that we are locking ourselves to petroleum for the next 17 years.

So, the single most important thing I think we need to do is to make sure that the cars that we put on the road today have a capability of running on something other than gasoline. Gasoline, too, diesel, too, but also something else. Whatever that something else is, I do not care. It could be ethanol, it could be methanol, it could be electricity, it could be bio-diesel, but if we continue to sustain a system, maintain a system in which the only transportation fuel that can play in the marketplace is gasoline, we are preparing ourselves -- we are going face a major problem in the future.

I think that fuel choice is something that is very much in line with the American thinking, and it is something very much in line with the values that the Federal Trade Commission is trying to promote, which is competition. It opens the door to competition. Today, the transportation sector is a monopolistic sector, because there is only one commodity, one beverage that can feed all the cars, and that needs to change.

Thank you.

MR. GASKINS: We have time for some questions.

AUDIENCE MEMBER: I was wondering, I have been surprised that I have not seen in the papers since the Iranians kidnapped those sailors that perhaps the reason -- I have been a little surprised that I have not seen in the papers that somebody's suggesting that the Iranians kidnapped the sailors in order to raise the oil price a few bucks. I was wondering what you think about that. It sounds like you would think that might be behind their doing it.

MR. LUFT: I cannot explain the Iranians behavior. I think it was not for that reason. I think it was maybe more of a way to test the resolve of the west. It is more of a test balloon. I do not think that they did it for economic reasons, another half a billion dollars or quarter of a billion dollars. That is not going to make Hammadi Ajad happy, but I think that they really needed to see if we are -- if west as is resolved as it is, as tough as it is. I think that they pretty much learned that we are not interested in the fight, and there will be a follow-up.

MR. GASKINS: Other questions? Yes, one more.

MR. SLOCUM: Hi. First, I think it is critical to have more vehicles run on alternatives. Do you think the market will be able to implement the infrastructure necessary to provide those alternatives? And what do you think about increasing fuel economy standards as another goal?

MR. LUFT: I'm not so sure what is the infrastructure requirement for a flex-fuel car or to retrofit a pump to serve alternative fuel. It is something that has been going on. Oil companies have been retrofitting their pumps. They have done it several times for even when they move from one fuel to another.

Electricity, for example, plug-in hybrids, certainly do not require much of an infrastructure. So, the infrastructure challenge is only a challenge if you talk about things like hydrogen, which I am not particularly a fan of, but other than that, as we can see in other countries that have introduced alcohol fuels, China is now setting aside an alcohol standard; they are doing methanol. Here in this country, we are more interested in ethanol, but whatever you decide to do, a pump is a pump. To retrofit a pump, it costs you about $20,000. This is something that can be easily offset through some tax credits if the Government wants to help, but even without that, it can happen once you have the market beginning to build up.

The problem is that you need the cars. All those things will follow once you have the chicken. The chicken is the cars. The cars need to be able -- once you have enough cars out there, there will be people that will say, "Okay, I have millions of cars that can run on methanol or ethanol. Why not build a plant? Why not --" and then the gas station owner will say, "Okay, I can retrofit a few pumps here so I can serve the fuel."

But if we do not have the cars, if we do not have the flex-fuel mandate, then everything that we are talking about will be theoretical. You know, the Secretary of Energy can invest as much money, but -- in selling losic ethanol and all this, but if you do not have people that can buy it and use it, it will not amount to anything. We do not want to be in a situation where we master a technology to produce a fuel and then we wait 15 years for the cars to come.

CAFE should be part of the equation, but I am not very clear whether the efficiency gains are really there and whether the politics for CAFE is really here. As you know, there are some severe opponents of this approach in Congress. The head of the Energy Committee in Congress is very opposed to it. I think that there is a lot of talk about it. I do not see much progress when it comes to a CAFE standard in the coming Congress.

MR. GASKINS: Thank you. I think we are -- Doug, do you want to talk to us about future energy prices?

MR. ARENT: Thank you for inviting me. It is a pleasure to be here, and thank you for bearing with us through the first morning. I think these are the first slides that you are going to see of the first few days, so hopefully they are of interest, and we will go through them relatively quickly so that there is time for Q&A.

I am going to take a slightly different bent and think about both the drivers as well as maybe a bit longer term history. So, let me walk through this.

I am at the National Renewable Energy

Laboratory. We are one of the Department of Energy's federally funded research and development centers, based in Golden, Colorado, and I lead the analytic group there that looks at techno-economics, for lack of a better term.

I think we heard about the enormous challenges of the energy sector this morning, both from the Chairman and the Secretary. This slide merely articulates that in a cartoon where I have tried to capture the three principal drivers that the Secretary, in particular, talked about this morning: energy security, productivity, and environmental impact.

I think historically, when we think back -- and I will challenge you to work through this for the next three days -- that we have tended to derive policy and think about particularly one of the stools of this triangle, one of the legs of this triangle, and not all three of them. I think our challenge today is to recognize that we need to find solutions that provide a better balance and need to address each of these three drivers and not one solely, and certainly not one at the expense of another one. Clearly the piece of uncertainty and risk we heard about this morning, and that is clearly the driver here, is that we will need private investment and significant amounts of it to address the energy demands of the future.

Let me just put up two charts to think about how large that challenge is, and I like to put up numbers because I tend to come from a quant group, and we are a bunch of analysts. So, this just is providing a little bit longer historical perspective, not quite from 1970, but back from 1850, and it is global energy consumption in exajoules per year, and you can see that we have actually grown by about an order of magnitude -- actually more than an order of magnitude -- up through 2000, where this chart stops, and it keeps growing from there, and it is about 450 exajoules per year, and you can see the breakdown in terms of gas, oil, nuclear, hydro and biomass.

Maybe more interestingly is to take a look at least one future scenario, and there are many of these, and "many" meaning probably 100 or more. Many of them have different sets of assumptions that go into them, and so my guidance, at least for myself when I look at these, is to ask the critical questions, what were the assumptions that went into this output?

So, this one in particular comes from I'll call it a pragmatic economic approach from Exxon/Mobil. They talk about this in their public presentations, and I just show this as one example. It is the combination of population growth, and here you can see both OECD and non-OECD; along with GDP growth, and you can, again, see that broken down in terms of OECD, non-OECD; and then the total, which is at the top, 2.8 percent, and that is per year going forward. You can see that that is actually quite exponential if you look at the graph.

Then what does that mean for energy demand? They have translated all this into million barrels of oil per day, and if you translate that into exajoules, you are actually looking at something like a doubling of global energy demand between now and 2030. It could be 80 percent; it could be 100 percent. Again, it depends on the assumptions that are going there.

The point here is that the challenge is enormous, and it is not all domestic. In fact, most of the growth in energy demand is in non-OECD countries.

Now, media team? Somebody from the media team here?

(Pause in the proceedings.)

MR. ARENT: Let me talk to you a little bit about the -- I want to take an example of the U.S. electricity capacity additions -- and maybe some of you have these slides, I am not sure -- but I have got a graph together of looking at from 1950 through at least early 2004-2005, and the interesting part here -- and you are going to spend a lot of time looking at the electricity sector -- is when you look at the history of coal plant additions, natural gas, nuclear, and, in fact, even if you look at alternative energies like wind and solar, et cetera, the graph, I think the first take-away is that it is not very smooth. In the 50s, a lot of coal was built, some gas; in the 70s, continuing coal, some gas, and a fair amount of our first nuclear plants were all built up.

There was actually then an interesting law put in called the Power Plant and Industrial Fuels Act. Maybe some of those with the graying hair remember that, in 1978. It basically eliminated the ability to approve power plants that were fueled by petroleum and natural gas. So, you then see a commensurate decline particularly in natural gas, petroleum we heard about already, and that continues.

Then you have other such regulation and acts like the Clean Air Act and how that impacted coal, particularly, you know, around 1980, and that decrease, pretty significantly all the way through in terms of annual average capacity additions, through to last year, or a couple of years ago, and now you start to see many more coal plants on the books than were previously in the last couple of decades.

Natural gas, on the other hand, having gone through a very low period of capacity expansion, essentially went through the roof, and many of you will remember this, back in 2000, this was a combination of both a change in the production in -- and the Power Plant and Industrial Fuels Act, as well as PURPA, which I have not mentioned yet, but I will, some combined cycle efficiency improvements, clearly driven by -- perhaps mostly from the aeronautics industry, and then deregulation really moving forward.

In 2002, 63 gigawatts of natural gas plants were added to the U.S. marketplace. Regretfully, a couple of years later, most of those sat idle, but it is a pretty telling picture, and it -- I guess the take-away there is that policies actually do enable markets -- sometimes you might call them drive markets -- and so one needs to think very carefully about that.

Today, just to keep it in perspective -- and I know you will go through this in some detail -- coal provides about 50 percent of our electric power; gas, 19 percent; nuclear, 19 percent; hydro, 6 and a half percent; other renewables like wind and solar and biomass, about 2.5 percent; and oil, remarkably, petroleum products, still 3 percent.

In fact, if you look at the number of plants --

and these are EIA statistics -- petroleum power plants are number two. There are still 3,750 of them in our base. They are not used very much. Most of the time they are used only as peaking plants. That is because they have pretty severe restrictions on their emissions, and the companies have to pay pretty severe penalties when they use them and emit. The number one, of course, is natural gas; there are a number of hydro plants; and then, of course, coal.

More interesting, late last night, sitting down thinking about what is on the books coming forward, interestingly -- and I do not have this graph up here -- but natural gas plants actually planned natural gas, and that does not mean they will actually come online, are actually going to continue pretty severely in the ten to 20 gigawatt-per-year range, at least according to EIA statistics, and, in fact, if you look at the next couple of years, you will see very little coal, but coal three and four and five years out will grow substantially, and that has very significant implications, both in terms of domestic supply, in terms of pricing, and in terms of emissions.

Now, I have three graphs that I really want to show you because they are really significant, and they all come down to the bottom line of we are really bad at predicting the future. So, the point there is that when we make policy, when we think about policy, when we think about regulation in the marketplace, one, I think we need to understand and talk to our colleagues who really do pay attention to history, because there is a lot of lessons in that history and a lot of knowledge. Two, what we think we might know about future forecasts of pricing, regulation, investment environments, I think we need to be -- how should we say -- wise enough to second-guess ourselves and to really think, what are the mitigation factors and the mitigation angles that we need to think through in terms of alternative future scenarios?

She is working hard at this, so hold on one second. Are you ready? Thank you. Here we go, great.

Here is the graphic that went along with my description. I am going to glance through it real fast because we need to move on in time, but you can see this on the website; it is also up on our website. Here is one of those forecasts. This is the 2003 dollars per barrel of oil, and you can see the EIA forecast there on the black lines by year, and principally what you see is that we are not very good at forecasting oil prices.

Let me repeat this for you, because it is not unfamiliar territory, gas prices were probably -- we are not very good at predicting those either, and, in fact, that red line here, and also down on the oil graph, stopped in 2003, I would have to regraph this to deal with the current spikes well past $10 per MCF, and I have not done that yet. So, just take this. This is just the message and not the detail of current work.

Coal pricing, interestingly, is also not very good, particularly back from the 1980s through, we are maybe a little bit better these days, but you can see that the graph is starting to inch upward, and I think that there is a lot of new demand on the coal market, and you are going to see some discrepancies between what we think we know and our future scenarios and what the real pricing is.

So, what is the message there? And I want to turn a little bit from to renewables, because I come from a renewable energy lab, so I know a little bit about it. I would ask you to just stare at the screen for a second and I am going to build a slide with different density. This is a national map of the average solar energy resource, which is impinging upon the U.S. Dark is a higher resource, i.e., more sun hits it. You can see that is pretty obvious in the Southwest.

Let me build on this. Concentrating solar power, that is what CSP stands for, so that is the direct normal radiation from the sunshine, something that glares at you when you drive. Here is wind, and that is a general map, not a detailed map, and there are many details here that we are just glancing over here. Then there is biomass, which, of course, has grown pretty ubiquitously around the country, and then there is geothermal.

So, the point of this is that we are well endowed with alternative energy sources across the nation. They change from place to place, and you have to look at the details there, but I thought that might be of interest to folks who do not look at pretty colored maps all the time.

The other interesting part on the alternative fuels side is to look at the cost trends, and these are some graphs that our organization has put out, and these are general historic trends, not specifics. This is in levelized cost of energy in cents per kilowatt hour, and, again, this is for the power sector alone. These are the general trends for wind, photo-voltaics, geothermal, solar thermal, and biomass, and you can see that the key take-away message here is that all of these technologies are what you would call on very steep learning curves, and quite interestingly, if you compare them to both natural gas and coal and nuclear, those learning curves are what you would consider to be very mature; i.e., those technology costs on the margin have been flat or increasing over a length of time, and I reference back to some EIA documents on that one.

The interesting part, maybe reflecting back to Secretary Bodman's comments this morning about investing in the future and new technologies, is captured here in this slide, and here what I have done is captured the annual growth rates of many of the alternative technologies, as well as the increase in energy technology investments as a percent of total U.S. venture capital.

In annual growth rates, these are broken down by technology type: Grid, photo-voltaics -- that is what that PV stands for -- wind, biodiesel, and down the line. You can see, relatively robustly, that these technologies in the marketplace are growing at double digits, if not 50 or 60 percent, 30, 40, 50 or 60 percent per year for the last numbers of years, and if I were to add 2005 and '06, those trends continue and, in fact, accelerate quite a bit.

On the energy investment side, the Secretary mentioned this morning, Q1 venture capital investments in clean tech is around $2 billion. That's just in a quarter. It is a relatively small "slice" of the venture capital dollars that are put into the global economy, about 4 percent in 2005, growing to between 5 and 6 percent in 2006, but significantly, those investors definitely sense opportunity to make money and to do the right thing, I think.

So, here are a couple of pictures of the different technologies, some solar troughs, those might be called concentrating solar collectors. Those are actually out in Kramer Junction in California. There is some wind, you have not seen those. A bunch of wind. There are some other concentrating solar plants down here. Those are actually parabolic mirrors driving a sterling engine, and then those are just some examples to show you.

And I will stop there and answer any questions.

MR. GOLDBERG: Steve Goldberg of Argon.

There is a key question that you go into when you do renewables in any new technology, and that is those things that are low-hanging fruit and those that require breakthroughs in science, and in your area there is a lot of hope that the science will catch up with the need of the energy requirements, and as an analyst, have you projected out what kind of a price signal could go out there where things like you could get much better technologies, whether it is a nano-technology or a biotechnology that could come into play here, so that we could have more energy generation?

One of the good examples might be electrical storage, because a lot of your stuff that you have at your lab is intermittent, and if we were able to have more robust electrical storage capacity in the United States, we would have a lot more utilization of renewable energy.

To do much more electrical storage requires more science, and there is a lot going on in the Office of Science to do such a thing, but in your area, can you figure out what kind of a price signal could feed back into the science so that people are willing to take a risky venture, whether on the private side or on the public side, and see that their pay-off is reasonable to meet mutual energy requirements?

MR. ARENT: Yeah, perhaps a slightly complicated answer to, in fact, a complicated question. The basic R&D, as you know and the Secretary mentioned this morning, really is well fed by the Department of Energy, I think he said the largest investor in the world, perhaps, in basic energy R&D.

That is a very early stage, exploratory set of R&D. I think what you are seeing at this stage is that the price signal or the market signal is already strong enough that the private sector investors are investing their dollars where they think they can make investment returns in the relatively short term. A venture capitalist's time frame is in the three to five-year expected return on investments. That price signal, I think, is already there.

The price signal on top of what is already in the marketplace, which is kind of skirting around the edges and there is a lot of discussion, of course, is around greenhouse gasses and what that will do in terms of repositioning these non-carbon-emitting or non-greenhouse gas-emitting technologies relative to the install based or relative to emitting technology. So, it is quite complicated, but I think the signal is there, and if you look at the some of the analyses, particularly on the -- I'll call it the unknown per se right now in terms of greenhouse gasses, you can see a very significant shift in the price of the non-emitting technologies to be "competitive," again, depending upon the assumptions that go into that. So, let me go down here.

AUDIENCE MEMBER: You mentioned in your talk that there were natural gas -- there was natural gas capacity that went unused for a period of time. Can you explain why that is the implication for the future?

MR. ARENT: I think you are referring to the fact that in 2002 there was a significant build-up of capacity in the electric generation sector of natural gas. Around 63 gigawatts was built up. Much of that was put in "on the margin," hoping that these plants would be run for peaking and take advantage of essentially low-cost natural gas on the marketplace.

A couple of things changed, particularly the price of gas in the marketplace, and so many of those plants were left idle. They have a relative low capital cost financial structure, and thus, the operating margins on them, when they had to run in a high natural gas price environment, were not there, and thus, they were money losers, and they were left idle.

I think we have done it, so...

MR. GASKINS: All right, thanks very much.

MR. ARENT: Thank you.

MR. GASKINS: Our last speaker will talk about the utility sector, economics of our generation, and he comes from California, so he knows a lot about --

MR. BUSHNELL: Thank you.

MR. GASKINS: -- about the policies in that area.

MR. BUSHNELL: Thank you, and thanks to Doug for working through the PowerPoint glitches. We will see, I really just wanted to show you one picture, so I just hope we get to there.

I heeded Jimmy Carter. I am wearing a sweater. I am from California, and it is really cold here relative to what I am used to.

I was going to talk about the economic history of the electricity industry, a brief history, a brief economic history, and try to cue up a lot of discussions we are going to have over the next day of two talking about deregulation, the future of the industry, the future of energy industries, and so on.

When you talk about the electricity industry, it stands in contrast to the other energy industries in a couple of ways. It is certainly dominated by regulation, and it has also -- traditionally, it has been dominated by vertically integrated firms; firms that do generation, transmission, distribution, retailing, and there was always one firm that did all those things. Those two characteristics really, I think, dominate the story of the history of the industry during at least the 20th Century.

It was viewed, basically because of economies of scale and other sorts of things about network industries, that a lot of these activities that electric companies did were natural monopolies. So, this is this phrase that economists like to use to justify regulation, that it really does not make sense to have multiple firms building wires into your house. Even at one time it was thought it did not make sense to have multiple firms building generation plants in different areas, and so, rather early on in the 20th Century, we had the emergence of the electric company, your electric company. It was -- local service did everything in the electric industry, served your local company, and it had a franchise monopoly. It was the only company that was going to sell electricity to you. Because it had this legal monopoly status, it was regulated. We did not let it charge market prices because we gave it a franchise.

That logic dominated the industry through most of the 20th Century, and it did not work too badly, actually. In the United States -- there were different models, you see, in other parts of the world. The big difference in other parts of the world is you would see the vertically integrated company, the one company, be a national company. So, instead of having your local electric company, you had your federalized electric company.

In the United States, we had more of a patchwork of a lot of local electric companies, all growing up, getting larger, and bumping into each other, which resulted in some vulcanization of the networks and the distribution systems. There were a whole bunch of these little franchise monopolies, some of them quite big, as we grow up through the 20th Century.

When you get to the phase of deregulation, it is really about a change in attitudes, about what exactly was a natural monopoly in electricity. Certainly the wires business is viewed by a lot of folks as still a natural monopoly enterprise, but building generation throughout the 70s and 80s, we sort of learned that we do not need to have your local electric company build the generation. There could be other firms that do that and that could even compete with each other under the right types of circumstances.

So, the process of deregulation in electricity, just like in natural gas and in telecommunications, was really about trying to deal with the fact that you had these potentially competitive suppliers, generation companies, and you had these customers, and in between you had this natural monopoly network. So, the emergence of both technology and kind of economic thought and regulatory thought on how to provide open access to networks was really at the core of trying to get to a point where we felt like we could try to introduce market pricing to at least one sector, where we would have some kind of open access on the network where different producers can compete to supply electricity to different customers.

Before that point, though, we had an industry dominated by cost-of-service regulation. It was a local franchise monopoly. Basically the model was here is a forecast of your demand, go build power plants to make sure they do not have black-outs, and send us the bill, and we will pay for it, and we will make sure ratepayers pay for it as long as you weren't extraordinarily wasteful in what you did, and some utilities were extraordinarily wasteful, and they had disallowances.

The other important difference, I think, between the electricity industry and the other energy industries that I should point out based on the discussions we have already had is the role of the Federal Power Act in the electricity industry today. Competition policy in the electricity industry is complicated, certainly, by the fact that it is covered by more than just our traditional antitrust laws, and, therefore, whereas in other industries, if a firm is unilaterally charging high prices, in general we do not consider that to be an antitrust violation. We have to deal with what gouging is now, but in general, we do not consider it an antitrust violation. If you are not colluding with a bunch of other folks to raise prices, it does not necessarily bump up against U.S. competition laws.

It does potentially bump up against the U.S. Federal Power Act, though. The electricity industry is under a law that says prices have to be just and reasonable, and this has created an interesting situation where antitrust officials and competition policy folks want to usually approach an industry by setting up a competitive playing field, by making a structure that looks like it will be reasonably competitive, and letting markets work, and not going in and second-guessing market outcomes.

The idea is to sort of set it up ahead of time, make it a reasonably competitive market structure, let the prices go. We do not micromanage what the prices coming out of the process are. When we have in the past, it has created difficulties.

The Federal Power Act, though, bestows upon FERC -- it has been argued -- a legal responsibility to make sure that the prices coming out of these markets are just and reasonable, and so this creates a second layer of regulatory difficulties that -- and responsibilities -- that have really played into the story that we have seen through the deregulation period.

We had a discussion already about the California crisis. I was not going to talk a lot about it. I am going to talk about it tomorrow a bit more, but it is worth pointing out that one of the aspects of markets, when they get tight, is certainly that costs go up, marginal costs go up, and even in a perfectly competitive market, you would expect prices to rise, but it also gives firms more of an ability to exercise market power unilaterally, to raise prices on their own that might actually not be any kind of antitrust violation, but would probably bump up against the Federal Power Act, and that is where the process at FERC had to cope -- what process at FERC had to cope with during the California crisis where there really were some serious competition problems that were created by some of these structural conditions that we have heard described earlier.

What is interesting, though, is a lot of those structural conditions that you hear about in California -- tight reserve margins, retail markets that were not deregulated -- they exist in almost every electricity market in the United States and many around the world, and yet California was the only market that had the kind of crisis that we saw. If you want to know why that was, come back tomorrow. I'll talk about it more.

AUDIENCE MEMBER: No hints?

MR. BUSHNELL: Well, it had to do with the fact that in other parts of the country, when generation was sold off by the distribution companies, it was either held by the distribution companies, so that they remained vertically integrated, or when the generation was sold, there were long-term contracts let, so that there was very little actually being bought on the spot markets, and this meant buyers were less exposed to the volatile spot prices when they came up, and also, suppliers were much less interested in raising spot prices, because they had already committed to sell most of their output under forward prices.

Really, I think one of the big challenges in the electricity industry going forward is how to get this sort of forward hedging into a system where we still have largely regulated buyers -- distribution companies -- and deregulated sellers in many parts of the country; in other parts of the country we do not.

Where we are now -- well, so, working through the -- that got more into deregulation than I had originally planned, I want to go back in time a little bit and just sort of talk about the three epics we had during the 20th Century.

The cost-of-service regulatory model worked pretty well through most of this century, because the economies of scale were really there, utilities liked to build bigger and bigger power plants farther and farther away from where the demand was, and for the most part, those were the cheapest kinds of power plants to build, and as long as demand kept growing and the economies of scale were really there, that model worked pretty well.

But then we hit the 70s, and because of all the disruptions we had to the macro-economy and to fuel prices, demand drops or does not grow like it was forecast to, and then we had this ultimate exercise in economies of scale with nuclear power, where we thought we were going to be building very high capital costs, but, you know, too cheap to meter electricity. It turned out it wasn't too cheap to meter and it wasn't -- those economies of scale were not quite what we thought they were going in, and so this combination of more expensive production and demand that did not materialize that we were expecting created a large overhang of capacity, really expensive capacity, that led to financial crisis in a lot of electric utilities around about the late 70s and into the 80s.

This led to a lot of experiments with how to deal with an alternative model for running the electricity industry, moving away from cost-of-service regulation with just a franchise monopoly. We had different experiments. We already heard mention of PURPA, where really we had an independent power production industry created, and this is where attitudes about whether you could have companies building generation within the service territory of a utility, could they do this on a small scale and still be competitive.

PERPA had a lot of problems with it and led to a lot of expensive generation. If you have ever been to California, drive through the Altamont Pass, you will notice we have a lot of windmills, and you will also notice that most of them are never operating. They were built during this period, and they are quite expensive. But what we did see was that there was an attitude that you could have generation built on a smaller scale, it could be competitive, and this, I think, laid the seeds for the moves towards more further deregulation that happened later.

You also had a lot of experiments with renewable generation, and in the 80s, you also had this movement towards more sophisticated, if you want to call it that, more complicated forms of regulation where we tried to move beyond just economic issues and get into a whole slew of different types of social issues that would all be wrapped up into some kind of optimal plan where we are balancing the environment, renewables, other sorts of social goals, along with just the cost of owning, operating, and generating from power plants.

We are actually moving back towards some of that in some parts of the country. Other parts of the country, these experiments with this more complicated form of regulation helped contribute to a desire to do away with regulation altogether.

This was the one picture I wanted to show you. So, when you talk about the electricity industry, you really have two epochs during the 20th Century. You have this era from 1930 to 1975, about, where nominal rates are basically constant; real rates are falling.

Then you have the shocks of the 70s, which triple nominal rates, more or less, and bring us to a new plateau where we have sort of sat now for about 20 years. There is a blip up at the end. We are not sure where that's going. We will see whether that's a new rise to a new epoch or not, but we have these two periods of basically stable -- long periods of stable prices that are interrupted by this one period of a big shock.

Now, when we think about the politics of deregulation or electricity restructuring in the industry, I want to overlay another idea on top of this picture. Recall that the rates -- this is the cost of building, owning, and operating power plants, and transmission wires, and all the other stuff. This is the average cost, the cost of owning and operating all this stuff, because it was cost-of-service regulation, not what the market-clearing prices of this kind of activity would be.

So, to think about the politics of restructuring, consider a world, a hypothetical world, where, say, the refining industry in the United States were run under cost-of-service regulation, and in the 1970s and 80s, we had a big overbuilding of refining capacity, there was a lot of money invested in it, and then we have refining margins very low. Firms -- it was a really bad business to be in. Firms were not able to recover the costs of their investments in refineries, because refining margins are so low and there is such a glut of capacity.

During that kind of period, if refineries were truly operated under cost-of-service regulation, the prices for refined products probably would have been higher, because the costs of owning, operating, and building refineries during that period, they were not being recovered from the market. And so, if we were recovering them from rates instead, cost-of-service rates, prices probably would have been higher, and you would have seen customers agitating for some kind of deregulation that would have let prices go to some kind of market level, which at that time would have been lower than the all-in costs of operating refineries.

Now, fast forward to today, though. Today, the refining situation is very different. We have tight refining margins. It is a great business to be in. I think almost everybody would agree that the costs of building, owning, and operating those plants, at least the historic costs, are far less than what the market value of selling refined products are.

Now you would have customers who were perhaps deregulating in the 80s wanting to go back to that cost-of-service model. That looks better now. And markets do this. They go back and forth between overcapacity and undercapacity, not in any kind predictable way. If we could predict it, we would make a lot of money on it. But you do have the fact that markets at any point in time will get the answer wrong. On average, in the long run, we think they get the answer right, but at any given point in time, you could very well see overcapacity in a market or undercapacity in a market, and you will see prices responding accordingly.

When you have an underlying environment where there is a history of regulating under cost of service, it is very hard to make that transition, because if you see a switch from overcapacity to undercapacity, there is always that desire to want to go back, and I think that's what has happened in the electricity industry through much of this period.

So, I am going to overlay an artist's rendering of marginal costs. You could think of this as what market prices, competitive market prices for electricity would have looked like during the same period. You have long periods where average costs are declining, and then you have these periods of shocks where average costs are increasing and marginal costs or that market-clearing value of electricity are above average costs.

So, when the black line is above the red line here, that means that prices from the open market are probably higher than the all-in costs of building, owning, and operating power plants, and that means, if you are a customer, you would rather be paying -- you would rather own and operate it rather than be buying from the market.

During the other periods, like the 1990s, where we have overcapacity, owning a coal plant did not look so good. Gas prices were very cheap. Owning a nuclear plant really did not look good. You are not recovering your costs of building and operating those plants during that period, and rates, which are set at the red line, the costs of building and operating, are above the market price during that period. That's a period where you have a lot of agitation for restructuring, customers saying, "Hey, I would like to choose to buy my electricity at this lower price here, rather than at the higher regulated price."

Now, you get to another period where there is a big run-up in marginal costs. Gas prices rise. There is also competition issues -- I don't want to minimize them -- but I think the underlying economics are also that marginal costs are rising above average costs, and in many parts of the country, there is a desire to move back, because now, all of the sudden, owning and operating a coal plant looks pretty good again. You know, we will have to see how global warming policy plays out, but right now, you know, coal plants and nuclear plants do not look so bad any more, and I think basically the regret we are seeing on the part of regulators in a lot of parts of the country is a reflection of the fact that, well, back in the 90s, it looked like a good deal, and now it doesn't look like a good deal. We are not sure where this is going to go over the lung run.

Of course, the idea behind deregulation in the long run is all of these costs go down, because in theory we have the discipline of the market bringing better investment decisions and all of that, and, you know, the jury is out on that. We are still seeing that. There is a lot of reasons to believe, because we see this work in a whole lot of other markets, that it is really true, but it takes a long time to manifest itself in the electricity industry where capital assets last 50 years or more.

There was also a mention -- I was not going to talk with this either, but it fits this graph perfectly -- of all the generation that was built since 2000 -- actually, you know, starting in 1998, the markets, even in California, gave a pretty strong signal to build new generation, and we had this flurry of investment in generation. There was a really an investment bubble in electricity in the United States from the period of about 1999 to 2004. We did not notice it because we were having black-outs in California at the same time, but there was this massive overbuilding of capacity.

Some of it was in the wrong places, and, in fact, what happened was you had all this money going into building capacity, and there was a glut in many parts of the country, and, again, boy, the costs of owning, building, owning, and operating them looked higher than what the market price was, because the market price was dropping in certain parts of the country, and, in fact, those companies that overbuilt are searching now for means to kind of get back to an average cost regulation and other ways to try and recover some of the costs of those investments, and in many parts of the country, there are different experiments with new quasi-market/quasi-regulatory mechanisms to pay for investments in different parts of the country, part of that caused by this regret from having overbuilt the system and really the drop in market prices as a response to that.

So, this picture, I think, explains the political economy of restructuring. It doesn't, you know, explain the underlying economic rationale, which is still sound, if we can make wholesale generation markets competitive, there is a lot of reason to believe that they will eventually lower costs, but the key is trying to make them competitive, and we are going to talk a lot more about that over the next few days.

I am going to skip a couple of slides here. I guess I should just say, you know, this is 1993 when the pressures for deregulation in different parts of the country were growing. The darker states on this map are the ones where electricity is more expensive, one of the results of the fact that we had this patchwork of cost of service local utilities. We also had a patchwork of different regulatory approaches across the country.

The pressures for deregulation were closely aligned to where prices were really high, particularly where prices were really high and they happened to be next to places where prices were really low. So, in California, you have extremely high prices next to states like Oregon where they are really low, and you have cement manufacturers and other large industrial customers saying, "Gosh, I wish I could choose to buy electricity from Oregon through some form of open access rather than buying it from California."

Again, separating out this question of are you really trying to get to a good economic answer or are you just trying to get out from under the overhead of some bad investment decisions that have already been made but cannot be undone, trying to separate those two issues really is one of the difficulties in trying to push forward restructuring policy.

Okay, so, where are we now? Right now, in the United States, we have really two models coexisting, and I think they are probably going to coexist for the foreseeable future. We have the world of restructured markets. The northeastern United States is really the most concentrated area of this, where a lot of the generation is now operating under some form of market-based pricing, and you have independent system operators that do not, for the most part, own the transmission network but try to manage the transmission network in a way that provides nondiscriminatory access.

So, that is how we have dealt with this vertical integration issue. We have created these independent entities that are supposed to be the traffic cops on the grid and make sure that there is not discrimination in providing it. So, that is one model, and it is competing with the other model where you sort of have the ISO is the big utility still in parts like the Southeastern United States and the Northwestern United States, where there is still an attempt to try to provide access, but it is happening in a more informal way in regions that are still dominated by vertically integrated utilities that are probably going to be regulated under cost-of-service regulation for the foreseeable future, particularly if this relationship in the picture means the cost-of-service regulation is cheaper. There is not much of a move to try to restructure a market when it would actually raise prices.

I wanted to end with one picture. You may have heard that the Northeast and California are also pursuing these greenhouse gas initiatives. It is kind of exciting. We are seeing moves to try and lower greenhouse gasses from all sorts of sources, including the electricity industry. You start to get really excited about it, and then you look at a picture like this, where you see that the states that are actually pursuing these initiatives, there is not a whole lot of carbon, and the states that aren't is where all the carbon is.

So, California and the Northeast are relatively coal-absent, relatively oil-absent, and so this is one of the issues that is being grappled with in both of these regions, is how to deal with the fact that we would like to lower carbon emissions, but they are actually coming from some place else, which is on a small scale the same issues that are being worked out an international scale, where you substitute China for Ohio, and this is where we are right now, and we will see how those policies develop. They are being worked on right now in California. There is a lot of excitement. It reminds me a bit like 1996, and I hope that the results turn out to be quite a bit more successful. So, I will leave it at that and open it for questions.

AUDIENCE MEMBER: Yogi Berra once said it is very difficult to make predictions, particularly about the future, but if you could speculate for a minute on the chart that you had with the nominal -- or the marginal costs and so forth, as we sit on the edge of what is likely to be a building boom in generation across the country over the next few years, with a lot of ideas being proposed, where you think those lines are likely to go with respect to the average cost or the marginal cost, and then I know we are supposed to direct questions specifically at the most recent speaker, but I would be interested, because we did not hear anything about this, if there is anybody else on the panel that would like to talk about the role of nuclear power as part of the mix going forward.

AUDIENCE MEMBER: I am going to talk about that in the next panel, a lot.

MR. BUSHNELL: Okay. So, the comment -- no, it would be great to hear from everybody. You know, one of the things about this picture that I was just mulling over as I was putting it together is, unfortunately, it is a national average picture, and I think within regions of the country, you see a different relationship, and those are the regions of the country that are actually trying to move towards whichever line is lower.

I am not sure there is going to be a building boom everywhere in the United States, because there are these areas that have overbuilt gas capacity. I think a lot will depend upon what gas prices look like going forward versus whatever people perceive as this risk of building coal plants.

There has been a lot of interesting developments in the last year about coal construction, where there was these oft-touted figures about the hundreds of coal plants that are being planned and some being constructed, but clearly there is an attitude even in places like Texas, where building coal plants is maybe not such a great idea environmentally and maybe not even financially, because of the tremendous uncertainty about what the carbon risks might be at some unforeseen point in the future.

So, yeah, I mean, I am like Yogi Berra I guess. I don't know which way these things are going to go. I think if you do, in fact, see this big building boom --

and there are a lot of different experiments with different regulatory solutions to this -- it is certainly plausible that you would see an overbuilding and you would start to see this capacity overhang again.

Now, the whole logic behind restructuring was if there is a mistake made by investors, it is like the refining industry. Ratepayers do not pay for it. It comes out of the investor's pocket, basically. We are not sure if that model is going to play out fully in electricity markets, because there are these moves to pay for installed capacity and those sorts of things, which are, in part, going to compensate for that. So, exactly how deregulated restructured electricity markets are is really a debatable question.

Nuclear power, you know, I have just been looking at these numbers, and the goals for 2050 are really astounding in terms of trying what some folks are talking about, and if you look at the available technologies today, it is hard to see how we would get there without nuclear power. I am not sure what, you know, the other folks on the panel might think about that.

MR. YERGIN: I think nuclear, I would wisely cede my time to Shirley Jackson.

AUDIENCE MEMBER: Jim, you mentioned very quickly the issue of competition policy versus just and reasonable, and we recently had a practical debate on that issue. Given the fact that the Federal Energy Regulatory Commission is charged with making sure that rates are just and reasonable, which at least under some theories would be competitive, and that we actually engage in mitigation in these markets to make the rates close to what they would be, how can you argue -- first of all, how do you structure the hypothetical monopolist test under the Merger Guidelines to fit that paradigm, and secondly, how do you argue for divestiture when the mitigation test is concentration-neutral?

MR. BUSHNELL: Well, I guess I am not going to be chaining myself to the burden of the mitigation tests, then. I think -- and these things are all matter of degree, but I tend to think -- and you know this -- that we have maybe gone a little too far into trying to focus on mitigation and have given up a little too much on the structural solutions within the electricity industry.

I think the electricity industry is not a stand-alone different industry. It is an industry like the other energy industries. It is just a more extreme manifestation of a lot of that. We have the issues with -- it is hard to store all of these energy products. It is a lot harder to store electricity. The capacity constraints are much harder. Demand elasticity is lower. All those things make it much more difficult, but I think there are elements to market structure that can create a pretty competitive market, which we see internationally, that outside of severely transmission-constrained regions, would probably survive with a minimum of aggressive types of mitigation.

How that translates to a structural test, you know, off the top of my head, I am not going to give you a description of that -- I have actually filed testimony at FERC on it, though -- and I just think we need to think hard about how the traditional antitrust measures of concentration and those sorts of things map to the electricity industry, to recognize that, you know, you do have much less price-responsive demand, and so the number of firms we can tolerate in the refining industry or the furniture industry is much different than perhaps in the electricity industry within that context.

There is this crucial role of forward contracts and maybe a role for vertical integration. That is sort of an issue that is being debated a lot, at least out west where we are.

AUDIENCE MEMBER: Hi. My question might bleed over somewhat into the context of the next panel, but I was interested in, since this is the historical panel and looking at the price history, interested to know to what extent subsidies would be considered a role or a factor in the relative price of various forms of energy, or accountable for boom and bust cycles in terms of capacity, overcapacity, and I am using the term "subsidies" in a broad sense, meaning it could, you know, be anything from incentives to, you know, arrangements, and I apply it to the whole panel, I would be interested.

MR. BUSHNELL: Sure. I guess off the top of my head, the most prominent example of this would have been experiments in the 80s under PERPA, to really spur the investment in renewable technologies and cogeneration and small electric generation. A whole bunch of different states took different routes to try to do this that sort of translated to subsidies, and the states where you had the most lucrative financing of these sorts of projects were the ones that had the largest capacity installed, and there was a fair amount of regret, as you get into the 90s, as to the cost of those sorts of things.

But I do not think that dominated the story in terms of these general trends. I think that was the story of the underlying main technologies and just the way the dynamics of cost-of-service regulation worked. A lot of this other stuff was experimenting around -- maybe not the fringes, but, you know, not the dominant story.

Nuclear power may be the difference there -- maybe that is the opinion coming up -- and I guess I would pass on the role in which various forms of public subsidy have influenced the choices in nuclear power during this period.

MR. GASKINS: Can I just interject on that? I have just a little history that was not related --

MR. YERGIN: I was going to call on you to answer.

MR. GASKINS: Not related to the energy sector directly, but the U.S. railroads, freight railroads, were built on subsidy programs. They were all built, for the most part, through land grants and eminent domain, and broadly speaking, that was a huge subsidy. The interesting thing is that every single one of the U.S. railroads that took land under the land grant program went bankrupt at least once over the next 50 years, and there was only one railroad in this country, a freight railroad, that never went bankrupt, and they did not except any land grants. They were not given any. So, it is very interesting.

If you look far enough back, there is always this interplay between the generous government intending to do well and then the long-range consequences --

MR. YERGIN: Why don't you answer it on energy, too? I mean, what are you --

MR. GASKINS: Well, why don't you?

MR. YERGIN: No, go ahead. You are thinking about it.

MR. GASKINS: I am thinking about it.

Well, it is a serious problem with ethanol right now. I think we are getting ready to go off a cliff with corn-based ethanol. We have -- and I don't know whether you call it a subsidy or not, but when you prevent anybody from importing ethanol that is cheaper, based on sugar or some other product, that is a subsidy to domestic producers, and when you demand that people use it in a certain percentage of vehicles, that is a kind of a subsidy program that is stimulated by the government, and I think it is going to turn out badly.

I don't think $4 corn is sustainable, quite frankly, and I think a lot of people are going to get hurt, and we are going to have a terrible time trying to undo this mischief. I lived through the 70s, and I remember the small refiner bias. It was awful. I don't want to do it again.

MR. ARENT: Just to repeat Secretary Bodman's important comment this morning about the role of cellulosic ethanol development, and that's clearly recognized by the research which has been done by DOE.

MR. GASKINS: Yeah, but I am making another comment. I am saying it will be hard to disengage from corn-based ethanol once you have built the industry up. Once you have created an entity out there that has a big vested interest in corn-based ethanol, you'll play hell getting it out of the American economy, just like you had a difficult time with the small refiner bias.

MR. BUSHNELL: Can we hear from Shirley on this?

DR. JACKSON: Actually, I will save my comments for when I have the opportunity to make comments, but I do have this question: Each one of you have gone through historical lessons on it, but let's turn to the affirmative, and ask, you know, we are sitting here at the FTC, what would your one or two affirmative policy recommendations be?

MR. BUSHNELL: With regards to the electricity industry, I think, again, I want to draw attention back to this what I think is the key driver in the success of the industry, which is trying to deal with this relationship between wholesale buyers, which are, for the most part, regulated distribution companies and these deregulated generation companies. I think if we find a model -- and maybe it's retail choice in some regions. In other areas they have given up on that. I think there are other ways to try to work market mechanisms into that process. Then I think we can be a lot more comfortable with the electricity restructuring model.

I think that is just -- that is an area that has really been under emphasized, in part because it is maybe not the jurisdiction of federal policy, it is one of those gray areas, but I think it is one that we grapple with in the natural gas industry and the electricity industry, how to get these guys to care about prices, to care about price risk.

I think that was supposed to go down the whole panel.

MR. YERGIN: I think two things: I think spending more money on research and development, with some sense of how much we can absorb so that it is not just throwing money at it, but I think on a consistent basis, so that people can plan their careers in science and technology knowing that there will be support for it, that might count as a subsidy incentive, in other countries, I think that is one thing.

I think the other thing is a higher efficiency in the automobile fleet one way or the other just is such an obvious thing. And, you know, if you look back on the 70s and the history and say what were the two most important things we did as a country, one was on the supply-side one was on the demand-side. On the supply-side was the Alaska oil pipeline, which added at its peak about 2 million barrels of supply, and the fuel efficiency standards, which over a period of ten years probably saved about 2 million barrels a day of oil. So, I would say that when you look at those numbers I mentioned for the growth of automobiles around the world, efficiency is certainly at the very top of the agenda.

MR. LUFT: In the area of alternative fuels, we have a situation here that, you know, the most realistic or near-term alternative fuel that is a replacement of gasoline is alcohol. Our government basically tells us that there is only one alcohol that can play a role in the market, and that is ethanol, but that is not the case. There are many alcohols. Some of them, in my view, show even more promise than ethanol.

I would point out that the Government of China looked at this very, very carefully and they came to the conclusion that methanol has more of a promise than ethanol, and there are currently about 80 coal-to-methanol plants under construction; eight provinces have standardized methanol as their alternative fuel of choice; and they are talking about 20 percent displacement by 2020. What do they know that we don't?

The only reason is that we do not see here a situation that we have free access to all the alcohols is because there is a clear intention by the ethanol industry to make sure that no other alternative fuel plays in the marketplace, and I think it is a travesty. I mean, I do not see why auto manufacturers only warranty their flex-fuel cars to run on ethanol.

So, I am not in a position of recommending policies, but I will make a couple of comments. One, I think the renewable fuel standard, the federal fuel standard is not specific to a molecule, so I think you will have some more debate about that later, although the R&D focus is clearly around an ethanol product, although there are other products that you can derive from bio-resources.

I think there are a couple of comments to be made thinking forward. One is that -- it comes back to the point I was making -- is that the global energy demand challenge is huge. It is much bigger than we think about. Think about doubling the current world energy infrastructure in another 30, 40 or 50 years. That puts it on some level of scale of thinking. It is a very, very large challenge.

The response to that is that demand-side management, demand activities, efficiencies, however you want to say that, will become increasingly important, and we have not really talked about them explicitly here, but I think that they cannot fall off the radar screen.

The second is that even if we continue to increase our global energy intensity, if you want to use that term -- and people will argue that that's the wrong term -- but even if you do that, we will need almost every energy source that we can find if we are going to continue to and be successful, in the words of the Secretary, to provide clean, reliable, and secure energy, not only domestically, but globally, and particularly if you think about a carbon-constrained future where there is global agreement to mitigate greenhouse gas emissions. So, those are my parting comments.

MR. BUSHNELL: You know, this discussion just raises the example of how we have these two policy goals, energy security, however you want to define that, and then there is this issue about climate change, and in some areas, these are correlated, but in other areas, they are basically diametrically opposed, and coal-to-liquids is the poster child of this issue. It is a way to deal with energy security, but it is also creating a bigger problem on the climate change front.

MR. GASKINS: Yeah, we have to wind up, and maybe you can ask your question.

I would like to thank the panel for a very interesting presentation.

(Applause.)

MR. SEESEL: I just want to thank Darius and the panelists for an excellent and very thought-provoking discussion. We are going to break now for an early lunch, and we will reconvene about 12:15 for the next panel, an excellent panel on how energy markets work within the framework of public policy choices. So, it is an early lunch, but I hope we will see you all back at about 12:15 or so. Thank you.

(Whereupon, at 11:39 a.m., a lunch recess was taken.)

AFTERNOON SESSION

(12:29 p.m.)

MR. SEESEL: Good afternoon, everybody. Welcome back from the somewhat abbreviated lunch hour, my apologies about the schedule.

I would like to have us begin the panel on how do energy markets work within the framework of government policy choices.

Moderating this panel is Catherine Wolfram, who teaches at the Haas School of Business at the University of California at Berkeley. Catherine will be joined by The Honorable Shirley Ann Jackson, who is the President of Rensselaer Polytechnic Institute and served as Chairman of the U.S. Nuclear Regulatory Commission from 1995 to 1999; by Bryan J. Hannegan, who is the Vice President in charge of environmental matters at the Electric Power Research Institute; Jeff Hazle, who is the Technical Director of the National Petrochemical and Refiners Association; and Tyson Slocum, the Director of Public Citizen's Energy Program. I'll turn it over to Catherine. Thank you.

PROFESSOR WOLFRAM: Thank you, John.

I figured we would do what we did before lunch and have each speaker speak for 15-20 minutes and then open the floor to questions for that particular speaker.

So, without much further ado, I'll turn it over to Shirley Jackson.

DR. JACKSON: Okay. Good afternoon. Effective policy to promote competition in energy markets and to foster the innovation, production, distribution and trade involved in energy marketing are best viewed in the very broadest context, because this is a global challenge faced by every nation, and no one nation will solve it alone, or for themselves alone. And in this regard, many do speak of energy independence, but what we really mean, as Dan Yergin has said and what responsible public policy must foster, is energy security. Because there is no real energy independence as such, because the energy challenges we face are interrelated, interdependent and global.

And so, I would start with a definition. I would define energy security as having an adequate and sustainable supply of energy to meet the needs and aspirations of citizens, commercial enterprises, and public sector functions.

The practical definition, that is the set of strategies for achieving energy security, varies according to nation and region, including our own, but certainly would include the following five elements: One, no overdependence on external suppliers, this entails both maximizing domestic and local production and ensuring reliable sources for necessary fuel imports; two, diversity of supply; this provides protection against supply disruption events, such as natural disasters or geopolitical instability. It also provides a hedge against fuel price volatility. Three, well-functioning energy markets. This includes ensuring the profitability or competitiveness of fuel production and energy generation for suppliers, as well as mechanisms to secure financing for long-term strategic energy investments. And in fact, this latter is frequently a sticking point of energy insecurity for developing countries.

All of this, to have well-functioning markets, requires large liquid and transparent markets with robust and alternative energy supply chains.

Four, what is required is sound infrastructure, for energy generation, transmission and distribution. And this includes the necessary regulatory and operational protocols to ensure the safe, secure and reliable performance of refineries, power plants, electrical grids, which we have not talked a lot about, and other energy facilities, and with the electrical grids that includes interconnectedness, as well as reliability.

And five is environmental sustainability, the impact of human energy consumption on the planet is taking center stage as a global concern.

And so, all of this requires a comprehensive view, with a broad-based approach to R&D, research and development, to regulation, to values considerations, and geopolitical factors. And so, in the end, rather than focusing in a narrow area, it really requires roadmap thinking, and thinking about energy source for energy sector, vis-a-vis, the available technologies and which are competitive.

But, again, I want to repeat that a narrow focus on U.S. energy interest alone, without thinking about how that plays into the energy interests of other countries, is neither practical nor productive, because we have global energy markets, global supply chains, we have rising economies, and, of course, we have terrorism, all which have great impact. And so, again, the more realistic focus must be on redundancy of supply and diversity of source.

In order to then have true national energy security, then we are dependent upon energy solutions which can be developed globally and applied regionally. And, of course, this depends on innovation.

So, my first key point, then, is that there is no energy independence, but energy security. Energy security likewise is linked to global markets. Now, global dependence on oil and other fossil fuels and the U.S. dependence on the same are likewise intertwined.

Geopolitics, as you've heard this morning, always have affected energy markets, but especially so in the past 30 to 35 years, and this is more true today with rising economies worldwide.

So, what is being presented, then, is a challenge to the traditional market model, with publicly traded, integrated oil and gas companies dominating oil supply and demand. In fact, they control 10 percent of worldwide production and 3 percent of worldwide known reserves. And this is happening because of the rise of national oil and gas companies which link suppliers and importers through political processes, as well as the market. And these national oil and gas companies control one-third of worldwide production and hold one-third of known reserves.

And so, our energy policies in the United States must reflect these realities, at least in the short to intermediate term. And Europe, in fact, and the UK, present an interesting case study about which I will make a few remarks later.

My second key point is that government policies, including domestic ones, which is what we have been primarily focused on here today, do affect market economics and market share. Nuclear power is an example.

Nuclear fuel is relatively cheap and relatively accessible. Nuclear operational costs are at their lowest levels ever. Safety performance of nuclear plants has been greatly enhanced. But the role of nuclear power depends heavily on governmental policies with respect to the environment, cap-and-trade policies, for example, with respect to renewables, with respect to safety, and within that the licensing of facilities, with respect to security, particularly in the post-9/11 environment, and I am going to talk about an example in a little bit, and with respect to waste disposal, particularly spent fuel.

Nuclear power also is uniquely affected by public sentiment, and all of these factors make the policy aspects of nuclear power globally linked as well. And I'll speak more completely on this in the Q&A session.

But, again, energy security rests with redundancy of supply for reliability, diversity of source for robustness, and both to reduce vulnerability.

My third key point is that innovation is critical. There are a range of innovations and different energy sources, strategies and technologies being pursued. Obviously with renewable solar, wind, thermal, nuclear, with bio fuels, with fossil, especially with the more recent focus on LNG, liquified natural gas, as well as other gas sources, including exploration of so-called methane hydrates.

And we cannot just be oil and gas focused, although to move away from them in the short to intermediate term is not likely. So, let's look for a moment at the EU and the UK as an example.

Now, Europe faces its own -- and you could say, why am I spending the time, because there are some lessons to be drawn. Europe has its own unique mix of energy security challenges. In January, the European Commission forwarded a paper to the European Parliament entitled "An Energy Policy for Europe." The Commission called for urgent action on three aspects of European energy security, which sounds similar to what Secretary Bodman talked about this morning, namely sustainability, security of supply, and competitiveness.

Now, the European Union depends heavily on imported hydrocarbons, oil and natural gas. In fact, imports today account for 50 percent of total EU energy consumption, and if no changes are made, this dependency is expected to grow to 65 percent by 2030. This places great strategic importance on maintaining effective relationships with gas suppliers, such as Norway, which is inside the European economic area, and Russia and Algeria, which are not.

Still, the vulnerability is high for EU member states that are fully or almost fully reliant on a single gas supplier.

On the positive side, the EU has committed itself to a leadership role in reducing greenhouse gas emissions, to offset air pollution and climate change concerns. In fact, the Commission has proposed a legally binding target that would increase the level of renewable energy from 7 percent in the current overall energy mix to 20 percent by 2020.

Now, the EU already is the world leader in renewable energy technology. For example, EU companies hold 60 percent of the market share in wind technology. Even so, meeting the proposed targets, as well as the even more ambitious targets projected for 2030 and 2050, will require extraordinary growth in renewable energy sourcing in all three sectors of primary energy use, namely electricity, transportation, and heating and cooling.

But perhaps the greatest challenge Europe faces is inherent in the diverse energy supplies infrastructures and energy policies of its member states, and if you want to translate its member states to the states of the United States, there is a parallelism.

For example, in the nuclear sector, countries such as Ireland and Austria are strict opponents of nuclear power. Germany, Belgium and Sweden are all at some stage of phasing out their nuclear power programs, although there are signs from time to time that those phase-outs may be reconsidered.

By contrast, France derives nearly 80 percent of its electricity supply from nuclear power and is the greatest electricity exporter in Europe. France and Finland are planning or getting underway with new nuclear construction. The Baltic States and Poland have indicated their intent to team up on building a new nuclear plant, and the United Kingdom and others are still embroiled in discussions over whether or not to go forward with more nuclear power.

But what is encouraging about the European energy security climate is the focus on developing a coherent energy policy, and in some ways, the current EU discussions on energy security are a version of a discussion that must take place on a global scale, and in this country.

In fact, the sharp divergence of views on how best to proceed is to be expected, but if the EU can balance successfully the competing concerns, achieving security of supply, reducing carbon emissions, convincing its consumers of the need to convert to more energy efficient practices, while remaining economically competitive, it gives them hope that this type of cooperation can take place on a broader scale worldwide.

So, let's take the UK as an energy security case study. Traditionally, the UK has prided itself as being one of the few countries to be self-sufficient in energy. Coal, oil, natural gas and nuclear power all have made substantial contributions to this self-sufficiency.

In the early 1990s, however, market liberalization combined with the privatization of government-controlled energy companies, the ready availability of cheap North Sea gas and other factors began to have an impact on UK energy consumption. Dependency on coal for electricity generation dropped sharply, replaced largely by natural gas. But change is on the horizon.

Domestic production from the North Sea gas fields continues to diminish. By the year 2021, North

Sea oil and natural gas production is projected to slip by 75 percent from 2005 levels.

Now, in the interest of full disclosure, I have to tell you that I am on the board of a New Orleans gas company. It is called Marathon Oil and Gas. In addition, I'm on the board of a utility company, Public Service Enterprise Group, and in fact, Marathon, in fact, does North Sea oil and gas production. So, what I am telling you is what they, in fact, see.

Now, just last month, the British government proposed new legislation that would set a carbon budget every five years and create a binding emissions reduction target of 60 percent by 2050. As a consequence, more coal-powered stations are expected to close, unable to meet new clean air requirements. A number of older nuclear power plants have been phased out. In fact, most of the UK coal-fired and nuclear plants are scheduled to be retired in the next 15 years.

The bottom line is that the UK is well on its way for the first time to becoming a major net importer of energy. And, in fact, a UK industry report declared in 2005 that if business continued as usual, by 2015, the country would experience a 20 percent shortfall in electrical generation. But efforts are underway to counteract this trend, even with tougher emission standards. Two energy companies are planning to build new coal-fired power plants by 2012 and 2013, respectively, at least one of them using newer technology incorporating so-called super critical boilers that operate at higher temperatures and pressures for greater efficiency.

There are additional infrastructure investments underway as well to enhance pipelines and storage of imported natural gas, mostly from Norway, as well as to enable greater electricity imports across the channel from France.

Now, in the UK, the construction of new nuclear plants continues to be a subject of speculation and controversy. Renewable energy projects have received a great deal of attention in the UK. The development of bio gas from sewage and landfill has been exploited in some areas, becoming the largest UK renewable energy source. Great interest exists in installing more on-shore and off-shore wind farms, following the lead of countries like Germany and Denmark, or in making larger investments in solar generation capacity.

In fact, the British government has set targets for cogeneration, using waste hot water from power plants for district heating. It also has enacted laws encouraging micro generation, the local production of electricity by homes and businesses using small-scale wind turbines to offset peak electricity demands and also which can be fed back onto the electrical grid.

But there is an issue with the grid, and that is that people have really not studied and understood very well the actual effect of putting more energy efficient devices and these micro generation sources on the grid. So, again, you cannot make policy decisions in isolation.

As an island nation, the UK also is uniquely situated to explore marine energy, harnessing tidal streams and wave energy. The Scottish Executive has set an aggressive target of generating 17 to 18 percent of Scotland's electricity from renewables by 2010, and in fact, he's funding a three megawatt wave farm.

Now, the point here is that the case study of the UK, like many others, reveals three things about the energy security picture: First, that it involves a complex set of priorities, some of which conflict with each other; second, while each country has a unique mix of strengths and vulnerabilities, many of the problems, particularly the technological challenges, are common to all; and third, there is much to be gained through collaboration to address the challenges.

Now, when it comes to energy security, then, we may have different local priorities, but our choices, our policies, and ultimately, what we pick have broader national implications and broader global implications. And so, collaboration is the name of the game. Because it will enable us to innovate at an unprecedented pace.

Now, the U.S. Government is pursuing collaboration and support on two levels, domestically, as Secretary Bodman described this morning, with a couple of efforts, and internationally, and let me just make a few comments here about nuclear power to set the stage for the later discussion.

Now, on its surface, nuclear energy satisfies many of the optimum requirements for enhancing energy security. Nuclear power produces virtually no sulfur dioxide, particulates, nitrogen oxides, volatile organic compounds or greenhouse gasses. The complete cycle from resource extraction to waste disposal emits only about two to six grams of carbon equivalent per kilowatt hour, and this is about the same as wind and solar, if one includes construction and component manufacturing, and is roughly two orders of magnitude below coal, oil and natural gas.

Moreover, nuclear power can supply the large baseload capacity needed to support large urban centers and to stabilize large electrical grids. But one of the most controversial aspects of nuclear power, which I have sometimes referred to as the Achilles heel of the nuclear industry, of course, relates to the management and disposal of spent nuclear fuel.

Now, the amount of spent nuclear fuel that is produced annually, about 10,000 tons, which is about 2,000 tons per year in the U.S., is actually small when contrasted with the 25 billion tons of carbon waste from fossil fuels that is released directly into the atmosphere.

Now, most of the technological issues associated with geologic disposal of spent fuel have already been solved, but given the intense polarization around the nuclear waste station, public policy will likely remain skeptical, until some fuel cycle closure solutions have been demonstrated.

Now, I was going to talk about Yucca Mountain, but I would let you ask me about that in the Q&A. But let me just close-out with a little bit about innovation. The U.S. Department of Energy has a program called Nuclear Power 2010, aimed at facilitating additional orders and construction of power plants by the end of the decade.

In December, in fact, and this has to do with international collaboration to solve national problems, Energy Secretary Bodman and his Russian counterpart, the Federal Atomic Energy Agency Director Sergei Kiriyenko of Russia, submitted to their presidents a joint work plan for bilateral collaboration in nuclear energy R&D, including work on advanced reactors, including fast reactors, new reactor fuels and fabrication processes, advanced methods for recycling and transmuting spent nuclear fuel, and exportable small and medium-sized reactors for developing countries.

Now, on the technical front, innovation and nuclear energy is mature and there are a number of reactors that are being built and demonstrated, but let me close with a last word about the economics of nuclear power. In fact, nuclear plant operating costs are low when compared to most other energy sources. And, unlike oil or coal or natural gas, the purchase of fuel comprises a relatively small part of energy costs, such that the volatility in fuel prices while having an effect, has relatively little effect on the overall costs of nuclear electricity generation.

On the other hand, nuclear plants are capital intensive, requiring initial investments in the billions, $2 to $4 billion, as well as a sophisticated regulatory infrastructure to ensure safety oversight.

Now, with all of these costs taken into account, new nuclear plants can produce electricity at a cost of between 4.9 and 5.7 cents per kilowatt hour, and this makes nuclear power cheaper than natural gas for electricity if gas prices are above about 470 to 570 per million BTU. On the other hand, it is more expensive than conventional coal, unless coal rises above $70 a ton. But nuclear power would be more competitive if a financial penalty on carbon dioxide emissions were introduced.

So, in the end, we need to do roadmap thinking, again, linking sector use to technology choice, but understanding that it is always going to play against public values and strategic intent.

Thank you very much.

(Applause.)

PROFESSOR WOLFRAM: Thank you, Shirley. So, in many ways it is appropriate to start off this session talking about nuclear power, because perhaps none of the other energy sectors so clearly identify this tension between the mix of regulations, environmental regulations, safety regulations, waste disposal, combined with economic regulation.

So, I would like to start off the questions, myself, by asking Shirley what she thinks the biggest barrier going forward to expanding nuclear power is, and

I would like to throw one thing out there, which is I have heard companies say that it is really the economic regulation that is deterring them from starting new nuclear power projects, that they want some kind of commitment from the state PUCs that they will pay for the nuclear power on an ongoing basis and not wait until the plant is in service.

DR. JACKSON: Well, the very question about state PUCs implies that nuclear plants will be built within the framework of what others have described as the integrated model of cost of service regulation, and there are a number of power generators, including those that -- Public Service and I believe that Exelon is evolving this way -- that are generators in a competitive framework.

So, the fundamental question then is will energy companies see, in an unregulated environment, the economics of building new nuclear facilities benefitting?

PROFESSOR WOLFRAM: Yeah, I guess I was thinking that if a regulated company would not even do it that the unregulated companies aren't going to --

DR. JACKSON: Well, the irony is, I actually believe that the economics need to be calculated in the unregulated framework, because in some ways, if there is a consortium of companies that operate in that arena, and there are such consortia, by the way, pursuing licensing of plants, then they know what the economic factors are.

Now, the recent Energy Policy Act of just a couple of years ago actually had some early incentives for the first plants out of the gate in terms of guarantees and so on. There is also the issue of insurance, so to speak, against a nuclear accident, and so, all of those things have to be put into place, but even so, Constellation Energy came forward, applied for an early site permit to build -- no, I am sorry, Exelon came forward for an early site permit to build a new nuclear plant in central Illinois, and this is the first such permit that has been granted by the Nuclear Regulatory Commission in nearly 30 years.

PROFESSOR WOLFRAM: So, why do not we take questions from the floor and, Shirley, you can direct your own questions.

AUDIENCE MEMBER: You mentioned that Germany was phasing out its nuclear power while France was increasing its nuclear power.

DR. JACKSON: Well, France is already at about 80 percent.

AUDIENCE MEMBER: Can you explain the reason for that and what the implications are for nuclear power in this country?

DR. JACKSON: Well, as you may recall, as I was ending my remarks, I made the point that government policy making in the nuclear arena always occurs against the backdrop of public values, and so, what's driving the movement away from nuclear in Germany has to do with just that, and that people feel that there are ways to deal with environmental concerns with renewables. In fact, Angela Merkel has pushed this arena and she's a physicist. In fact, I knew her when she was the Environmental Minister and I was the NRC Chairman.

And so, I think it is always the backdrop of worrying about a nuclear mishap that always plays on people's minds. And so, one thing that I did not mention, but is the reason I talked about the newer technologies is that there are key things that have to happen. They have to be newer, more passively safe reactor designs, and in fact, there are such designs. Secondly, the spent fuel problem has to be resolved. Third, you have to have a regulatory framework that is transparent, fair, open, but where the regulation is done that engenders public confidence, and you have to have continued excellent performance by the nuclear operators, and the nuclear industry has come a long way.

And you mentioned the economics. Part of the difficulty in the economics of nuclear plants, and the fact that the people have always viewed them as almost too expensive to deal with, is it was oversold with the too-cheap-to-beat-her piece, but then people learned a lot of hard lessons along the way about how to build plants in a more efficient way, how to standardize on designs, and then how to operate them in a cost effective way. So, all these things come into play.

PROFESSOR WOLFRAM: Just one more.

AUDIENCE MEMBER: Thank you, Shirley. The thing you just said there about standardization design, it seemed to me that with our original nuclear program, each one was a custom design.

DR. JACKSON: That's right.

AUDIENCE MEMBER: Do you see additional standardization and maybe a couple, three models that would be much easier for the NRC to regulate in the future?

DR. JACKSON: Yes. In fact, when I was at the NRC, we did what we called the final design approval and design certification of a couple of more advanced designs, ones where the designs were actually done using probabilistic risk assessment to kind of look at the various potential vulnerabilities of plants.

What design certification means is that once they are approved, these designs have a shelflife of about 15 years. So that if a company comes in, gets an early site permit, and then chooses and can get then a combined construction and operating license, that's streamlining in and of itself, such that if they build one of the pre-certified designs, and stay within certain parameters so they do not change the design a lot, then they can automatically start the plant once they've built it. But it requires, of course, whole points to test various things, but it is not a separate licensing and adjudicatory proceeding, and that's the way it works.

PROFESSOR WOLFRAM: All right. We have three more speakers, so we will keep things going. Thank you very much, Shirley.

The next speaker is Bryan Hannegan, who will continue the electric power theme.

MR. HANNEGAN: Well, I want to thank Dr. Jackson for setting me up so nicely, because a lot the topics that she has talked about in her remarks are things that I am going to try and amplify on a little bit here in my remarks if I can bring up my slide deck here successfully.

I want to talk about some of the impacts that policies make on markets for electric generation, and before I start, I do want to say a few words about EPRE, the Electric Power Research Institute. We are a 501(C)(3), a nonprofit organization, that specializes in collaborative research for the electric power industry, but our membership is broader than that. In particular, we look at all of the various technologies that Dr. Jackson mentioned in her remarks, things like how do we improve the electric power grid to accommodate all of these new smart devices that are both serving load and also being load at the same time; what are we doing about new generation technologies like wave and tidal? We actually have probably one of the world's leaders on tidal energy on EPRI staff, and we are doing a lot of work in the United States to identify tidal sites, and many of them are now the subject of applications at the FERC. So, it is yielding real results. We are doing work in the nuclear area as well as in clean coal technologies and renewables and how you integrate those into the grid.

We are also doing analytical work to back up decisions about what is put on the grid and by whom and at what time, and that is really where I want to focus my comments this morning -- excuse me, this afternoon.

A couple of key questions are really sort of what are the factors that are driving choices over new generation and how we are using existing assets, and I am going to focus a lot on carbon because it is sort of the heavy-hitter in the environmental space, and it is obviously something of great interest, but keep in mind that my comments could extend to all sorts of other pollution controls as well.

Then, how do policy choices on things like coal transportation fees and natural gas access to new resources or the building or nonbuilding of LNG facilities, how do those actually wind their way down through choices on what we use to create electricity and the prices at which it is delivered to consumers?

So, I want to hit three points in my presentation, which is how non-CO2 policies and regulations affect technology choices for electricity; why natural gas prices are and will remain a significant influence in both planning new generation and also in dispatch of existing units; and then I want to, if there is time, talk a little bit about how CO2 regulations affect the dispatch of both new and existing units, and that may be something that we get to later on today.

This is our standard model, and it is sort of a simplified analysis, and Dr. Jackson said, well we really want to look at this a unregulated space, and this is exactly what we are doing with this chart and the others that will follow. What we are doing on the far left is determining the life cycle costs of electricity for pulverized coal, indicated by the red curve, and for IGCC, indicated by the blue curve.

This is based on our technical assessment work, our interactions with the vendors, our work with our member companies who provide us pricing information on a confidential basis. We wrap that all up to figure out what are the capital costs, what are the costs associated with O&M, and what are the fuel costs associated with, in this case, the coal that's being burned?

That gives us the left hand point, the intercept with the zero line there, a little less than 5 cents per kilowatt hour for pulverized coal and about 20 percent higher than that, a little bit less than 6 cents per kilowatt hour for IGCC. What we can do, then, is vary the cost of CO2 by a dollar per metric ton figure as a proxy for the stringency of the policy constraint in a carbon-constrained world, and you can see on the right-hand side, we then adjust for the CO2 cost.

Recognizing that coal technologies emit about eight-tenths of a ton of CO2 per megawatt hour, you can then adjust the curve so you can get this upward sloping line, and you can ask yourself, all right, if we do that for the full range of electric technologies, how do those curves interact with one another and what are the lowest cost options at various points along that parameter space?

That is what is shown on the next diagram here. These are the comparative costs that we see for the entire range of sort of larger scale electricity generation technologies in the 2010 to 2015 time frame. In other words, if you placed an order today to put a plant into service, this would be the window in which it came through. If you look on the far left, you can see that pulverized coal clearly has the advantage, but nuclear is not too far behind. Then, as Dr. Jackson pointed out, once you moved beyond a modest carbon constraint, let's say something in the neighborhood of $10 per ton of CO2, nuclear actually becomes the lowest cost option.

Following pulverized coal, you see natural gas combined cycle there at $6, which is actually a rather low gas price; today it is trading at about $7.50, and it has been in the $7 to $9 range or so, and I will show you how that changes the dynamic in a moment. Then, right above that, around 7 cents per kilowatt hour, unsubsidized, without the production tax credit, is wind energy at a 29 percent capacity factor, which represents the average capacity of wind on today's U.S. grid.

IGCC is still at a level above that, and based on some recent work we have done in the direct use of biomass space, you can see that biomass, second among renewables, but well above the point at which it would compete economically in the marketplace.

But we are talking about 2010 to 2015, and so what I have done now is I have pulled nuclear off the chart, given the licensing period of five years or so that we are seeing right now --

DR. JACKSON: Faster now.

MR. HANNEGAN: Faster now hopefully under what the NRC is currently doing, but let's take five years nominally to license, five years to construct, outside the 2010 to 2015 window in many cases if folks are just getting started today.

So, if you take nuclear off the table in this time frame, you will see that pulverized coal has a clear advantage even in a carbon-constrained world. In some cases, a utility will find it easier just to pay the carbon price, to buy that credit on the market, and continue to build the proven pulverized coal technology.

If natural gas prices were to suddenly decline, let's say we had an influx of natural gas imports via

LNG, or the natural gas pipeline from Alaska was built, or we increased domestic production and gas prices came down to $4 per MCF, then clearly natural gas would take the lead from a lowest cost perspective, even ahead of coal technologies.

But what if we went the other direction and what if we actually limited access to oil and gas -- or sorry, to coal and gas, such that natural gas prices came up to $8 per MCI, more like what you see today if you projected that forward, and if there were issues with coal transportation, or if we were putting new restrictions on mountaintop mining, for example, or we were limiting access to new leasing in the Powder River Basin, let's say that the coal prices came up from $1.50 a ton to $2 per ton, what would that affect -- how would that affect the interplay?

If you saw some increases in cost due to delays in the licensing process for nuclear energy, or if you saw, as some are seeing today, increases in the commodity prices for steel, and the wages that we need to pay today's laborers, because they are in demand, not just here in the United States, but also globally, to build nuclear plants in China, in India, in other places around the world. Suppose the capital cost for nuclear increased by 50 percent. How might that affect the levelized cost of electricity? I show that on the diagram here.

What if we extended the production tax credit for renewables now out to 2015, an idea that has been kicked around in Congress, suppose that came about? That would bring wind energy from about 7 cents per kilowatt hour down to something more in the range of 5, if we assumed a 1.9 cent per kilowatt hour PTC, and that would actually bring biomass down to about 8 to 9 cents per kilowatt hour.

Let's take all of those what-ifs now and put them together and call it a policy-driven case. Let's say we made some explicit choices that affected the variables shown on the chart. You can see if we extended the production tax credit, now wind is clearly the lowest cost option at any range of CO2 prices that you might can thinking of. Pulverized coal is still competitive, and if you are not able to have access to the wind resource, as you might not in places like the Southeast, then you would certainly be looking at pulverized coal and thinking about how we gain the technologies to capture and store the CO2 to reduce the costs even more.

Nuclear, even with a 50 percent increase in capital costs, is still the lowest cost option under a severe carbon constraint, once you go beyond your available wind resource, and natural gas now is not really even an option. It is well above even IGCC for most of the range of CO_2 prices.

The point I want to leave you with that is our policy choices do make a difference when it comes to the decisions that are being made in board rooms about what to site, what to use, and what fuels to burn, even as we think about the uncertainty of our carbon-constrained world going forward.

Again, if we took nuclear off the table because of licensing delays or inability to get those plants constructed and online, between 2010 and 2015, you would have a much clearer run for pulverized coal technologies.

So, what does this mean? The implications are clearly if you can get nuclear online now, it has a very good foothold in the market, a very good cost advantage going forward, but there are concerns about regulatory delays, about the uncertainties associated with dealing with the spent nuclear fuel. All of these things could raise costs and prevent reactors from coming online beyond 2015.

In many cases, with the exception of wind resources, they are of good size and good variety.

Renewables are unlikely, in our view, to extend beyond the state mandates that we see out there. If it were not for these state RPSs, I would be hard-pressed to see why people would be investing in biomass because of the cost increments that it would trade at relative to other generation technologies, but if fossil fuel costs are high, if we have limits on coal and natural gas production or imports, then subsidized wind with the PTC really competes well in the marketplace, and that would explain, by and large, why you are seeing lots of wind being put into the market today.

Even with some policy changes, if I go back to this policy-driven case and I even include nuclear, if you focus on the left-hand side of the diagram, the technologies that immediately come in right after wind are all fossil-based -- they are all coal-based, in particular -- and if natural gas prices are lower, certainly natural gas plays a role as well.

The bottom line is that for the near future, new base load generation is going to use fossil technologies, and those technologies are going to operate without CO2 capture and storage, because we have not proven it at a scale yet where someone is out there willing to make the investment and Wall Street is willing to put up the money.

The choice of coal versus natural gas is going to depend, obviously, on the fuel prices, but the bottom line is if you are worried about climate change, the next few years do not really present you very good opportunities for significant CO_2 reductions at an economic price. You have to start looking at fuel switching; you have to look at conservation measures; and things which really may fall outside the range of your economic tolerance.

I want to talk just briefly about existing units, because we have talked so far about new units and choices that people make, but before I do so, I want to come back to this new generation thing and say, you know, stick around, because at 4:30, I am going to talk about how some of the technology work that we are doing and the R&D needs that we are working on with DOE can actually change this balance over the longer term with respect to climate, but let me finish up by talking about existing units, because CO_2 impacts them as well, and certainly fuel costs and limits on those fuel availability and sources would indicate that as well.

The point I want to make here is that if you increased carbon prices in the market to $10 per ton, the present value of all the carbon permits that an existing coal-fired plant would have to buy today is literally equivalent to the capital value of the plant as it exists. So, it is not inconsequential to say we are going to put a tax on CO_2 at a modest level. It means quite a lot for the operation of an existing unit, and I show you some examples there.

The interesting thing, though, is that higher costs means higher bids into the market, and if fossil is driving the market price, then those market prices are also higher as well, so that the higher bids from fossil units do not necessarily hurt those units as much as you might think, and that really focusing on the net revenue is what we at EPRI think is the most important measure of how an existing asset will bear up under a carbon constraint.

Let me just show you that graphically, briefly. You can see on the left-hand side, CO_2 price is zero, so the market price is set in this case by the natural gas unit at a dispatch of $50 per megawatt hour. If we add a $20-per-ton CO_2 price on top of it, indicated by the yellow bars on the right-hand side, you can see the cost is greater for the coal unit, but the coal unit still makes some net revenue relative to the gas unit which now has a CO_2 price also associated with it.

What we can do is look at how plants are dispatched in a region or in a state with respect to their position in the generation stack, and if you assume that we are generating or we are -- sorry, we are dispatching the lowest cost units first, and we are not focused on green dispatch or any other mechanism like that, then you can see that in a traditional stack, nuclear and hydro, being the lowest cost units, are usually dispatched first, then the coal units, and then the natural gas peaking units, and the oil-fired units in succession. Then we look at how these changes over time depending on where the carbon market price and the natural gas prices might be.

So, we look at regions of the country. I want to talk about an area we call Coal Land, which is represented by the E-Car, in the main areas where coal units set the market price almost two-thirds of the time in 2005, and for some hypothetical plants that we place on the dispatch curve there, you can see where they come out and the numbers following the slashes are the heat rates. So, 9.8 is 9800 BTU per kilowatt hour, fairly efficient unit, and then you see a coal unit at 12.3 down towards the end of the stack.

What I want to do is take this chart at zero dollars per ton and step quickly through $10 to $50 per ton. What has happened now is the nuclear units are achieving greater net revenue, obviously. They are emissions-free; they are being dispatched quite the lot; they are making a lot of money. The units with capture and storage, the ultra-super-critical pulverized coal and the IGCC units, move from the back of the stack in a zero dollar carbon world to the front of the stack in a $50 world, which makes sense since they are also non-emitting, but a good base load and low cost.

Even the U.S. -- the ultra-super-critical PC and IGCC units continue to fare well. Their net revenue goes down slightly, but it is still significant. It is non-zero. In fact, what moves to the end of the stack are the most inefficient coal units, and that is evidenced by this chart, which shows net revenues for existing units going up in blue for the nuclear plant and going down slightly for the coal units, and most dramatically for the least efficient of all those coal units.

If we look at new technologies, the technologies with capture and storage of CO_2 do well, but even the natural gas combined cycle unit down there in yellow increases in its net revenue per year as the CO_2 value increases.

Now, that was in a market with $8 natural gas prices. What if we brought those natural gas prices down to $6? I give you a couple of options here on how that might actually occur. I want up to focus on the natural gas unit down there at the bottom, because that is really where the rubber hits the road. At $50 per ton at $8 gas, it is down there at the end of the stack; at $6 gas, it moves up almost to the knee in the curve. In fact, it is being dispatched side by side with the other fossil units driven by coal.

So, natural gas prices, particularly for natural gas units, obviously make a fair amount of difference, but notice, for the others, the positions on the stack, the net revenues, are really largely unaffected.

So, let me draw some conclusions and end up. Higher production costs from CO2 value doesn't imply that all your coal assets necessarily become useless. In fact, in many cases, the higher efficiency ones will stand out and continue to be functional, even in a strong carbon-constrained world and even in the absence of CO2 capture and storage. The real risk to your assets depends on what is your regional generation mix, what is your natural gas price levels and how -- you know, again, how efficient is the plant that you are looking at. Clearly, older and less efficient plans are more exposed to CO2 risk, which means as we think about environmental retrofits in a carbon-constrained world, those are the most likely candidates, but the bottom line here is that regulatory impacts are not straightforward, and the way in which we design the carbon market is obviously going to have a lot of impact on choices both the national level and individually amongst our companies in how they use and generate electric power.

So, those are the comments I want to leave with you. A teaser, at 4:30 this afternoon, you will get part two of the story, how R&D can really change this dynamic going forward in the next couple of decades.

Thanks.

PROFESSOR WOLFRAM: Thank you, very much. Why don't you stay up there for a couple of questions.

MR. HANNEGAN: Okay.

MR. SEESEL: I should have mentioned this at the beginning of the panel, and that is if people could identify themselves for the benefit of our reporter, that would be very helpful. Thanks.

MR. GOLDBERG: Thank you. Actually, I was going to ask Dr. Jackson a question, but I could put it to both, because it both involves nuclear and IGCC.

I am from Argon National Labs, Steve Goldberg. We did extensive work on the cost of new nuclear as well as new IGCC. We found there were two ingredients that were critical. One is in the area, in nuclear, the overnight costs for the new plant, coupled with the risk premium that investors are willing to pay for these new plants, and I am going to segue into loan guarantees, because I see somebody from Constellation here, and that's a big area for Unistar's loan guarantees. So, if you could both address it or one or the other, that would be great.

On the IGCC front, when we did the calculation, it looked pretty reasonably economic for onesies and twosies, but when you get to a lot of IGCCs and carbon, you are sequestering a lot of carbon, you are backing into an area which nuclear is very familiar with, the disposal of the carbon or the storage of the carbon.

Have you thought about, when you go into a macro calculation of CO2 sequestration, where that takes you? Because then nuclear looks actually a little better than it would otherwise. So, those are the two questions.

MR. HANNEGAN: Well, let me address the second one first, and that is that you are absolutely right to put the spotlight on CO2 capture and storage as being the linchpin for coal technologies going forward. I was asked about this at a Senate hearing a couple of weeks ago, and my comment was simple. You know, we have three projects around the world that are working on sequestering and storing 1 million metric tons of carbon per year. That's about one-fourth of what you get from an average commercial scale coal plant on a given basis, and we have how many of those around the world?

Even if you took just all the new plants that EIA projects in its annual energy outlook case going forward and you said, "I want to capture and store the carbon from all those new plants," you go quickly from millions of metric tons into the billions of metric tons of CO2. We have the technical capability to do that; we have the reservoirs. Do we have the political will? Do we have the regulatory space to support that? Are you willing to host it under your backyard if the reservoir happens to be there? Are you going to want your piece of the action? There are a whole host of questions regarding that that are really I think the limiters on IGCC.

Then, to your first question about nuclear and IGCC costs, our worry actually is, frankly, is the labor and materials cost excalations that we are seeing out there. It is not a matter of loan guarantees and risk insurance anymore. If what you are talking about is a bid of 3,000 to 4,000 per kilowatt for a capital cost out there, I mean, that's a substantial change in the economics that is -- you know, we are hearing about instances where that is the case, because the demand for these new plants is rapidly outstripping the supply.

PROFESSOR WOLFRAM: Why don't you take one more question?

MR. HANNEGAN: I don't know, Dr. Jackson, did you want to weigh in?

DR. JACKSON: I will just make a comment, and that is that a lot of the comparisons -- and because nuclear really is really pretty cheap, at least on an operational basis, the competitiveness analysis -- and this is actually kind of a comment and a question -- the competitiveness analysis for other fuels, particularly natural gas, tends to be predicated on assumptions about nuclear licensing risks and costs, on the one hand, and about carbon costs on the other.

So, a fundamental question is, how are carbon costs set? Because a lot of the discussion is about carbon capture and sequestration, and you talk about putting it into reservoirs. That capture is in the form of a gas, CO2. Reservoirs do not hold gas forever. Therefore, if one really wishes to truly have true carbon capture, one has to think about technologies that would reconvert the gas back to some more elemental or solid form. I have yet to see a factor put into the analysis that relates to closing the carbon cycle in that sense.

MR. HANNEGAN: Right. Just to that point, the analysis that I showed a moment ago includes all the sort of decommissioning costs that we know to be inexistent with nuclear, and it also includes a $10-per-ton CO2 capture and storage charge.

DR. JACKSON: Yeah, but that is capture and the storage. That does not have to do with reconversion of the gas to an elemental form of carbon or some other solidified form, and until and unless you do that, you have not closed the cycle vis-a-vis environmental mitigation.

MR. HANNEGAN: The current practice is to use a chilled ammonia scrubber or something like that to pull the CO2 out, and then we assume compression and super-cooling so that it becomes a liquid that is suitable for injection into a deep saline reservoir or so on. But I agree with you, absolutely, and that is why we have a very healthy research program in area, that the environmental consequences of putting something into a reservoir when you are not exactly sure at that scale what it is going to do, whether it is going to react with the surrounding rock, whether it will escape, those are areas that I think both we and DOE are working on with some urgency.

DR. JACKSON: I had some comment on --

PROFESSOR WOLFRAM: Thank you. We have two more speakers, so --

DR. JACKSON: He would be one to talk to. He's an important one to hear from.

PROFESSOR WOLFRAM: We will save him for the end.

So, the next speaker is Jeff Hazle, who will talk to us about Petrochemicals.

MR. HAZLE: Anybody know whether my file is up here?

All right, that is who I am. I am Jeff Hazle, Technical Director for the National Petrochemical and Refiners Association. Petroleum refiners are certainly affected by government policy choices, and I have been asked to talk about that today.

A brief outline here, I want to characterize the petroleum refining business for you, then describe how that industry allocates resources, and then summarize those points.

First of all I want you to know that the National Petrochemical and Refiners Association, the NPRA, represents petroleum refiners. We have members who are vertical, integrated oil companies. They do production, they do transportation, terminaling, retail, but our group focuses just on the refining segment of the industry. So, that is the way we see the world, and that will be my viewpoint for today.

Characterizing the petroleum refining business, it is a commodity business, and it is a commodity business on both ends; that is, it buys a commodity as its feedstock, and it sells a commodity as its products. These are not value-added products, and by that I mean they are not products made to suit a specific consumer taste. They are primarily made to meet either government specifications or industry consensus standards. So, they are made to a specification. They are not made to please a particular segment of the population.

Commodity businesses, in general, are governed by supply and demand, and I am talking about commodity businesses such as carbon steel manufacture or aluminum manufacture, and I am going to assert that these points apply to the petroleum refining business as well. So, they are governed by supply and demand, and it is that balance of supply and demand that determines the price, again, both for the feedstock, the crude oil that we buy, and for the products that we produce.

Capital investments in our business are generally of the stay-in-business type. There is not -- you may know this, there has not been a new grassroots refinery built in the continental United States since the mid-70s. It is an unusual thing to invest in new products or new areas of the business. In general, we face low profit margins, and the profit strategy typically is to minimize production costs and maximize volumes.

I would like to describe how they allocate resources in the business and some of the capital investments. There are three types of capital investments: The first one is stay-in-business-type investments; by that I mean investments that you have to make in order to comply with government regulations, and these can be for the facilities, such as reducing refinery emissions; these can be applied to the products, and that is common in our industry, where they have to reformulate fuels to comply with the government regulations.

There are also other kinds of stay-in-business regulations, but they are less -- they have less effect on the industry. Those apply to security, safety, but in these areas, the Government's effect is direct and significant. As an example, you have fuels regulations. Starting about 2000 to 2003, we had Tier 2 gasoline sulfur regulations, followed soon after by state NTBE bans, followed soon after by highway diesel sulfur reduction, followed by a renewable fuels standard, and now off-road diesel desulfurization will be implemented this year, and then mobile source air toxics is out in the future.

Now, these regulations pile on, and they add on a cumulative economic burden for individual petroleum refineries. So -- if that effect is too much, then refineries or refiners face a choice of do we continue to operate this facility, do we shut it down, or do we sell it to somebody who is willing to make these investments to stay in business?

There is a second type of capital investment, and that is for cost reduction. Remember, one of the profit strategies is to minimize production costs. And so refiners will invest in equipment or changes in their process that will reduce their crude acquisition costs.

One of the primary examples that a lot of refiners are doing at this moment is they are putting in what is called coker capacity. That permits them to run a cheaper crude and increase the volume of cheaper crudes. It reduces their overall crude acquisition costs.

Refiners also will invest in equipment that will reduce their energy costs, and they will also invest in projects, either through software or through better management, that optimize the process, either increasing throughput or maximizing yields. In general, government policy effects on those kind of investments are relatively minor.

There is another kind of investment, and that is the investment to increase throughput. Again, that is one of our profit strategies in a low margin industry; maximize throughput. So, refining capacity investments, typically through smart operation, technology advances, and incremental investment, refiners have been able to increase capacity by about 1 to 2 percent per year. We generally refer to that as capacity creep.

Whether or not investments in refining capacity are made depends on the business outlook, it depends on the outlook of the competition, and it depends on capital cost. For the first one, it is how you look at your business, and there are a couple of things that refiners will do in terms of evaluating their business going forward, and one of the major components to that is the outlook for that crude supply/demand -- the balance between supply and demand. That will ultimately determine that price in the future. So, they take a view of the world, look at what they expect supply of crude to be versus demand, and whether or not that has a positive or negative effect on price.

Government can have a substantial effect on these areas either through government incentives to produce oil, if such a thing should happen; production bans, which may apply to certain geographical areas; and then things like carbon taxes and import taxes are also possibilities that would have a significant effect.

Refiners are also going to take a long-term view of the supply and demand balance for their products, and those also can be affected in a significant way by government policy choices. Some of those possibilities are -- and we are seeing the first one actually already -- biofuels renewables mandates may reduce the size of the petroleum product market; vehicle mileage standards, if CAFE standards were to increase, that would have the effect of reducing, again, product demand; consumer vehicle choices, and we have seen this over the last 20 years, can either positively or negatively affect the size of that product market. But here, government can affect those consumer choices as well, and you might want to think of tax credits for hybrids, which have influenced the popularity of those vehicles. Then, there is also the potential for greenhouse gas reductions in the future. That would certainly have an effect on product markets.

There is another thing that refiners are going to take into account as they decide whether or not to invest in additional refining capacity. One of those is the outlook for their competition. One of the things they are going to take into account is that in Europe, there has been a shift there from diesel fuels to gasoline -- or I am sorry, it is the reverse -- they have shifted away from gasoline and towards more diesel consumption. That has left Europe with a capacity overhang for gasoline, and it has allowed Europe to economically export some of that material to the U.S.

So, a U.S. refiner is going to take a look at the potential for Europe to be able to export to this country before they build a refinery here. They are also going to take a look at U.S.-oriented export refineries. There are already refineries in Canada and the Caribbean that are oriented towards the U.S. market and depend on this market for their throughput. There is at least one Canadian refiner who has announced a major expansion. So, this is another area where there is going to have to be a determination by the petroleum refiners about the long-term potential for import competition.

Refiners are also going to have what I call an internal competition for company resources. Capital is not an unlimited resource. Even if it were an unlimited resource, companies are still limited by the number of people they have, because to build anything, it takes people's time and resources to build, construct, and execute a project. So, after all the stay-in-business commitments are made by a petroleum refiner, they are going to take a look at what money is left, what projects are on the table. They are going to look at maximizing profit, and that may not include expanding capacity. So, government policy in this area can have an effect with respect to imports and exports and the movement of products across international boundaries.

There is another area petroleum refiners are going to take a look at, and that is capital costs; when they are evaluating projects, to take a look at return on investment. The denominator for that is the capital cost of the project, and so that is going to be a key consideration. They are going to look at the cost of steel, the cost and availability of labor, the cost and availability of engineering. In today's environment, all of those are going up pretty rapidly, and it is changing how refiners are -- in viewing their business. Now, government policy in this area, their effects are relatively small, although there are some things that government can do to change those decisions.

So, clearly, when a refiner is looking to expand, stay-in-business investments come first. Beyond that, refiners are now today looking at expanding capacity. I am estimating that U.S. refining capacity will increase by almost 2 million barrels per day by 2011. It currently stands at about 17.3 million, so we are seeing an additional 2 million ready to come online.

The refiners' commitments to do that, to me, indicates that they are more optimistic about the business than they have been in the recent past. This shows capacity over the last several years in the United States, and the red line there just represents the rate of capacity that we have added over the last three or four years.

Now, if you push that out to 2011, you can see the end of the line. We would end up at 18 and a half million barrels a day. The difference between the top of the bar and the tip of the red line there is what I am going to say is a measure of how optimistic refiners are about the business. So, they are more optimistic, I think, today than they have been.

Now, we have to keep in mind that refiners can change their mind, because as they go forward with these capacity investment projects, they continually evaluate them, and if costs go up for steel or for manpower or if it looks like the product markets get shrunk by additional government mandates for biofuels, that extra capacity there could disappear.

In summary, government policy can affect magnitude of stay-in-business investments, primarily those regulatory investments, and it can have a major effect in that area. It can affect the cost of capacity expansions, usually through tax policy, and there, that is usually a minor effect. Government policy can also effect the supply of crude oil and the size of product markets, and there, the government policy choices are going to have major effects.

Cumulatively, all of these effects are going to affect the refiners' outlook and whether or not they are optimistic or pessimistic about their business, and I told you a few minutes ago that refiners are more optimistic than they were -- certainly than they were ten years ago, more optimistic I think than they were five years ago, but with some of the things that people are talking about in terms of policy choices, CO_2 limitations, and additional mandates for biofuels, we cannot guarantee that they are going to stay optimistic about refinery capacity in the U.S.

Those are my remarks. Thank you very much.

PROFESSOR WOLFRAM: Thank you, Jeff. So, we have heard a couple of times about the increasing costs of steel and the effect that is having on energy markets. We have time for a couple of questions.

MR. WEBB: Michael Webb with REG.

How important do you think the coming online of the Canadian crude is to refiners, and what are the regulatory events that need to take place in order to facilitate Canadian crude enhancing refinery production?

MR. HAZLE: That crude is very important, I think, to the United States. Some of the other speakers earlier today have talked about diversity of supply, and from that standpoint, it is a very good thing to see additional crude supplies come online from Canada. You have pipeline transport, which is generally secure and inexpensive. So, it is an important source for refiners, and they are making investments in their refineries to be able to process that crude to a greater degree, and we are seeing it pushing down beyond the northern tier refiners to much lower parts of the country, down into Oklahoma and even some into Texas. So, it is a very positive thing for our industry, I think.

I am not sure what they have to do in terms of regulation. I don't think there is anything additional related specifically to Canadian crudes. It is a heavy crude, it is going to have a higher carbon content, and they are going to have to worry about all the carbon associated with the tar sands operations up in Canada, and those are going to be vulnerable, I think, to the CO2 limitations, if there are any.

DR. JACKSON: I think, as well, there is the Canadian regulatory framework, and it has its own issues, and then, as Jeff says, the crude grades are heavier grades, and so there are issues about getting them through the pipelines in the first place. Then the final thing has to do with the complexity of the refineries, to be able to take this crude and then to refine it into the kinds of products for the consumer market, and then how all of these things that he just went through affects the ability to upgrade those refineries to do that kind of thing.

MR. HAZLE: Refiners presently are taking advantage of those Canadian Syncrudes, divide from tar sands, as a way to minimize their crude acquisition costs. That's generally a cheaper crude.

Other questions?

(No response.)

PROFESSOR WOLFRAM: All right, thank you, Jeff.

So, our final speaker is Tyson Slocum.

MR. SLOCUM: Hi. Thanks a lot. Great to be here.

First, I want to thank the Federal Trade Commission for putting on what is a very ambitious schedule, but so far, it has been fantastic. This morning was very interesting, and this panel has been great, and I just appreciate the invite to be here.

I am going to focus on oil and gas right now. I am going to be talking a little later about electric power markets.

First, a little bit about me and my organization. I am the Director of the Energy Program at Public Citizen. Public Citizen is America's largest consumer advocacy group. We get most of our funding from individual contributions of over 100,000 dues-paying members across the country that help finance our operations and hopefully pay my salary as well.

So, the title of this particular panel is, "How Do Energy Markets Work Within the Framework of Government Policy Choices"? We have heard a lot of folks talk about energy supply -- in fact, that has been one of the biggest aspects -- and actually, that has been probably the biggest focus of U.S. Government policy decisions that have gotten us to where we are today, is focusing almost entirely on increasing access to energy supply.

I think that we need to rethink that focus. I think that there is no question that the United States is one of the world's largest energy producers. Not many people know this, including Senator Ted Stevens, who I testified before his committee last year, and he challenged my assertion that the United States is the third largest crude oil producer in the world. I had to remind Senator Stevens, who represents -- he's probably represented Alaska since it was a state in the late 50s -- that his state leads the way, along with the rest of the other 49 states, in producing a heck of a lot of oil. Only the Russians and the Saudis produce more than we do.

So, any way you look at the issue of energy policy in America, the problem in America is not one of supply. We are awash in huge surpluses of crude oil right now. The problem is our consumption. We use one out of every four barrels of oil on the planet every day, here, in the United States. We use that oil among the least efficiently of our major economic competitors. In Europe and Japan, they use half the oil per person than we do.

So, clearly, not only can we do better, we must do better if we are going to solve America's energy problems, because we can turn all of Alaska into a giant oil-producing state; we can drill for oil off the

Atlantic and Pacific coasts. If we were to double our oil production to match that of Saudi Arabia, we would still be importing nearly half of our oil. This is not a situation that we can produce our way out of this crisis.

Consumers have to have more options to use energy more wisely. That includes stronger fuel economy standards; that includes much bigger investments in mass transit. Only one out of every $5 in the federal transportation budget goes to mass transit. I took the bus here. I took the 96 bus, which runs from Anacostia to Woodley Park. It is amazing, when I give talks in other cities, how many cities I literally cannot take mass transit from the airport to where I need to go. It is either completely inefficient, taking me six or ten times longer than taking a cab, or it doesn't even exist at all.

So, increasing access to mass transit, increasing fuel economy standards, investing in alternative fuels, and energy efficiency, those are all things we need to do, but we are not going to end our dependence on oil overnight. The fact is that oil is what drives our economy, and we are stuck with what we have got for the next at least 20 years.

So, what I would like to talk about now is how we can focus on making what we have got now, and our dependence on oil, as transparent and efficient as possible, and I want to touch on two general themes. One is on energy trading, these are the energy trading markets where prices are actually set that we pay; and the second is on oil refining markets, which I think is where a lot of the action is right now.

So, let me start off by talking about oil refinery markets. There is no question that we have seen a radical transformation in the downstream oil sector over the last ten years or so, and that has largely been driven by a wave of mergers. Using Energy Information Administration data, I took a look at what the effect of mergers has been, and our research shows that in 1993, the largest five refiners in the United States controlled just over one-third of national refinery capacity. In 2005, as a result of a wave of mergers, the largest five controlled over 55 percent, and the largest ten today control over 80 percent of refining capacity, whereas a decade ago, in '93, the largest ten controlled just over half of refining capacity.

So, you have seen a large consolidation of control over refining, and what that has led to, Public Citizen believes, is a reduction in adequately competitive markets. In my report -- I wrote a couple of reports, one on power markets and one on oil that was available out here. The oil one has the subtle title of "Oil Mergers, Manipulation and Mirages: How Eroding Legal Protections and Lax Regulatory Oversight Harm Consumers."

On page 13 of that report, in the middle of my discussion on some of the problems in domestic refining markets, I quote from a Wall Street Journal article that was interviewing Exxon/Mobil's new CEO, and he says, we do not plan on building any new grassroots refinery, because we have crunched the numbers, and by Exxon/Mobil's estimates, by the year 2030, hybrid cars and plug-ins and other very energy-efficient vehicles are going to make up 30 percent of the U.S. market, and, you know, because of this broader shift in more fuel economy in the U.S. market, that U.S. gasoline consumption is going to peak by the year 2020. And so what Exxon said is, we're looking at the numbers, we don't want to invest a couple of million dollars in building a new refinery, because it is not in our financial interest to do so.

Well, this is a really important point, because why are consumers paying record high prices at the pump? From an economist's perspective, it is because we are sending price signals to the refiners to build more capacity, right? I mean, what is the purpose of a price signal but to send a signal to the marketplace to do investment to deal with rising demand?

But if the refiners are not going to build new capacity -- and it is true that they have been expanding capacity -- but if they are got going to be building any new refineries, what is the purpose for the high profit margins that we have seen? And there is no question that the profit margins in the downstream sector are very, very good.

I looked at Exxon/Mobil's 10-K annual report, which breaks down their return on capital employed, which is the key metric of profitability in a capital-intensive sector like oil, where they earned in 2006 a 66 percent return on their capital investment in their U.S. refining operations. That is tremendous, historically very, very high, and it has been very high over the last couple of years, and because they do not have any plans to build any new refineries, we can pretty much guarantee that refining profit margins are going to continue to grow stronger and stronger.

This is about the only time you will ever find me in agreement with the Saudi Government, where they have consistently said that the problem of high crude oil prices is not a lack of adequate crude supply, but bottlenecks in downstream markets, particularly refining, and that is what we are seeing in the United States, where because of these bottlenecks, we are seeing prices being driven by gasoline futures.

A lot of that is reflected in the crack spread, and the crack spread is around $23, which is extremely high, and it just is an indication that refining profit margins are very strong, and they are going to continue to be very strong.

So, what is it that we can do to address some of this over the next 20 years since we are in this framework? Well, I think that what we need to do is to give more tools to the Federal Trade Commission to deal with unilateral withholding. The FTC, in one of its assessments of gasoline markets back in 2001, interviewed several oil company CEOs, and one of them admitted that they withheld supply in order to wait for prices to go up before releasing their product. This is a common practice, and we feel that it is anticompetitive. We would like to see the FTC have more tools at its disposal to limit or end the ability of these kinds of anticompetitive practices to occur.

I think that Congress ought to give more tools to the Federal Trade Commission to have stronger Merger

Guidelines. I think that the number of mergers that we have seen over the last couple of years has reduced competition, it has caused harm to consumers, and I think that we ought to make it more difficult for some of these mergers in the future, and I think we ought to revisit some recently approved mergers.

I think another thing we have got to do here is put together a U.S. strategic refining reserve. We have got a petroleum reserve, which has been fantastic. As we saw during the Hurricane Katrina, as soon as the hurricane knocked out America's Gulf of Mexico oil production, we were immediately able to release supplies of crude oil to send to refiners. There was never any shortage of crude oil.

What there was a shortage of was refined products. Luckily, we were able to import products from Europe. I do not think that we should count on Europe to save us in the event of another natural disaster, other supply disruption. We ought to have the Department of Energy develop a strategic refining reserve, and if that means the Department of Energy building a refinery somewhere, then they ought to do it, because if the industry is not going to do it, unfortunately, the Government probably should.

To us, it is a no-brainer to shift oil subsidies that are current subsidizing operations of the oil industry into less mature, less profitable, but more promising technologies, like renewable energy, shifted into more energy efficiency, and, of course, bigger incentives for states and localities to invest in mass transit, and, of course, improving fuel economy standards.

Now, the other issue that I want to very briefly talk about is energy trading. I have briefly talked on how I think that refining markets are not adequately competitive. Well, I think that there can be some basic government tweaking to try to limit anticompetitive practices. Energy trading markets are a complete mess in the United States right now. Contrary to what most people out there in the United States think, where they think that OPEC controls prices, OPEC desperately tries to influence prices. Sometimes they do a good job and sometimes they are ignored, and the fact is that energy traders on energy exchanges are the ones that are setting prices, and because of a law passed by Congress in the year 2000 and because of regulatory decisions by the Commodity Futures Trading Commission in '93, more than half of the trades that set prices occur on unregulated exchanges, meaning that there is very little ability for federal regulators to have adequate information over these markets.

As I was taking the bus in this morning, I opened up my Wall Street Journal, and there is an article on page A15 that says, "Rise in Electronic Trading Adds Uncertainty to Oil." If you all do not mind, I am just going to read a couple of sentences, because people who write for the Wall Street Journal are often a little smarter than I am, so they will be able to put it much better than I can.

Matt Chambers of the Wall Street Journal writes: "Oil markets were rocked by a massive, almost instant surge in after-hours electronic trading one day last month when prices for closely watched futures contract jumped 8 percent. This price spike stands out because it was unclear at the time what drove it. Two weeks later, it is still unclear what drove this price spike. What is clear is that a rapid shift in the bulk of crude trading from the raucous trading floor of the New York Mercantile Exchange to anonymous computer screens is making it harder to nail down the cause of price moves."

It gets even worse. There is an energy trader who is quoted in this article who says: "The initial price jump triggered more orders already set in the system, and with prices rising, people thought, 'Somebody must know something.' The more prices rose, the more it seemed somebody knew something."

This is embarrassing. We are the world's most powerful country, we import a huge amount of our oil, we use 21 million barrels of oil every day to make our economy move, and yet we have energy traders making huge bets that we all pay because somebody might know something. There is so little information available to the traders themselves that they are making bets based upon assumptions of what they think other people are doing. If we do not want to re-regulate these exchanges, we ought to just replace these traders with chimpanzees and have them respond to colors or noises, because that basically is the system that we have right now, where huge, gigantic bets are being made based upon a lack of adequate information, and worse than that, there is evidence that there is some collusion going on.

There has been a rise that Public Citizen has been tracking in affiliates of energy traders starting to own and acquire actual physical infrastructure assets. So, for example, the FTC recently interceded on a proposed acquisition by some private equity firms and investment banks to acquire the over 40,000 miles of pipelines formerly controlled by Kinder Morgan.

There were three financial entities, one of them is Carlisle Riverstone, which the FTC put some conditions because they owned interest in a separate pipeline network, but no mention was made of the fact that Goldman Sachs, which is the largest commodities trader, was now acquiring active ownership of infrastructure pipelines, and as we learned from the CFTC civil complaint against BP last year where the CFTC accused BP of single-handedly manipulating the U.S. propane market, how did they do it?

The energy traders at BP were in active communication with the folks who were operating the pipelines and the storage facilities, and they were getting an insider's peek on this information. So, who has the information? The folks that controlled the energy infrastructure, and I think that as part of the reforms, in addition to, you know, closing the Enron loophole, reregulating exchanges, I think the FTC ought to start taking a look at antitrust concerns with affiliate abuses between owners of energy assets and those entities that are doing large futures trading, particularly in the unregulated markets.

So, that's all I have to say, and I appreciate any questions you might have. Thank you.

PROFESSOR WOLFRAM: Thank you, Tyson.

Once again, I am going to take the prerogative to ask you the first question.

MR. SLOCUM: Please.

PROFESSOR WOLFRAM: So, you started out -- and you are by no means the only person that I have seen do this -- but you start out by saying that you want to see more efficient use of energy, more mass transit, for instance, but you also want lower prices. You want the FTC to, for instance, deal with the unilateral withholding. To an economist, those strike me as divergent goals. So, why don't higher prices serve to encourage us to be more efficient?

MR. SLOCUM: That's a great question. I am very glad you asked it.

There are two main issues with why I am concerned about high prices. It is one thing if the high prices are being translated into direct investments that are assisting consumers. In the case of Europe, for example -- and I am not advocating the European model -- they tax the heck out of retail gasoline. It is at punitively high levels, and what that does is a couple of things.

One, it provides a lot of money to subsidize mass transit; and second, it offers a huge disincentive to drive, and it offers all sorts of encouragements to drive more fuel-efficient vehicles.

In the United States, we have seen the tripling of the retail price of gas in the last five years. There has not been a huge impact on demand. In fact, there is a lot of folks who say that there has been no real effect. You have had -- some buying habits have changed. People have been moving away from SUVs, but for the most part, people continue to drive because demand is what they call inelastic, meaning I bought my house and I am paying my mortgage on it and I live X amount of miles from my office or X amount of miles away from where I take my kids to school, and it is not really feasible for me to respond to rising prices by selling my house, especially in this market, to move quicker.

The ability to change consumption patterns with oil and gasoline in response to price signals does not really happen, and what I am concerned about is high prices that are not being invested into providing people with an alternative to those high prices, but rather, it is going to energy corporations who in the refining sector, anyway, are not necessarily re-investing that back into things that are going to help alleviate the problem. So, that is the issue, is that the price signal is not that efficient.

I would rather see -- before we start rising prices on folks, I want to make sure that people have access to alternatives, because essentially, after the 1973 Arab oil embargo, you know, that served as a huge disincentive for folks to drive. You know, demand plummeted after that, but unemployment went to double-digit rates, annual rates of inflation were at double digits. So, you had a situation where high prices served as a deterrent, but at enormous economic costs.

What I would like to see is the United States Government try to finance some of these renewable energy objectives, some of these alternatives, with help from the oil companies in the form of higher taxes, to lay the groundwork before we start applying punitively high rates.

PROFESSOR WOLFRAM: All right. I would like to put it out to the floor, but also, at some point, I would like Tyson and Jeff to address what seem to me to be divergent views about optimism in the refining sector.

First, let's do the floor.

AUDIENCE MEMBER: On your discussion about affiliate abuse, what additional what regulations do you think there need to be, given that pipelines revealing shipper information is a criminal violation of Section 1513 of the Interstate Commerce Act?

MR. SLOCUM: Well, I would like to see firefalls. I mean, actually, there are details that folks can review. There are certain -- you know, what BP is being charged with is not a violation of that. It is a violation of false reporting, where they were reporting false information to regulators to try to cover the fact that they were in constant communication with their affiliates. So, what I would like to see is a stronger firewall.

If a large energy trader is going to -- is interested in acquiring physical assets, I think that there ought to be a concrete firewall. Actually, I am acting as an expert witness out in California right now in a proceeding at the California Public Utility Commission, where two of the pipelines that Kinder Morgan owns are technically classified as public utilities, so it is going through a very thorough public review process, and in that process, they did not have any procedures to forbid communication between the energy trading affiliates and the pipeline affiliates until we demanded that they do it, and they said, "Okay, we will come up with a design," and the Public Utility Commission is going to sign onto that. So, that is my understanding of it, is that there is not a blanket prohibition on that, and we would like to see it, because I think it opens up the door to insider trading, in effect.

PROFESSOR WOLFRAM: Any other questions for Tyson or the panel as a whole?

MS. SPICER: Hi, Veronica Spicer from the Illinois Attorney General's Office.

I was interested in what you were saying about the market not being very efficient and not working very well in terms of the price signals. So, would you want to move away from a market-based pricing system?

MR. SLOCUM: Not for oil and gas. You know, I was not a fan of price controls. I was a little young, so I do not remember it first-hand, but that's not what Public Citizen is advocating. We are advocating more transparency. We think that sunshine does a heck of a lot of good stuff for markets, and the tendency of these markets to operate outside of regulatory overview is a really bad thing.

Information is very powerful, and we ought to have full information about who is trading. To have anonymous bidders being able to add significant volatility to crude oil markets is not in our national interests; it is not in consumers' interests; it is not in anyone's interests except for those traders who are making money off of it.

So, that is what we would like to see, is just a full reregulation of these markets. Get rid of these over-the-counter derivatives exchanges. There is no reason to have unregulated energy trading contracts. The CFTC has to have more authority, and more of this information should be made public, because there should not be anything to hide. It is in everyone's best interest to have more access to information when it comes to these markets.

PROFESSOR WOLFRAM: Follow-up questions?

MR SCHLEEDE: May I ask a question of Dr. Hannegan? Two brief questions. The first question, would you be willing to make available all the assumptions that lie behind your graphs? Are they publicly available, or how can I get them, if you could tell me afterwards.

MR. HANNEGAN: Yep, they --

MR. SCHLEEDE: Second --

MR. HANNEGAN: Let me just -- quickly, they are publicly available. If you go to www.epri.com and look for something called "Generation Options in a Carbon Constrained World," we have a full report and all of the data, and we certainly can get you anything that might not be there.

MR. SCHLEEDE: Second, why do you show wind on the same chart with the other sources when wind is an intermittent source that produces electricity primarily when we are not at peak demand and really has less value, and further, it has very little capacity value, so to the extent you build wind, you've got to build something else anyway to maintain reliability of the system.

MR. HANNEGAN: Right.

MR. SCHLEEDE: So, why do you show it on the same chart?

MR. HANNEGAN: Well, we show that primarily because when folks are looking at capacity additions, regardless of whether it is base or peaking, they tend to want to compare apples to apple-like fruit, not exactly apples to apples sometimes.

The other aspect of it is that we are also working very actively to develop energy storage technologies that will enable wind to become more dispatchable. If I had a fuller time to present some of the underlying assumptions contained in the chart that I showed, you would see that we take into account the intermittency and the backup costs in our cost assumptions, and we distinguish it as being an intermittent resource, compared to a dispatchable, renewable, like a biomass or a -- you know, some of the other things that are on demand.

But certainly -- and you will hear more about this from me this afternoon if you are here at 4:30 -- getting intermittent renewables to behave more like dispatchable resources and developing the grid capability to handle those and the storage technologies is a critical linchpin to enabling greater renewables use going forward. Otherwise, the only thing that will be driving them into the market are the state RPSs, and at that point, people are into the market for renewables kicking and screaming.

PROFESSOR WOLFRAM: All right, thank you very much to all the panelists.

DR. JACKSON: May I make one comment to that?

The one thing that we do not talk enough about, and I think that the energy industry itself, even beyond what EPRI does, and EPRI does a great job, and that is invest more in R&D. The industry is not known for real investments in R&D except through mechanisms, you know, like EPRI and so on, and more direct investment is important, because these questions about intermittent versus dispatchable resources and the role of storage, that is a real R&D question, and we are not where we need to be.

It easy to talk about it, but we are not where we need to be to have these sorts of intermittent sources in any way become dispatchable, and the storage capacities -- the storage technologies have got to become smaller and themselves more benign in terms of their environmental effects. So, all of these things in terms of full life-cycle effects and costs really have got to enter the discussion, and then we have to talk about where within that full life-cycle discussion R&D has a role.

Until we get there, you know, we are all looking to the DOE to do its thing, but unlike other industries, the energy industry has not, you know, at least in the last 20 years been the great investor in R&D.

PROFESSOR WOLFRAM: Thank you.

So, John has set up the incentives right for the moderator, because we are starting to cut into my panel, so let's take a short break and come back.

MR. SEESEL: I just want to thank Catherine and the excellent panel for that discussion. We will be on a break for about the next ten minutes or so, and then we will start a three-part program on the electric power industry.

Thank you.

(Whereupon, there was a recess in the proceedings.)

MR. FRANKENA: Good afternoon. My name is Mark Frankena. I am the Deputy Director For Antitrust in the FTC's Bureau of Economics. Our co-moderator this afternoon is Jolanta Sterbenz, who is Deputy Assistant Director in the FTC's Bureau of Competition.

We would like to give you a warm welcome, particularly to our 12 participants in this afternoon's three panels on electricity restructuring and climate change, and we also would like to welcome both our live and webcast audiences.

In a number of U.S. industries that were heavily regulated in the past, such as telecommunications and airlines, changes in regulation and technology have led to greater reliance on market competition to determine resource allocation and prices, and consumers have experienced considerable resulting benefits.

In the electric power industry, many of us expected and still expect that if there is efficient access to transmission and distribution, if conditions are reasonably competitive, then consumers will benefit substantially from widespread reliance on markets to provide efficient incentives for resource allocation and to determine efficient prices.

Different parts of the U.S. have tried a variety of approaches to restructuring the electric power industry both at the wholesale and the retail levels over the past decade. Our goal this afternoon is to discuss what we have learned from both the successes and problems encountered in electric power restructuring and then to consider the challenge of climate change.

Now, we have three panels this afternoon, each of which will last about an hour. In each panel, we will begin with a series of ten-minute presentations from our panelists, and these presentations will then be followed by 15 minutes for discussion and questions initiated by another panelist, and there will be ten-minute breaks between the panels.

Now, as you can see, we have an extremely full afternoon. We are going to be lucky to get out of here by 5:45, so I need to hold all the panelists to the ten minutes, and the way I am going to that is if any panelist goes over ten minutes, they pay for take-out for dinner for anybody who is here, okay? If that does not work, if we cannot get response to incentives, our attorney here will turn off the microphones after ten minutes. So, we mean business, okay?

Now, in our first panel, our speakers are going to address, among other things, what existing studies tell us about consumer benefits from restructuring, how design problems have limited the benefits of restructuring, how greater competition has affected the efficiency of generation, and what we need to do to have an efficient transmission system.

Jolanta will now introduce the members of our first panel.

MS. STERBENZ: In the order they will be making their presentations, Professor John Kwoka from Northeastern University; Professor Wolak from Stanford University; Dr. David DeRamus, from Bates White Consulting; Professor Catherine Wolfram from University of California, Berkeley; and Edward Tatum, Jr., who is Assistant Vice President of Rates and Regulation at Old Dominion Electric Cooperative.

I will be the official time enforcer. I will try to give each one of you a two-minute warning or so, and at ten minutes, this is it. So, let's get started.

MR. KWOKA: Thank you, Jolanta, and thank you, Mark. I want to express my appreciation, too, to John Seesel for the very kind invitation to be here today. It is a pleasure always to return again to the FTC where I served many years ago now.

The issue we are addressing is really beyond normal importance. Electricity is a huge and hugely important industry for all aspects of our economy and all consumers in it. Over the past 15 years, we have broken up and reorganized countless of these traditional electric utilities, replaced traditional regulation with looser oversight or deregulation, created entirely new institutions to assist in the coordination function between stages, and encouraged entry of new players into both generation and end use supply.

The GAO has called electricity restructuring one of the largest single industrial reorganizations in the history of the world. This has been a truly massive undertaking, and it has been costly. The costs have included the transition costs incurred in transforming existing institutions, the costs associated with creating entirely new institutions, such as RTOs, and the distractions to management, challenges to regulators, disruptions to consumers from having to deal with entirely new products, methods, and systems of operating. These costs have been very substantial. One estimate simply of the cost of implementing and operating RTOs nationwide, for example, concludes that they are on the order of $2 billion per year.

For restructuring to be that official, then, there must be equal or larger benefits to outweigh these costs. These benefits may take the form of outright lower prices to consumers, as competition drives prices toward unit costs, or the benefits could be in the form of lower costs, as competition improves the efficiency of operating units, but ultimately, that, too, should lower prices to consumers as wholesale cost benefits are flowed through to business and residential users.

These were the promises of electricity restructuring. The question we have before us is, has restructuring, in fact, delivered on those promises? Over the past few years, there have been a number of economic studies that have sought answers to precisely this question. Some of the studies have concluded that restructuring has resulted in substantial benefits, benefits large enough to outweigh these various costs.

A typical study of that sort compares actual prices in some period like 1998 through 2004, the post-restructuring period, to prices that it estimates, using a predictive model, that would have prevailed in the absence of restructuring. This particular study finds a substantial difference favoring the actual prices, a substantial difference between the two, between the but-for prices and the actual prices. It aggregates across regions of the country, across period of time, and it calculates a benefit to all U.S. consumers of on the order of $34 billion.

But other studies using what are broad-brush, look to be very similar methodologies, conclude quite the opposite. Another study contrasts the rate of price change before and after restructuring in states that undertook that restructuring process with other states that did not, in fact, engage in restructuring and finds no correlation, no difference in the rates of price change after that period of time in states that opted for restructuring. This conclusion that restructuring has had no effects on prices is shared by other studies as well.

So, we began with one question, what, in fact, has been the effect of electricity restructuring on prices and costs, and now I think we have two, the second being, how can studies that rely on broadly similar methodologies, to some degree similar data, come to such fundamentally different conclusions? I am here today primarily to address this second question, the question about the studies themselves.

What do we know about the effects of electricity restructuring based on the available evidence? These are important issues since they are shaping the current debate. They help establish a benchmark for our understanding restructuring to this point, and they also provide guidance regarding further reforms.

For these reasons, I was asked last year by the American Public Power Association to evaluate these studies, not to undertake a new study, but to evaluate these studies to determine which of them might be based on sound methodology and which may not, and which, therefore, may be convincing and reliable evidence with regard to the effects of restructuring. I conducted most of that review last year, examined by now a total of 13 studies, ten of them quantitative, econometric, or simulation in some fashion.

Some of these focused on retail prices; others looked at wholesale. Some were authored I academics; some by consulting firms. Some were sponsored by interesting parties; others not. A number came to a favorable conclusions concerning restructuring; others did not.

I assessed each of these studies against the standard of modern economic research and policy evaluation, and I published the results of that review last November in a report that can be found on my website or that of APPAs called "Restructuring the U.S. Electric Power Sector: A Review of Recent Studies."

My conclusion was very simple. While each the studies that I looked at had its strengths, each ultimately failed adequately to address one or more crucial issues, methodological issues, issues that needed to be addressed in the process of good, sound research, and, therefore, none of the existing studies that we have before us really represents credible evidence with regard to the benefits of restructuring.

So, one might ask, how can that be? How can all these studies really fail to reliably assess reforms? And I would like today to outline three or four reasons why these studies, by and large, fail to measure up to the standards of good economic research.

Let me see, my slides diverge from my talk, the slides were prepared at an earlier time, and they bear some relationship, but not close. The answer to the question of what represents the shortfalls of the current body of literature really has four parts. First, electricity restructuring is unlike deregulation of airlines or perhaps telecom. It did not involve a discrete event that occurred at a particular point in time, throughout an industry. Rather, it involved a substantial number of different state and federal initiatives, many of them phasing in over time.

The consequence for empirical research is that there is no single point in time, a big bang, that you can point to as the defining moment for electricity restructuring. Rather, one needs to recapture different aspects of restructuring and the different timing of the effects of actual reforms.

Out of the ten quantitative studies that I mentioned, seven of them, unfortunately, treat restructuring as such a discrete event that occurred at such a single point in time or treat states or regions as having either restructured in their entirety or not at all, with no allowance for timing. Those studies, it is easy to see by example, mischaracterize experience, by misclassifying the basic data.

Second, in other industries, I should say, calculating the prices that would have existed, but for reform, is the primary challenge. But in the case of electricity, those but-for prices do represent a challenge, but it is also true that the observed actual post-reform prices are not generally good guidance for the effects of reform.

MS. STERBENZ: We have two minutes.

MR. KWOKA: They are often the result of entirely different factors. The three major factors that drive a wedge between observed post-restructuring price and equilibrium price are price freezes and rate reductions that occurred at the institution of retail restructuring, which makes post-reform, or the immediate years of post-reform prices, a temporary and artificially depressed set of prices, stranded cost recovery, and thirdly, excess capacity in generation, which drove down generation prices in the year 2000 and later.

All of these imply that a simple comparison of but-for prices with actual post-restructuring prices is misleading. Of the ten quantitative studies, only two or three even mentioned the distortion due to rate freezes. Only one makes an effort to avoid it and that effort is not really successful.

A third broad issue is that there is inadequate attention to causation. Good economic modeling requires an appropriate set of explanatory variables, adequate data to examine experience over a long enough period of time or in different regions.

I need to speed up and simply point out that many of these studies failed to utilize adequate modeling or data for the purposes that they themselves have set out.

And lastly, a truly comprehensive study of electricity restructuring needs to pay some attention to other effects, including market power in mergers, RTO governance and effectiveness, service and reliability. None of these studies really addresses those at all adequately.

So, in the studies that I have looked at, these issues, by and large, have not been addressed at all, or at least not comprehensively. A couple or three studies look at some of these, but no single study ultimately addresses all of these criteria successfully. And the result is that while there are now a significant number of studies of electricity restructuring, none of them, I believe, represents credible evidence about the supposed benefits of restructuring to this point.

How can that be? This is the point where I am usually asked do I really believe that he can electricity restructuring has had no effect. So, I'll use some of my Q&A time, which is that I would pose the question that inevitably someone is going to ask me.

MS. STERBENZ: Two minutes extra.

MR. KWOKA: Which is inevitably do I really believe that. Well, there are certain hidden assumptions of electricity restructuring that I now think have manifested their consequences. Not necessarily hidden, nobody hid them, not that everybody ignored them, but they were assumptions that proved to be crucial to the actual outcome of electricity restructuring, and I am happy to talk about this more later at some other time.

One is that there was substantial belief that there would be easy entry into generation, and while there has been entry into generation especially in some times and places, there are also other places where building new generation is literally impossible or extraordinarily expensive.

Secondly, there is a belief that generation would be ample in supply, so we would not be confronted with a circumstance where demand pressed on supply, particularly on the vertical portion of the rising marginal cost curve at capacity. When that happens, and of course it does, that is the set of circumstances that gives rise to market power and particularly to unilateral withholding.

Third, and the trump card for many people's arguments, is that there was a belief that there would be ample transmission and, of course, we know that there isn't, and the absence of adequate transmission, leads to both transient and localized market power.

And lastly, there was a belief that there were no substantial vertical economies to be sacrificed in the process of de-integration.

Now, I don't believe any of those assumptions, in fact, have proven to hold, and I believe the consequences from all of them have been some unexpected outcomes, maybe outcomes that some people might have predicted, but largely unexpected outcomes from the process of electricity restructuring.

MS. STERBENZ: I hate to be rude, but we will need to be wrapping up.

MR. KWOKA: Okay, and for that reason, I just want to say that the danger that we face is that further reforms might be based more on faith and ideology and flawed studies rather than the kind of evidence that consumers and regulators and supporters of orderly market reforms, I think, deserve. Thank you.

MR. FRANKENA: So, John is buying the appetizers.

MS. STERBENZ: I am taking notes, and again, I hate to be rude, but we do not have that much time and we would like to give everyone an equal opportunity to speak.

Professor Frank Wolak.

PROFESSOR WOLAK: So, what I would like to talk about is the title of my talk, which is why the U.S. has yet to achieve any benefits from electricity restructuring and what can be done to change this.

And I guess the first is, you don't need any surprise following on what John said, is it has been a lot tougher than people thought, and the question is that the interesting thing is I think the evidence is far clearer outside the United States, and so what I would really like to focus on is why is it that the U.S.

has been so difficult, and what are the features that are unique to the U.S., and then talk about features that are common to all markets, and what can we do.

So, the first feature that is unique to the United States is the fact that we have this bizarre 50 states where there is state level regulation at the retail level and federal regulation at the wholesale level, and so what you have got is two different mechanisms operating. The other is we have got the Federal Power Act that Jim talked about. We have got essentially a very good history of state-level regulation, and, unfortunately, we have got sort of a response, in part, to California of increasing regulatory intervention in the wholesale market operations. So, let me just briefly go through each of these things.

So, you know, as I said, the United States is the few country that has a separation between retail and wholesale regulation, and, you know, it is real simple. If you assume a wholesale market, where final load responds to realtime prices, you can create a great-looking wholesale market, but if that doesn't exist, disaster. Similarly, if you design a retail market ignoring the need for retailers to head spot price risk, this can also create a disaster.

So, it really requires coordination of wholesale and retail regulation, and the trouble here is that a lot of the so-called retail policies that appear consistent with making the wholesale market work better appear to state PUCs like they are giving up regulatory authority. I just list a few examples here, but essentially telling consumers they need to be able to protect themselves from price volatility through their own actions, that sounds like the PUC giving up authority.

The point here is that once you introduce a wholesale market in your region, you are basically giving up pricing authority, as certainly California observed, this is giving up authority to FERC.

So, the other is the Federal Power Act. Jim talked on that, so I am not going to review it, but basically there are no markets that I am aware of around the world where there is this requirement for just and reasonable prices. I mean, that is a unique feature of the United States, and, in part, the result of why I always say it is restructuring, not deregulation, because prices still are regulated. It is just that we do have a different form of regulation, and this really, I think, creates a severe form of moral hazard in the form that FERC has to ensure prices are just and reasonable. If I know FERC has to ensure prices are just and reasonable, why take any costly actions to protect myself against unjust and unreasonable prices, because FERC is going to make them just and reasonable? So, this is really not a great background to restructure the industry against.

The other is the fact that we have been different from other countries in the world. We have been essentially doing state-level retail price regulation for over 70 years, and these sort of two tenets of state level regulation really give rise to a good set of incentives -- not a great set of incentives, but a good set of incentives -- for utilities to keep their costs down, and so what happens is largely I think the state regulation has done a good job of squeezing out the major inefficiencies, at least the big inefficiency that's come in investments but probably not as much in operating efficiencies, and many of the wholesale markets in the United States, particularly eastern ISOs, were historically tight power pools that you could really argue were sort of cost-based markets, you know, for a very long time.

But the difference is in the other countries of the world, the UK, Australia, virtually all of the markets where you could say there has probably been pretty successful restructuring, what happened is you took a government-owned national monopoly and you restructured it, and so you could argue that, you know, they sort of had much further to go than we do in the United States, and that one argument could be is the reason that the United States has not seen the benefits of restructuring yet is because essentially there were just less inefficiencies in the system because of a pretty good state-level regulatory process to begin with. So, one question certainly I think is, is the major source of benefits just privatization and good regulation rather than really the introduction of wholesale and retail competition?

The other problem in the United States is this disturbing trend towards "We really care about price volatility." So, in other words, one price that is a thousand dollars too high for one hour is far, far worse than a price that is one dollar too high for 10,000 hours -- for 8,000 hours of the year, and so what we will do is whatever it takes to essentially make prices less volatile. This is the so-called automatic mitigation procedures, capacity payment mechanisms, and essentially attempts to restrict forward markets in energy to be purely physical.

The way the amp mechanism works is essentially it says if you bid above some reference level, then we are going to say you violated this conduct test; if this impacts the market price, then we are going to say you related the impact test; and if both those things occur, we are going to mitigate your bid to a reference level, but that reserves level is typically set at some regulated cost plus an adder. So, we are essentially giving the market participant lots of money to be mitigated.

True, we are sort of spreading it out over a bunch of hours, but we are saying instead of spiking the price and hopefully providing the signals to prevent that spike in the future, we are going to simply allow you to exercise just a little market power, but not too much.

So, the basic point here is just the fact that market power mitigation would -- necessarily is always imperfect, and so the idea that we always face is essentially the choice between an imperfectly competitive market or an imperfect regulatory process, and I think there is this sort of false sense of security that says, if we have a market power mitigation mechanism in place, we have effectively controlled the exercise of unilateral market power, and I guess my response would be is that it really just simply changes the ways that suppliers exercise unilateral market power.

So, for example, much of the amp mechanisms have what's called a reference price, where the reference price is based on accepted bids during "competitive conditions." So, if I am a supplier and I know that what will happen to reset my reference level is the fact that accepted bids in "competitive conditions," I am going to be more likely not to bid as aggressively during competitive conditions, because that will limit the extent to which I am going to get amped and, therefore, be unable to raise prices during so-called noncompetitive conditions.

So, essentially, once again, we trade off the one dollar too high/8,000 hours of the year against preventing that $1,000 price spike in a couple of hours of the year. And after all, what consumers presumably care about is, what do I pay for the year?

The other mechanism-disturbing trend is capacity payment mechanisms, which essentially, you know, will pay generation owners for the existence of their generation unit, and so what this does is it certainly stimulates -- it may, you know, cause more capacity to stay around and lower energy price volatility, but we still have to pay the generators to stay around, and so, you know, consumers have to pay for the fact that those generators are there.

The other problem is that, at least historically, is capacity markets are extremely susceptible to market power. It is kind of the problem of vertical demand meets vertical supply in a really big way because of the fact that you cannot build a new power plant in one day in order to meet your capacity obligations. So, if a supplier is pivotal in the capacity market, they can set the price at a very high level, and that is precisely what happened in a number of the capacity markets.

Then, the solution is to introduce this demand curve, which I would prefer to call a demand curve, because it really is just simply distinguished from the economist's demand curve, because it really is just a prespecified, simplified regulatory process for setting the capacity price, and it is a regulatory process that most likely is going to set it too high, which further makes it unlikely that customers are going to be able to receive benefits from restructuring, because what we do to solve the problem is overpay for excess capacity since the value of excess capacity is pretty close to zero.

The other is that, you know, capacity markets also do not really solve the problem that to attract new investment -- in fact, it is -- you know, the standard argument is that, you know, I would personally like a capacity market for professors, just paying me to exist, but -- I guess that is tenure -- but the idea that it is not sufficient to get people to invest.

The other problem is it really does not solve the problem that most of the markets have had, which is melt-downs in the wholesale market have not been due to inadequate capacity. It is typically inadequate energy, meaning that there is -- all the market melt-downs that have occurred around the world have occurred in hydro-based systems, or at least systems dominated by hydro, and what happens is that there is not a lot of water behind the dam; everybody sees that; all the fossil fuel generators figure that one out quite quickly; and, sure enough, they all of the sudden bid much higher or find themselves facing more inelastic residual demand curves, typically, at first base, because of the fact that the hydro suppliers are now trying to conserve their water and so, therefore, we are off to the races in terms of very high spot prices, having nothing to do with the capacity shortfall.

MS. STERBENZ: Two minutes.

PROFESSOR WOLAK: Okay, we will have to go faster.

The other is the idea of restricting financial transactions, and here the idea is that forward energy markets are just fundamentally financial markets, and by telling a market participant that, you know, you must stay on your schedule or we will penalize you for that essentially increases the cost of undertaking these transactions and unnecessarily increases their cost to market participation, and, you know, one of the ideas of restructuring was to essentially allow parties to transfer risks to the party best able to bear them, and so by requiring forward markets to be physical in the sense of large penalties on failure to fulfill forward market commitments just increases the cost with no real associated benefit. I mean, these are financial markets, just like financial markets that exist in all other commodities.

So, the other is features common to virtually all markets. In the interest of time, essentially the big issue here is asymmetric treatment of load in generation. In other words, all the wholesale markets that exist in the United States effectively have a free hedge provided to retail customers. In other words, go back to the retail prices set almost independently of what is the wholesale price, and also, people have the option to come back to the fixed retail price at any time.

What we really have to have is treat electricity like any other product where the default price is the realtime price, and if you want something different, you buy a hedge to get out of it just like you do in any other product that you have. The fundamental thing is, once we get that, we have a symmetric market just like every other market that we have where, essentially, willing buyers and willing sellers each face the same price margin and must buy out.

The other is this issue of the new role for transmission, is that transmission really becomes the facilitator of competition in a wholesale market regime. In other words, it really serves a different role of making an imperfectly competitive wholesale market more competitive versus essentially improving an imperfectly regulated, sort of vertically integrated, utility. So, it really serves a much greater role in a particular -- I think the criteria now becomes one of what I call economic reliability of the transmission network, meaning that what we are doing is facing all locations in the transmission network are essentially contestable, is that firms face substantial competition from a large number of independent suppliers a large fraction of the time, and so it really is the case that investment in transmission is facilitating the competitive set of the market, not something that we really had to worry about.

The final issue is this, we have to distinguish between imprudent and prudent investments. One of the big benefits of restructuring is the fact that mistakes get put on the guy that invested, not mistakes on the regulated customer, and I think, unfortunately, this is sort of one of the problems that I think the federal regulator is beginning to catch onto, in that the fact of distinguishing between these two types of investments is clearly one major source of restructuring, is that if someone brings online a plant too soon, they lose money. But the good news is, the unit is still there; it just sells for less, and the people that invested in it do not make any money, and, you know -- but the idea is it will be there to serve demand into the future.

That is really one of the big, big potential benefits of restructuring, is if you time your generation at the right moment, you will earn a good rate of return; if you don't, you will not, and consumers won't have to pay for those mistakes.

So, finally --

MS. STERBENZ: Two bonus minutes.

PROFESSOR WOLAK: Just to conclude, we just need to essentially think about it in terms of electricity is like any other commodity. Think of wholesale market/ retail market policies that essentially cause symmetric treatment of load and generation, and one of the big final issues that I did not have time to discuss is really this question of do not focus on the short-term market; focus on the development of the long-term market because that is the market that can be competitive. Short-term electricity markets are virtually impossible to make competitive for all the reasons that everyone knows, but long-term markets certainly can.

Thank you.

MS. STERBENZ: Thank you so much.

Dr. DeRamus?

As you've noticed, everybody has been given a two-minute warning, ten-minute cut-off point, and then extra two bonus minutes, which started with Professor Kwoka, so I had to be uniform here.

MR. DeRAMUS: So, to those of you who came expecting to see Bill Massey, my apologies for disappointing you. I was a last-minute substitute. I should also say that some would say you are probably fortunate, because I was told yesterday that I was invited to come and speak on the panel, so I only had a short time to prepare a presentation, but I got up to 25 slides. So, if I would have been given more time, you would have been subjected to a little bit longer treatment. I am going to make Jolanta's job a little bit easier because I have a little stopwatch --

MS. STERBENZ: Wonderful.

MR. DeRAMUS: -- to keep myself on track here.

One of the reasons my presentation might be a little bit long-winded, and I am going to rush through lot of it, there is printed copies out here. I have got some printed copies for the panelists if they want to tag along on some of the graphs, but it is because I feel strongly about these issues, and I have increasingly seen the evolution of the debates on restructuring evolve to a point where we are at a real crossroads. I do not think a week goes by without there being another legislative effort by -- a call for reregulation, and I have been particularly distressed at the ratio of political jargon relative to deep analysis to actually determine what the problems are and how to move things forward.

So, with that in mind, I'll offer my own thoughts about some of the issues, and some of this goes to some of the research that Professor Kwoka has reviewed in his paper. I do think there is a lack of appreciation that there are many different research questions to be asked of these empirical analyses, and I do think that the relevant research questions, even though they are numerous, that they are ultimately tractable, but I also think it is important to look to see whether those research studies are reliable, and I think to that end, I think any additional scrutiny of empirical research is welcomed, but I do think it is important not to throw the baby out with the bath water.

Finally, I think it is appropriate to step back and identify whether we have consensus about whether there is an appropriate standard that can be applied to competitive markets, wholesale markets or retail markets for that matter, to determine whether, in fact, they are competitive. And I say this because I have heard, again, increasing amounts of -- call them more of an alarmist type jargon about things like the dark spread, about marginal cost pricing, as if marginal cost pricing is something that is inherently out to harm consumers. So, with that in mind, let me go to it.

Now, I have got here a whole bunch of different questions that one could ask with empirical methods, and the one of the biggest imperatives that is coming out of some of these local regulatory -- or I am sorry, local legislative efforts is whether ratepayers have been financially harmed by electric restructuring and/or wholesale competition. This is really a dollars-and-cents-type question, and there are certain types of analyses that I think that are important and relevant in answering that type of question.

It is a very different type of question if you were doing an empirical research project, if you are to, say, ask the question or attempt to answer the question what the costs and benefits have been of electrical restructuring either to date or likely on a going-forward basis; similarly whether market -- how market prices compare to regulated prices, which may, for example, call for more cross-sectional or but-for type of analysis of what regulated -- continued cost-of-service regulation would have been relative to actual price experience paid by consumers. In that context, one might want to, instead of looking at actual prices, look at what are equilibrium market prices as more of a guide post in the future to how competitive markets are likely to work.

There are also other questions in terms of what institutional features of market make them more or less competitive, and I think that is probably one of the most interesting research questions out there, because that provides a guide post to regulators and policy-makers about how to make these markets more competitive.

Other questions are I think it is relevant to ask whether the cost of RTOs have been worth it, but that does require a different kind of an analysis, one that says have the efficiency gains that we have obtained by including additional generation into economic dispatch, do those outweigh the costs of generation? But those are hard empirical questions, and I think we have the tools to do them, and I think a lot of the studies published to date do shed some light on it, and unlike the -- I think the conclusion that Professor Kwoka comes to, I came to the conclusion, even if they are not bullet-proof, that a wide variety of these studies and approaches do shed considerable light on the potential benefits and actual benefits of wholesale markets in restructuring.

So, I want to focus on a couple of different things that the folks have identified as potentially being in or out of such analyses, and the question first is, is it appropriate to consider rate freezes a benefit of restructuring?

The second one is, is it appropriate to consider the generation and investment boom of the '99-2004 period as a benefit of restructuring competition.

Third, have restructuring in competitive markets shifted risks associated with development and ownership of generation from ratepayers to investors? I think that is an important question to ask.

Fourth, have empirical analysis of the benefits of competition and restructuring ignored market power issues? And as someone who came into energy via more antitrust, that is an issue that is near and dear to my heart, but I do not think it has gotten as short a shrift as some commentators would otherwise suggest.

Finally, this question about whether marginal costs are an appropriate standard for determining whether wholesale markets are workably or reasonably competitive.

So, to begin with, there are a whole wide range of things that we probably are in vigorous agreement about -- "we," I say those who may ultimately come to different conclusions about the quality of the research and the conclusions that can be drawn from them, I think we could all agree that estimating the impact of competition and restructuring has been difficult, is difficult, for all the reasons that Professor Kwoka mentioned, difficulty of demarcating a regulated versus an unregulated time period; difficulty making cross-date comparisons; identifying causality is difficult because high-cost states were those who were more likely to actually engage in restructuring; and rate freezes and stranded costs certainly complicates the analyses.

Wholesale creating but-for prices, creating a but-for price of what the regulatory price would have been, the cost-of-service regulatory price would have been, is an inherently difficult process. It is hard enough to create but-for prices of market prices. It is even harder to created but-for prices of a regulatory process.

But, despite all those difficulties, I do think quantitative methods can shed light on the impact of competition restructuring. I think regardless of the difficulty of identifying a clear big bang point, I think in retrospect, it is clear that electric markets today are very different than they were ten years ago or 15 years ago or even seven or eight years ago for that matter.

There are significant differences in the regulatory environments in different states, to state the obvious, and those can be very helpful in providing the basis for a cross-sectional analysis. Production cost models, I have used these in some of my work, and I find those to be very revealing in terms of identifying opportunities for efficiency gains by expanding the scope of markets. Those are both procompetitive, and they allow for, as I said before, the increased integration of additional units, removing constraints, to allow for broader economic dispatch and reasonable generation costs. One can also look at auction results, for example, to see whether wholesale prices are being passed through to consumers reasonably efficiently.

Finally, the obvious point, I would think, but one that gets lost in these debates, is that electrical utility restructuring is very much a work in progress. I mean, how do we assess California? The 2000-2001 experience in California, is that something you include in an empirical model to say this is an inherent result of deregulated markets or restructuring efforts, or does it identify specific problems that arose out of a specific implementation of market design and experience that hopefully we have all learned from and we can apply on a going-forward basis to ensure that those mistakes are not repeated? I would advocate very much the latter.

So, here's a couple of -- trying to address some of these issues, just to give you a sense of some of the quantification of them. I do think that the impact of price caps can be appropriate to look at in determining -- in assessing the costs and benefits, again, depending on the question being asked. If it is a question of what would the competitive price line have been during this time period, that is a different question that different types of analyses are appropriate to apply, but I do think in answering a hard question from a state regulator who says, "Did we make a mistake when we implemented restructuring," I think that is an appropriate question.

It is not -- I am not a big fan of price caps, don't get me wrong, albeit it has produced significant benefits to customers over the past several years. I think there are significant problems with rate caps, namely, in determines of discouraging new investment, which as someone who wants competitive markets, you want incentives for an investment. I am a firm believer in making sure consumers are exposed to price signals so that they can change their consumption accordingly.

The best cure for market power problems is to have a downwardly sloping demand curve, and the way to get some elasticity in that demand is to expose consumers to prices. You are guaranteed a vertical demand curve if you have rate caps -- price caps on there.

But nevertheless, this is one realization of a whole host of random variables that go into determining market price of -- electricity prices. This is the realization that occurred. Ex post, if we are doing an ex post assessment, I do think it is important to include those in that analysis.

Likewise, surplus capacity. It does result from -- the surplus capacity, particularly that which resulted from IPP investment, should be considered a benefit of restructuring wholesale competition, and it reflects an appropriate allocation of risks in competitive markets. I am sure all of you are well aware of the large number of bankruptcies and restructurings that have occurred over time, and those are costs that would have otherwise been borne by ratepayers.

I have got very little time left, so I am going to blow through some of this, but these are slides that I am sure are familiar to a lot of you in terms of the incredible increase in generation capacity, particularly by IPPs during the core 2000 to 2004 time period.

Likewise, market power issues absolutely should be addressed, but I do not think that one should jump to market power conclusions every time there is a price spike, particularly in an era of volatile fuel prices. I am particularly concerned about the persistence of vertical market power, an issue I know was near and dear to the FTC's heart back in 2000 when these restructuring debates were going on. I do a lot of work in unrestructured states, where there is the continued exercise of foreclosure, where efficient IPPs are being foreclosed from participating in the market. There is a lack of market institutions and so and so forth, and that is the type of market power problem that is not self-correcting. Unlike price spikes that generates signals for new entry, vertical foreclosure does not. I have got a slide in there on efficiency loss resulting from foreclosure.

Another thing that is a topic about market power that is very much in the industry these days is whether auction markets are competitive. That is a fairly easily determined process, and notwithstanding some of the more recent lawsuits that have been filed about Illinois, the analyses I have done in Maryland and others in my firm have done with regard to New Jersey suggest these options are very efficient at passing through wholesale costs onto retail ratepayers.

So, the last thing I am going to touch on, the marginal cost issue, notwithstanding the fact that I am just over time -- and I promise to kick my couple of dollars into the kitty -- that for some inexplicable reason, marginal pricing remains controversial. I have heard it referred to as the "dark spread," because infranet marginal units and nuclear units are paid the market-faring price. This is kind of a standard view of how markets are set in single-market faring prices. I think you will get a similar result it is paid-as-bid type markets.

In theory, these are not perfectly competitive -- we know these are not perfectly competitive markets, economic theory would suggest that prices will -- that bidding behavior will deviate from this perfectly competitive outcome. What I thought is -- but I think there are a lot of other factors that go into real world investment decisions that make -- or bidding decisions that make that simple theoretical view a little bit harder to rely on.

I am going to close with a couple of slides -- I encourage you to look at them a little more closely -- that are actually cribbed from Professor Bushnell, an article, and his colleagues at Berkeley, that I think provide a good indication exactly where the problem is, that overall, in a large segment of the market of ours, prices actually track the competitive market outcomes, the marginal cost pricing, very well. So, the same conclusion that the PGA Market Monitor came to in looking at PGA markets.

Where the problem is is in these high demand hours, in the case of the California -- a picture of California 1999 prices, and you see an increasing divergence of prices away from that competitive and marginal cost bidding, and these are things where that is an issue that regulators and policy-makers and economists should all focus on, but, again, not to throw the baby out with the bath water. There are lots of other hours in which prices behave very well, and, in fact, even better than a lot of our simple theoretical models would predict.

This is PJM, a simple model of oligopoly in which actual prices are far below those predicted by a simple Cournot model of competition and competition quantities that Professor Bushnell and his colleagues show actually can be tweaked to provide a better predictor of prices, but nevertheless, as you will see, up to -- in the vast majority of hours and even some of the -- a fair number of the peak hours, you see a lot of those dots down there, even as you approach that 1.0 on the horizontal axis, that actual market prices are actually fairly close to competitive market prices, and I think that is really the good news associated with how these markets are actually operating.

Thank you very much.

MS. STERBENZ: That was perfect. I also wanted to mention that copies of those presentations should be outside, and if for whatever reason they are missing and we have insufficient number of copies, please let us know, because I realize we are moving through this very quickly.

PROFESSOR WOLFRAM: All right, thank you. So, both John and David have talked very generally about studies that assess the effects of restructuring. I am going to talk a bit more specifically. First, kind of theoretically about what we might expect the effects of restructuring to be, and then, specifically, I am going to talk about two studies that I have been involved with.

And I should say that I am almost positive this is the case, but I got John's study back in November, like any good academic, or not all academics will admit that they do this, but I looked at the title and noticed that it had something to do with my own research, so the first thing I did was flip to the back of the paper and look at the bibliography and I did not see it cite my papers. So, at first I was annoyed. But then I read through the study a little bit more closely and saw that he was critiquing papers. So, I was less annoyed that my paper wasn't in there.

So, I am going to focus specifically on the effects that restructuring might have on electric generation, on that side of the industry.

And, so, John's studies, a lot of them assess the effects on prices, and I guess my position is that as long as electricity restructuring is reducing costs, somehow there is some economic efficiency gained. And whether that gets translated into prices, price reductions is a matter of rents and is something that can be addressed by market structure or market design changes.

So, as has been brought up already, there is heated debate, both about how to restructuring electricity markets and whether to restructure electricity markets, but the basic point is that from kind of an Econ 101 point, all of this should be moot if restructuring doesn't improve economic efficiency.

Jim talked in the morning about the political economy rationales for why restructuring actually happened. That might be a kind of description of what happened, but from what we actually should do as society, we should only restructure the market if it improves economic efficiency.

So, I want to talk a bit about where we came from, just to think about why restructuring might affect efficiency and why it might improve efficiency.

So, we started with about a thousand plus large interconnected generating plants, that were operated mainly by the investor-owned utilities. Investor-owned utilities were regulated under a cost of service or cost plus format, which basically gave them guaranteed revenues. They showed up to the State Public Utility Commission and said, we spent X on our plant, please give us X plus a return on our investment. Please set our rates to cover that.

And that's not completely true. I mean, there were some cases of disallowances, or cases of regulatory lag, where it takes a bit of time before the costs are translated into rates. But as one representative of a large utility in the South told us, regulated electric companies are very incentive challenged. You have not very strong incentives to reduce your costs if you know that the costs will, for the most part, be translated into your prices.

So, restructuring is changing all that. For one thing it is changing the incentives that are faced by the existing owners of the plants. So, even if the plants are left in the hands of the investor-owned utilities, in some cases, they are facing a rate freeze. So, cost reductions that they can make translate directly to their bottom line. The prices are frozen, they are not tied to their cost, so any cost savings they can eke out will translate to the higher profits.

Another thing that is happening is that the existing plants are changing owners. So, a lot of states have mandated or kind of encouraged divestiture so that the investor-owned utilities are divesting to new companies. And the third thing that is happening is that new firms are building plants.

So, very quickly, we can think of what actually might change. We have talked about the incentives for change, so what might the new owners or the old owners facing new incentives change? One thing is just what is called the technical efficiency of the plant, so they might just improve the heat rate of the plant, reduce the amount of fuel that they need to generate a kilowatt hour.

Again, somebody told us that conventional utilities, most of them are under fuel cost pass-throughs. So, whatever they spend on fuel is translated through the fuel cost adjustment into their rates. And, so, somebody told us under that system, if we told management we can spend a million dollars to save ten million in fuel, the management would tell us, no, that doesn't make sense. The million dollars may or may not show up in the next rate case, that's a capital cost, the $10 million of extra fuel costs that we are incurring we know we will collect through the fuel cost adjustment.

So, that just doesn't leave you with very strong incentives to make investments that could improve your fuel efficiency.

Similarly, other things that can change would be the input mix, there might be switches from more capital to more fuel, or vice versa, from less fuel to more capital, that's the same thing I said. And also the costs of the inputs might change. So, for instance, under a restructured environment, management might face bigger incentives to extract wage concessions.

At the dispatch level, the mix of plants that are included in the dispatch might change. Both because of market power reasons that if some of the bigger firms are withholding capacity and the smaller firms are bidding their plants in at marginal cost, there may be some inefficiencies resulting from that. Also, the mix of plants that are included in the dispatch might improve because of improved coordination.

So, in order to perform an ideal study to measure some of these effects of restructuring, you want to think about what the counterfactual is, and both John and David made this point, but let me just emphasize it.

What we want to know is not what has changed versus what we saw before, but what has changed versus what we would have seen in the absence of restructuring.

So, some candidates for this counterfactual, say you are looking for a variable X, which could be investment, which could be fuel use, which could be wages, staffing levels, whatever X is. One candidate for a counterfactual is X before any kind of restructuring took place, so X before 1995.

The problem with that is if you are looking at something like take staffing levels, if you compared X in 2000, staffing levels in 2000 to staffing levels in 1990, and you did it only in restructured environments, you would see, wow, there have been lots of cuts in employment. There has really been a big benefit of restructuring. But, all over the world, there has been increased automation. And, so, employment staffing levels have declined all over the world, just for technological reasons.

So, in order to account for that, you might want to bring in other information that would help you control for things that are happening in the world in addition to restructuring.

So, you could bring in X in other parts of the world, or X in states that aren't progressing with restructuring quickly, and here being careful to measure the point at which restructuring begins, which as John has pointed out is not uniform around the country and even within a state it is kind of not a black and white date.

So, the ideal thing would be to look at X in 2000 minus X in 1990 in a state that's restructuring, but then separate out the effects of everything else that's going on by controlling for that same change in a state that's not restructuring.

So, again, if X is staffing levels, you might look at staffing levels, have they fallen a lot in California, but then you want to control for the extent to which they've fallen in a state like Kentucky. Hopefully, Kentucky will help you control for kind of everything else that is happening in the industry, absent restructuring.

So, the first study that I want to talk about was joint with two other co-authors and we have done just this kind of differences and differences comparison, where we are comparing staffing levels and non-fuel operating expenses at plants that are owned by investor-owned utilities, we are comparing those to municipally-owned plants, so municipal plants there are kind of the Kentucky, controlling for everything else that is happening in the industry. But we have also compared investor-owned utility plants in restructuring states to investor-owned utility plants in nonrestructuring states.

So, just to give you a sense for the patterns that we see in the data, the blue line is the nonfuel expenses relative to a baseline of 1981. So, that blue line is that trend for investor-owned utility plants in restructured states. The brown line is that trend for investor-owned utility plants in nonrestructured states and the black line shows you the trend for municipally-owned plants in whatever state.

So, the first thing they notice is that everyone has shown staffing reductions, and as I said, that could be part of automation, that could be parts of a lot of things. But even the municipal plants are staffing at the same plant, so for the same kind of capacity, they are staffing at about a 15 percent lower level than they did in 1981.

But you see bigger improvements, or bigger reductions in staffing levels at both the nonrestructured states, at every investor-owned utilities, and the biggest improvement that you see is in the restructured states, the investor-owned utilities operating in restructured states.

MS. STERBENZ: You have two minutes.

PROFESSOR WOLFRAM: So, this is just kind of a sample of the analysis that we are doing, we also do a bunch of kind of robustness checks to make sure our definition of structured versus unrestructured is not driving our result. We look at the timing of the restructuring process, and the results are robust. It is suggestive that the increased incentives faced by investor-owned utilities led them to reduce their operating costs.

Another somewhat similar paper is joint with Jim Bushnell, and here, we are looking specifically at the heat rates, at the fuel efficiency of plants, and we are looking at the same plant before and after it changed ownership. So, we do both the just kind of simple before and after, same plant before and after the divestiture, but we also do a difference in differences calculation and compare the changes at the plants that were divested to municipal plants or to plants that were not divested.

And just quickly, the results of that show if you look at the coefficients in the divested row, the way to interpret those is about a 2 percent to 2.5 percent reduction in heat rate, or improvement in fuel efficiency that we are seeing from the divestiture. And it doesn't really matter whether we do it with the controls or without the controls.

And, so, the estimates suggest that the divested plants facing different incentives, either facing the new incentives or just because they can specialize in operating a type of plant have reduced their heat rates.

At current fuel prices, it is always a little risky to say that, because current fuel prices are changing, if you extended that 2.5 percent improvement in fuel efficiency across the board in the country, that would add up to almost $4 billion per year in savings.

So, just quickly, the additional evidence that there are potential benefits from restructuring, John Kwoka and co-author have a paper that looks at the distribution level, the Barmack, Kahn and Tierney paper looks at improvements in capacity factors at nuclear power plants, and there are a variety of other kind of indications that you can point to to suggest that there would be improvements in efficiency from restructuring.

So, just to conclude, I think it is useful to step back and remind ourselves about why we embarked on the restructuring process in the first place and what the potential gains in economic efficiency can be. So, I have focused on, and my work so far is focused on evaluating actual efficiency gains in generation, although gains in transmission and distribution are also likely. And there the effects would not be so much from the transition to more market-based settings, but more from the transition to improved regulatory environment.

So, I have also said little about long-term investment, I think that's harder to come up with a counterfactual for. That's harder to say what the level of investment would have been, but for restructuring. And, basically, I think more work needs to be done to assess the potential gains.

The approach that I have gone there is really kind of a bottom-up approach. You take one very specific part of the whole electricity industry, you know, I looked at staffing levels at electric power plants or you could look at fuel use at the power plants, and we want to do a careful empirical study of what has happened there. And, ideally, you would like to marry those to the more aggregate studies that look at the effects on pricing or the effects on the industry overall. But I think the approach that I have outlined kind of allows you to be careful and to think through some of the issues going on.

Thank you.

MS. STERBENZ: Thank you. Ed Tatum. I think we will run over a little bit.

MR. TATUM: Oh, I'm glad to hear that.

MS. STERBENZ: Oh, that's right, I'm giving you extra time unless you are super fast.

MR. TATUM: No, I am from Richmond, Virginia, I cannot speak anywhere near as fast as Frank Wolak.

MS. STERBENZ: Then we are in trouble. Go for it.

MR. TATUM: Well, I will try to be brief. I do appreciate the opportunity to be here today. I am not a doctor or a professor, I am an electrical engineer, and I did work for a not-for-profit electric cooperative that has been in the PJM market since day one. And, so, I have personal experience with a big bang, if you will, from regulation to a competitive environment.

I was talking today, about the different drivers for getting wholesale right, and one thing that I would think about is transmission. In essence, the premise here from our organization, transmission is indeed necessary for successful competitive markets. I would like to echo, and very strongly, we do not believe it is a competitive commodity and we would like to put that type of discussion to rest. We do believe it is a facilitator of competition amongst generation demand response.

We have recently started to make some improvements with regards to transmission investment and promises, if you will, of transmission investment through the PJM, and the regional transmission expansion plans with additional dollars, but to date, we still have not kept pace with the amount of generation that has been spent.

We took a look at the PJM market when we were debating the reliability pricing model and determined that approximately $10 billion of new generation had entered the PJM market from the time that it got started up until about 2003. And during that time frame, there was about $463 million worth of transmission investment. So, we thought there would be a better opportunities for more transmission.

To get it there, we need to plant it, pay for it and we need to build it, and there is many drivers that I have seen, but the two primary that I look at right now are the Energy Policy Act and the recent FERC Conference on Wholesale Competition.

Regarding Order 890, I think that is very important. Old Dominion was delighted with that order. We thank the Commission for it. It addresses two aspects of it, planning and pricing, but again, they talk about open access transmission tariff reform, the three primary areas with the consistency of the available transfer capacity between control areas, coordinated open and transparent planning, and transmission pricing reform within those necessary services to facilitate competitive markets.

Issued February of 2007, lots of compliance activities with 30, 60, 75, 90, 120, 180, 210 days of compliance. So, we are all going to be busy all the way up through October 11th, 2007, and are looking forward to the compliance filings within PJM.

Run through the planning principles, there are nine of them, you can read them yourself. From my perspective, the aspect of coordination, openness and transparency are the ones that are going to be paramount. That's going to give us an opportunity with a broader group of folks involved in the planning process, both locally and regionally, will give an opportunity for folks to have a say, how it is going to be built, understand why it needs to be built, hopefully engender a little bit more buy-in so that when we do finally get around to building the stuff, people will say, oh, yeah, I remember why we needed it and we need to support that.

890 also sets forth the concepts of an independent coordinator; the state commission

participation, which I believe is, again, important for ultimate buy-in; flexibility; the recovery of planning costs; open season for joint ownership; and much more level of detail on the planning process that is to be included in the open access transmission tariff.

And, again, the next upcoming compliance filings will determine how successful we are with regards to this, but this order has a tremendous amount of potential for great good.

Pricing within 890, again, is focused mainly on those types of services that are required to keep the transmission grid going for the competitive marketplace. And you can see these things here, the ancillary services, but there is also a reference with regards to cost allocation.

With regards to cost recovery, there is a number of proceedings that are ongoing and continue to be ongoing in our commission. They are, as you see here, the numbers are really when they started, but basically since 1997, the Commission has been indicating to folks if you are going to have a regional transmission organization, you need to have a regional transmission rate. And, so, our industry has been struggling through that.

The recent NARUC meeting, I guess it was even colder then, if you can imagine that, than it is now, but there was discussion and indication from the commissioners that many regional rate designs can indeed be just and reasonable, and those that are able to bring a consensus position to the Commission, I think, have the opportunity to be heard and actually might get something in.

All of these things are ongoing right now. I don't know what type of resolution we will ultimately be able to achieve.

Another aspect of paying for the transmission is through incentive rates, and the rulemaking came out here; AEP, Allegheny Power System, also had the filings there. We talk about getting additional incentives for being in an RTO, generating an additional point or so for new facilities, and, so, those have been put on, return on equity adders. Also, the concept of construction work in progress and the cost of abandonment of facilities is also being considered there.

Those are important if we are going to be looking at regional rates and regional transmission, and the possibility of facilities that might take 10 to 15 years to build.

As far as paying for it, we are going to try to rely upon some rate-making principles, and I just list a few of these here for you. The concepts of defined benefits and beneficiaries and the cost causation to me are very intertwined, and trying to get some ideas that a transmission facility might actually be in service for maybe more than a year, I am thinking hopefully 40, and, subsequently, beneficiaries identified by a one-hour snapshot might not necessarily be the most accurate way of cost causation and rate-making principle.

Another concept of the rate-making principle is an independence of the planning process that goes into identification of facilities that need to be built. Specific triggers for reliability violations and/or economic benefits should be identified, and solutions should be independent and developed based on the collaborative of load interest involved.

With regards to incentives, we do appreciate the need for return on equity to raise capital. We do, at Old Dominion, believe that the money is already there in the financial community. Return on equity adders, on top of regular established rates of return, we do not see a need for. We do appreciate the need for accelerated depreciation, construction work and progress, and more certainty of recovery if the facilities actually have to be abandoned.

Another aspect of rates, and how we are going to pay for it is whether or not you want to have a formula or stated rate, and stated rates is pretty much what we always used to have. They would be put into place, sometimes they would be as a result of intense negotiation among the ratepayers and the utility, and they sometimes could be put into a black box, and, so, once it goes into the black box, it stays there. Could disincent investment, return on requirement increases as the assets depreciate.

Formula rates, a number of entities just started with formula rates. Delmarva, Atlantic City, PEPCO, BG&E and the MISO rate designs. We think formula rates provides a good opportunity for updating your cost of service, and again, you do not have the regulatory lag as new facilities come into service, you can get compensated for them.

Other things to think about with regards to getting the transmission needed is, how are you going to allocate it. And, again, right now, in PJM, we are working on something called DEFAC. See me at the break and I will talk about that.

The other aspect that we have been looking at are license plate rates, which is basically the old style that we have had wherein each PJM transmission owner had their own established rate. And now, we are looking, too, in these various filings, at the concept of the highway/byway which attempts to find some middle ground, however you want to define it. We are looking for a middle ground and some way that everybody can get together and agree on between a concept of a postage stamp, where everything is regionalized, and the concept of a license plate, where it is not. And I think there is opportunities for compromise, and if we can get our act together, that might be the way to go.

Here is some quick review of some of our opinions of some cost allocation principles. I will not read them all. The cost allocation, the third one there I think is important, it should be based on total project cost as opposed to specific upgrade cost, and to us that is a subtlety, but when you put in, let's say, a new 500 kV regional line, there is a tremendous amount of underlying transmission investment and grid improvement that's necessary in order to support those new flows that would be coming along that line. So, you do not want to miss out on the overall project cost.

And we think that the regional benefits should be considered beyond those seen in a one-year snapshot of distribution factors.

Economic reliability should be placed upon the same basis for evaluations. Overall, we think that you should be taking a look at gross congestion. The benefits should be on a used and useful life. We are concerned about free ridership, that is why we do support the highway/byway methodology and a regional rate design that's intergenerational.

We think that transmission will be built once those transmissioners who build it and those who build it have rate certainty and rate stability. We are hoping that the ease of permitting and right-of-way acquisition will be coming out, and, again, with the open inclusive transmission planning process, we hope that it will be left a little bit politically more palatable.

MS. STERBENZ: Two minutes.

MR. TATUM: The third part of it is let's go ahead and get this stuff built and we have made great progress in that area as well. DOE came out with their National Interest Electric Tramission Corridor, you all are aware of that, 8806. The congestion studies completed identified all the different areas.

The other thing that has been going on recently is the FERC Order 689 on backstop authority.

I'll share some of the Old Dominion's opinions about corridors. We are looking forward to the DOE study coming out, although here is what we think. The corridors need to be just right. It is kind of a Goldilocks approach, if you will, to it, but if you have corridors that are too wide, it could frustrate Congress' intent; if it is too narrow, then folks are going to say these decisions are already made and the local progress will not be able to take over.

We want specific facilities to be included, we want existing infrastructure points with generalized paths between different areas to be identified. You need off ramps, you need on ramps. You need to understand, again, the underlying facilities.

You need to be able to get into a congested area. That is one thing that we think is very important, given that we serve a good amount of load on an area called the Delmarva Peninsula, and maybe you've heard about that, and if not, see me at break.

The regional plan, the corridor needs to be the result of a regional plan, and we that I think this 890 is going to provide a wonderful opportunity for that regional planning process, both in organized and nonorganized market areas.

Facilitative investment by nontraditional utilities, i.e., Old Dominion, engender some buy-in, facilitate solutions.

Order 689, and you all are familiar with this, and these are the basic points of 689, it gives the Commission authority to issue permits to construct or modify facilities if the state does not get their act together in time.

It will be used for the transmission of electric energy in interstate commerce. It has to be consistent with public interest. It will significantly reduce transmission congestion. We think that is important because, again, it is the economics, not just the reliability basis. And, finally, maximize, to the extent reasonable and economical, transmission capabilities of existing towers or structures, and, again, we like that because that fits in very nicely with what we think a corridor should be based upon.

In summary, 890 is a order that is going to tremendously help planning. The devil will be in the details of how we get it implemented and going through it. 689 and the DOE efforts are going to help construction. We are looking forward to DOE getting their study out. O-890 is going to help pricing, but, as an industry, we have got to get our act together and bring to the Federal Energy Regulatory Commission a consensus-based regional rate design that has a fairly wide buy-in. I thank you for your time and I am out.

MS. STERBENZ: You did great. Thank you so much, and thank all of you.

MR. FRANKENA: I was just going to thank all the panelists and just apologize for the fact that we have already exhausted our discussion time. So, we are now at the point of a ten-minute break. And, so, if I could guess we come back in ten minutes and we will start the next panel.

(Whereupon, there was a recess in the proceedings.)

MR. FRANKENA: Our second panel will continue the discussion of electric power restructuring. The speakers on the second panel are going to discuss, among other things, experience with regional transmission organizations and independent system operators, problems in organized markets, whether competition can work in the electric power industry, and how consumers have fared in restructured versus traditionally regulated parts of the United States. And Jola will, again, now do the introductions.

MS. STERBENZ: Elizabeth Moler will be our first panelist. She is Executive Vice President of Exelon Corporation.

Dr. John Anderson, President and CEO of

Electricity Consumers Resource Council will be following her.

John Kelly, he is Director of Economics and Research of American Public Power Association.

Marilyn Showalter, Executive Director of Power in the Public Interest will be our last speaker.

MS. MOLER: Thank you very much. I have been here since 8:30 this morning, like many people have. I think we get some sort of endurance award, especially those who are here at the end of the next panel.

I appreciate the opportunity to join you today. My name is Betsy Moler, I am with Exelon. I am retired federal employee, having spent a part of my life at the Federal Energy Regulatory Commission when restructuring of electricity markets were really in their infancy, and I agree with a lot of the previous speakers who have said it is harder than we thought.

And if I had the luxury that they had in Great Britain where you could say abracadabra, we will sell the generating assets, we will do the grid perfectly, we will figure out things and have total control over the whole system, I think lots of us think we could have done a more efficient job at this restructuring. However, we do not have that luxury. Congress has not given folks like at FERC the ability to just do it in one fell swoop, so we have, in the usual American fashion, been muddling through.

When I was doing my presentation, putting my presentation together, it occurred to me that there may be some newbies in the room, maybe not by this point in the day, except for the one who is in utero.

AUDIENCE MEMBER: Thank you.

MS. MOLER: It is important to remember that regional transmission organizations and independent system operators are a significant presence in our country. There are seven RTOs and ISOs, only one of them does not have a market, the SPP. They cover two-thirds of the U.S. population and include two-thirds of the country's generation. So, this is not really some sort of isolated kind of phenomenon.

The RTOs and the ISOs do perform really important functions, grid operation and reliability, independently administer transmission access, which I think is a very important thing, open markets with market monitors, market-based congestion management, regional planning, which again I think is an important thing, and it is the way we muddle through when you have state jurisdictions and federal jurisdictions.

You have elimination of multiple transmission charges, so-called pancaked rates, across an RTO. Where you used to have multiple rates, according to each company that you traverse he had, if you were selling from point A across company B into sync C, you paid three transmission charges, now you pay one.

And, then, critically, from a consumer perspective, they rely on the market to fund generation, not customers, who have no choice in what they pay.

I want to briefly talk about some myths. I am mindful of the fact that those of us who believe in RTOs and wholesale competition are in the minority on today's panels, even though they cover the vast majority of the customers in our country. I am not one who thinks they are perfect. I believe RTOs can be improved. But I think there are really some fundamental things we have got to understand here.

One myth, I saw it repeated in Tyson Slocum's testimony, is that prices have increased more in competitive markets than they have in regulated markets, and that is just not true. We at Exelon have performed an analysis, it is cited in the testimony, it is also cited in the testimony I recently gave at FERC, and we show that since 1999, prices have increased 34 percent in states both with and without organized markets. It is kind of remarkable, but it is true.

It is also true that the prices are generally higher in the states that have restructured, but they started that way. It was not restructuring that has caused this, it is the nature of the infrastructure that was there historically.

Electricity prices are largely determined not by market structure, but by the cost of fuel. You see price increases in organized market states and you see them in the big chunks of the country, here, the white, that do not have organized markets. The rates are going up significantly in both areas, and it is not about the market organization, it is all about fuel prices.

Neither the competitive model nor the cost of service model can shield customers from fuel price increases. We have looked at whether there is a pattern where prices have gone up more in regulated or states that have markets, and states that do not regulate it and deregulated, you can use lots of shorthand terms that are much more complex than the shorthand terms would have you believe. But, basically, there is no particular pattern that shows prices going up more in the states that have organized markets than those that do not.

I could show you corresponding slides that show that just really prices go up in tandem with fuel.

And I still think that electricity is a bargain.

Again, states with RTO markets and without RTO markets have increased since '99, roughly 34 percent, while other commodities, natural gas, gasoline, and heating oil have gone up dramatically more in that same period of time.

Let's look at RTOs and what is happening to transmission. I agree that transmission is the superhighway, you need to build it. We, at Exelon, are currently undertaking our largest transmission project ever, it is $345 million, it goes under the Chicago River. It is kind of cool to go under the Chicago River with a transmission project, it is also very expensive.

Again, there is this myth circulating out there that transmission is not getting built, and it is simply not true. PJM has had $683 million in new transmission installed since 2000, another $600, $700 million is under construction, and another $4.2 billion, all conceived of through a regional planning process, is on the drawing boards.

I see regional planning as a success story, all the more remarkable given the split jurisdiction we have in this country.

There is this other myth out there that competition somehow jeopardizes reliability and causes transmission congestion. I have found no evidence that competition jeopardizes reliability. Certainly, we, at Exelon, are aware of what is happening with nuclear performance. Nuclear performance has improved dramatically in RTO states versus non-RTO states. Congestion costs are declining in both PJM and in MISO, and PJM and MISO have dramatically reduced instances where parties' transactions are cut by the RTO, and in a competitive market. Instead, they routinely redispatch and it is a much more efficient way of doing business.

I can show you capacity factor indices, INPO, the Institute of Nuclear Power Organization indexes or indices to make my case.

And, also, these are the TLR rejections that we have seen in the last three years, and I expect the trend to continue this year in both PJM and MISO. I cannot speak to the others, I do not have personal experience in these, but we can document in those other markets our assets are in PJM and then on the edge of MISO with ComEd and PECO.

So, I do not see any evidence of the idea that competition is hurting efficiency or hurting reliability or is increasing congestion. It is just not there.

I would also like to talk about support for competitive markets. There is this myth that real customers do not support competitive markets. There are letters recently from a bunch of market participants, buyers, some of the largest buyers of energy in the United States, who continue to support competitive markets.

And that is my story in a nutshell, and I can keep to my allotted ten minutes. Thank you.

MS. STERBENZ: I did not have to give you a warning. That's incredible.

Dr. John Anderson.

DR. ANDERSON: Now, I am not only vertically challenged, but technologically challenged, let me see if I can do this. How about that. There we go.

I thank the FTC very much for the opportunity to be here today. This is a very timely subject, and one that is of great importance, and it involves a lot of money, as has been said by a couple of the other panelists.

I do represent the Electricity Consumers Resource Council, which is an organization of very, very large industrial users of electricity who operate, in fact, all of the world. One of our members is here today, Alcoa, which I believe will be a speaker tomorrow. But we cover just about every of the major industries, cut across all lines, and, like I said, operate in a whole variety of places.

What I want to do today within my allotted time -- I hope I can live up to what Betsy just di, that was quite a bar to set -- is assert that truly competitive electricity markets would be the best way to meet consumers' needs. We certainly believe that way. Our members operate in truly competitive markets all over the world and they really believe that truly competitive electricity markets would be the way to go.

They recognize very clearly that there were problems with traditional regulation, and that was one of the reasons why we started over 20 years ago advocating competition in electricity. But we have also come to the conclusion that there are critical problems in the restructured markets that are out there today. They are far from being competitive, and I will give you seven specific points that cause us problems. And we are not at all certain that these problems are going to get fixed, at least not fixed any time soon.

I only have one slide on the history, but I just want to say a couple of things about the history. Our members keep going back and looking at it on a regular basis. In the beginning, there were vertically integrated utilities, they had exclusive service territories. The regulators were the customers of those utilities. It wasn't the end-use customers at all that were the customers, it was the regulators. They went to them for all the kinds of approval.

But there was one thing that we at least got out of that, and that was we could attempt to at least protect ourselves by going into rate cases and making filings, and there were laws and there were rules and there were regulations that made people listen to us. While we were always outspent and outmanned, there is no doubt about it, and we are today, and we were then, at least we had that opportunity. And my bottom line is we do not even really have that opportunity in the markets that are out there today.

As I said, we thought that a healthy dose of competition would bring about tremendous results. We thought, and we still believe now, that it would discipline artificially high prices, but it would do a lot of other things, also. It would bring technological innovation, new products and services, and a customer focus, something that we think is absolutely critical and something that is true in every one of the truly competitive markets, and allow customers to control their own risk. But we have not seen these results, they are just not there.

We think that there are at least seven major problems with the restructured markets, this is the FERC jurisdictional restructured ISOs and RTOs that are out there today. And I have a slide or two for each one of these, so instead of spending the time on this one, let me just do them one at a time.

One, prices need to be established by an interaction of supply and demand. In the markets that are out there today, the demand-side has no influence over the establishment of price. At best, all we have is competitive bidding. The RTO or the ISO stacks the bids up, estimates what the demand is, sets the price at that particular level, and that's the way it is. That is no competitive market. When I was teaching basic economics, I think 201, much less anything else, you talk about an interaction of supply and demand. There is no interaction of supply and demand in these markets.

The demand-side must be treated symmetrically with generation. You should not force the demand-side to be in there, but if the demand-side wants to be, it must be able to and it must be able to have an impact on price.

To give you an idea of that, PJM like to talk about last summer where there was one week where they say, this was on their website yesterday, at least still on there, that actually at least $650 million that they saved in this one-week period and they paid the demand participants that brought about that savings $5 million, they had five to seven here but it was $5 million when I checked it. We are not saying that the people that save that amount money necessarily ought to get paid all of it, but there is something wrong with a $650 million savings and a $5 million payment for that.

Second, new investment must be incented by market forces not regulation. What we have in these markets is a new form of regulation, it is called capacity markets. They were all concerned that there are not enough capacities being built, so the ISOs and the RTOs, instead of the traditional regulators, go into a room and decide how much you have to pay the generators, existing generators, as well as new ones, to make sure that we have enough resource adequacy.

This is a situation where all it is doing is taking the risk that was supposed to be on the generators when they build the generation and transfer it right back over to the consumers again. We need to have competitive forces incenting regulation.

We have to have market entry and market exit reflected by market forces. All too often, a generator says that it is not economic in one of these markets, it cries the reliability factor, says that if I do not get paid enough money to support my generation, which is inefficient, I will shut it down. And, so, they designated a reliability must run unit or something along that line, give it a different kind of a contract than anybody else and this is, again, not a competitive market, this is regulation again.

Customers must be able to hedge future contracts with long-term bilateral contracts. In any competitive market, customers can protect themselves from the future by entering into bilateral contracts. But all the kinds of contracts that my members are offered in the ISOs and the RTOs that are out there today are estimates of what the estimated future prices and the spot prices in these markets are, set by locational marginal pricing, LMP, then say I'll sign a contract with you based on what these estimates that I think I am going to be making in these markets, plus of course I might be wrong, so I want a risk factor added on. This is not a way to negotiate bilateral contracts and they are just not working right.

Fifth, there has to be adequate transmission infrastructure. I hope that my good friend, Ed Tatum, is right and that we are going to have the transmission problem solved with Order 890 and the rest of them that are out there. But the problem is, right now, we have tremendous amounts of congestion. We do not have an interstate highway system for electricity. We know where the congestion is, it has been there for a long, long time, but we have set up a scheme that gives economic disincentives to many times take care of the congestion, because if the congestion is protecting a high cost generator in, say, a load pocket and you fix the transmission congestion, then you've got competition for the generator that was protected and you lose a lot more money on the fact that that generator is no longer protected by the transmission constraint.

Sixth, we have to mitigate market power. We know there is a lot of market power. There is still too much vertical integration, generation, transmission, and even distribution owned by the same entities. The market power is out there, there is problems with it. FERC had a conference on market power and market monitors just last week and we saw some of the problems coming out. We are hearing more and more about it. It is just something that has to be taken care of if you are ever going to have a come peck market.

And, finally, after the first six things are done, and I emphasize that our members are extremely concerned about that, after the first six things are done, then we think that we can start moving into the final area where we think will bring competition, and that is, get rid of the bid mitigations, price caps and things along that line.

We have to have customers, all customers, seeing price flexibilities and price changes if you are going to get the demand-side truly integrated into these equations. But none of those things are out there today.

We still believe that if we could get real competition or true competition, if we could get all seven of those things done, we think that consumers could then operate much better. They can vote with their dollars for the kinds of power they want, the kinds of green resources they want, all sorts of things along this line.

We think that real or true competition would bring consumer-oriented environment, which is what competition is all about. People would actually come to customers and say, what is it that you want. That is a strange concept in the electric industry today because that just isn't going on.

But we do not think we are going to see real competition or true competition any time soon. Some entities are making tremendous amounts of money on the markets that are there and they are going to spend tremendous amounts of money trying to tell us that everything is great, and that just isn't going to work.

FERC has said that it now understands that there are problems. It actually held a conference on February 27th on problems in the organized markets, and it had a wide array of people come and share their views. It has another one scheduled for May 8th. And this is great. And I commend FERC for that.

But the real bottom line is actions. When FERC starts to work on the things like we have laid out, the seven points, and actually take actions to try to implement them, then we will believe them.

And one thing we want to really emphasize is, and especially the people here at the FTC and whatever, the problem is not going to fix itself. The stakeholder process, which is used in each of the ISOs and RTOs, simply will not bring about the kinds of changes that are necessary. The stakeholder process in all of the RTOs and ISOs is stacked in favor of the generators and against consumers. At most, consumers have 20 percent of the vote in the ISOs and the RTOs. At an absolute minimum, we think consumers should be able to block anything moving forward that they think is not in their best interest.

Betsy talked about the support for the market, while there may be support, and she is certainly correct about the people that she put up on the screen, let me tell you that the rebellion against these markets is really, really growing. I think at least time is absolutely critical for things to be done.

First of all, the industrials, we have been the strongest believers in competition, we have sort of fallen off the wagon if you like. We are not ready to support what is out there now and we are saying that if that is the best we can have, we are willing to consider all options, including the reregulation work.

But if you think our opposition is strong, look at what happened. Maryland probably is the poster child, many of us in this area know, we are very close to Maryland, we saw what happened over the last year. But it isn't just Maryland, it is also Massachusetts and Connecticut and New Jersey and Illinois and that sort of thing.

I have some slides, which I am not going to go over today about what really happened in Maryland, I am just going to skip over them in the interest of time. The rebellion there was absolutely unbelievable, including legislation to fire the Commission, a new governor was elected, to some extent, to a large extent based on the rebellion that took place there, with a new Democratic governor that comes in and is now replacing the entire Commission, and many consumer advocates around the areas are watching it.

As I mentioned, though, it isn't just there. The Connecticut and Massachusetts Attorney Generals have filed several complaints. New Jersey regulators, reacting to very strong consumer opposition, blocked a proposed merger. Everybody else approved it except New Jersey, which woke up and said, I do not like what is going on here.

The Illinois legislature, right now, is in the process of passings legislation to freeze rates and their utilities have said they will go bankrupt if their rates are frozen for another year and the legislature looks like it is going to move ahead anyway. I don't know whether it actually will.

The Michigan legislature is considering new regulation and the Virginia legislature has already done so. Not a good deal.

We believe that true competition or real competition would be best to meet consumers' needs. We think that what is out there now is failing in this regard. We believe that today's market structure is not competitive and it is not sustainable. If stakeholders collectively do not choose to fix the problems of the market, we think that there will be serious attempts to move back toward regulation. This will be difficult and it will have some real bumps in the road.

The real problem to us is that neither traditional regulation nor today's organized markets have an end-use customer focus. No one ever seems to ask customers what is it that they want. The real challenge will be to find a way to bring about the needs of consumers and get them into the equation, and I challenge today the FTC to jump in with us and help us in that regard.

Thank you very much for the opportunity and I look forward to your questions.

MS. STERBENZ: Thank you very much.

John Kelly follows.

MR. KELLY: Good afternoon. I am John Kelly, and I am with the American Public Power Association. For those of you who aren't familiar with the association, we represent about 2,000 municipally-owned and operated public power electric utilities in the United States. Some of these utilities are state-owned utilities, also. They range in size from utilities with just several hundred customers to large utilities like Los Angeles, Seattle, San Antonio, Jacksonville, Florida, with hundreds of thousands of customers.

Again, I want to emphasize that we are

consumer-owned utilities and we are skeptical of the deregulation policies that are going on at the present time. Some of the people who attack skeptics of deregulation accuse us of being either special interest or regulators. Well, we represent consumers, consumer groups, and, so, this is a consumer perspective.

Many of our members have experienced dramatic price increases in wholesale power markets over the past four or five, six years, and they've seen few benefits from these markets.

Now, the whole issue of deregulation is much broader than public power systems, and I want to address it on those terms in a broader context. And I want to address it in terms of the evidence that is out there and the economic analysis that's been going on to assess the performance of these deregulated markets.

The title of this session or one of the things we are supposed to be talking about is comparing wholesale markets with and without independent system operators and regional transmission organizations. That's fine, but I think one of the problems in the public discussions of these issues is we do not call things by their names, and I think we should call things by their names.

What we are talking about is the issue of price deregulation, and the belief, and that's what somebody used earlier, one of the commentators, the belief that the electric power industry is sufficiently similar to other industries, that entry of new firms and the threat of entry will keep prices at an acceptably competitive level.

That is the issue. That is the question. That is the fundamental question that is out there.

And there is a belief, this was from a former FERC Commissioner, that kind of sums it up. Competition has elsewhere encouraged efficiency and innovation, better than regulation, electricity must be consumed when it is produced, it is no different than other products. The solution is to improve market rules.

And the main question, again, is are consumers better off under these deregulated markets or under, more specifically, price deregulation of these wholesale power markets. The first piece of evidence that should be looked at is there has been billions of dollars spent on the formation of RTOs, there has been hundreds of thousands of dollars spent on studies to tout the benefits of price deregulation in wholesale power markets, and none of them have been able to demonstrate that there have been any benefits to consumers.

Also, to be fair, the studies that Professor

Kwoka looked at, a few of them that said consumers have not benefited, they did not have sufficient information on input costs and so forth to come to a conclusion.

However, we heard information about the operating costs, the efficiencies and operating costs and these are important, but there is another type of efficiency that is important and that is price efficiency, that the prices reflect the economic cost to society of producing those goods and services.

And when you look at some of the anecdotal evidence that is more convincing, I think, than some of the information in the studies that have been done, you look at California, you look at Texas, you look at Massachusetts, you look at Maryland. These are states that have experienced rate increases of 60, 70 percent since 1998.

In Maryland, in particular, John Anderson began to talk about that, from 1998 through 2006, the rates in Maryland increased about 40 percent; however, in North Carolina, South Carolina, and Georgia, they've increased about 20 percent.

This year in Maryland, for those of you, many of you I know live nearby, you look at your electric bill, and since 1998, the prices have increased 70 percent compared to the prices in, again, Georgia, and the

Carolinas, that have increased by roughly 22, 23 percent. Maybe by the end of the year, of '07, the prices there may be 30 percent. But we are going to be talking about a price difference of increases of 70 percent versus 20 or 30 percent in states that are very nearby.

You do not need econometric models and you do not need very precise equations to figure out something is wrong. You simply have to go to some of the EIA data, and if you believe that most of this is due to the input costs, well, look at the input cost of generation in Maryland versus Georgia and the Carolinas, and they are very similar. Eighty to 90 percent of it comes from coal and nuclear. So, the input costs are very similar.

We are talking orders of magnitude. I remember somebody saying that one of the things that distinguishes some economists from another is a sense of having some sense of proportion, some sense of magnitude. And, so, it is important to focus on operating costs, as an improvement or benefit of deregulation, but there is also the price efficiency aspect that has to be taken into consideration.

When I look at my Maryland electricity bill and I see 14 cents a kilowatt hour, last month, for the month of March, and I see generation costs of almost 10 cents a kilowatt hour, after a quarter of century working in this industry, I have some sense that ten cents a kilowatt hour just doesn't get it as a reasonable estimate of what the economic cost of providing electricity is. This is not to say this is the canary in the coal mine dying, but it is the canary in the coal mine kind of gasping of kind of the economic reality.

In terms of, you know, other evidence, you look at utility profits of regulated versus deregulated states, the profits in the deregulated states are in the 20, 30 percent range; in the regulated states the rates of return are about nine, 10 percent. This is not to say that profits are bad. Profits are great. But if those profits went for increased operating efficiency that lowered prices to consumers, then I would say no problem. But when you see rate increases of 40, 50, 60 percent over a five or seven or eight-year period, then you begin to wonder.

MS. STERBENZ: You have two more minutes.

MR. KELLY: Okay. So, we hear a lot about making these markets work, making them more competitive, changing the market rules and so forth, but nobody talks about the nature of these markets. Things that have been forgotten are things like capital intensiveness, financial requirements, just this list that people have known about, classic barriers to entry, but for some reason, all of these potential impediments seem to make no difference to people analyzing the electric power industry. They are just swept under the carpet.

That's fine to do that, but at least it seems like there should be some attention paid to this or explain why the large capital investments needed for coal plants or nuclear plants do not serve as impediments to the markets.

In terms of some of the problems with these markets, a great quote by Warren Buffett, his observation on the electric utility industry is that investing electric utilities is not a way to get rich, it is a way to stay rich. Well, I think he was halfway right, it is also a way to get rich these days, or it was for those who benefited from the sale of the generating assets. Most of the deregulation was a mistake, et cetera, et cetera.

In terms of the problems we are experiencing with not getting enough investment, generation, you can read about that every day in the Trade Press, well, it is just what oligopolists do, but nobody wants to use the O word these days when talking about tight oligopolies.

What we are dealing with here is something that I think would be useful to go back to discussions of the 1950s, the 1960s, issues in dealing with barriers to entry, and there was a school of thought, there was the interventionist school, and there was the school of thought of self-sufficiency. The self-sufficiency school about monopoly power is that monopolists, there are these natural characteristics of the industry that could make an industry more or less competitive. The interventionist school believed that it was all government interpretation. Anything that was wrong with markets it was due to government intervention.

There was a clash back then, an ideological clash. It looks like the interventionist school has won where the evidence and the economic analysis does not have any bearing on the public policy decisions.

MS. STERBENZ: One last minute.

MR. KELLY: Okay, one last minute. And this was an observation many years ago by Carl Kaysen, when he was talking about economists dealing in the area of government intervention and competition policy is it seems that people are more committed to the idea of competitive markets, rather than to the economic analysis or evidence of whether these markets are, in fact, truly competitive.

Thank you.

MS. STERBENZ: Thank you very much.

Marilyn Showalter.

MS. SHOWALTER: I am Marilyn Showalter, I am a former regulator from the State of Washington and a former advocate for public power, now the head of Power in the Public Interest. I have had a career advocating in various government positions for the public interest.

This has been a very interesting day. It seems to me that I could summarize it by saying there are two big questions. One is, do we have effective competition today? If not, we should not be allowing deregulated prices. So, to get to Mr. DeRamus' point, the intra-marginal profits, the dark spread, in a truly competitive market, might be one thing, but if it is not a competitive market, then it becomes price gouging. So, it is very important to determine is there, in fact, effective competition.

The second point is, can there be effective competition? And, again, if there cannot be because of various aspects of electricity itself, or perhaps the structure of our country or its government, or other issues, then it may be going in the wrong direction to keep trying.

It is my proposition that the only genuine metric is what is the effect on the end user over time, and you can define that narrowly or broadly, that is just electricity or maybe the overall benefits, but I do think that the piece parts of competition are not valid measures of competition. That is, what is the competition switching rate or even what are the employees per plant. In the end, if it is working, overall it will show up that over time, and it has to be a long time, you have produced available, reliable, cost-effective, fairly-priced, publicly accountable electricity system.

And those last two are not really values that economics itself appreciates; that is, fairness in pricing. I think that it is a public value that people have, economists may not, but people do. They want prices to be fair for electricity in the same way that they might want it to be fair for oxygen, if that were put out to bid.

I also think because electricity is an essential public good, it is older than anything in the world, energy is the oldest thing there is. It underlies everything, that our public officials need to be accountable for its fair administration.

I am going to build a map here, and this is sort of familiar to most people. This is retail deregulation in the states. There is some matter of judgment here, but the vertical lines are the ones that have basically full-fledged retail deregulation. And these are the states with organized regional markets. If a little bit of a state had a little bit of a part of a regional RTO, I did not include it.

So, putting those two together, the ones with the crosshatches both ways have both retail deregulation and RTO. And as you can see, all of the states that have genuine retail deregulation are in an RTO, but there are some states, especially in the MISO area, that are still regulated, but they are in MISO.

So, what is happening in those states? The first thing that's important to notice is that most states did not deregulate. This question was put to virtually every state in 1997, '98, '99, and Enron was the lobbyist in most of the states, including mine, Washington, and most states rejected deregulation. Most states took a look at this and said, we are not going to there. And you will find no state today who is entertaining the idea of retail deregulation.

And to the contrary, as has been cited, the states that did go down this road are getting very, very worried about it, especially if it is not too late to reverse course.

This is above average retail prices in 2006. This is a correlation, I am not trying to say anything about causation at this point, but it is a fact that the highest cost states today are also, by and large, the ones that embrace both the retail deregulation and RTOs.

This is above average increase, 1996 to 2006, and here we get into how do you measure price increases? Betsy Moler talked about comparing deregulated states to regulated states and both increased by 34 percent, I think it was.

I think the better way to measure is in absolute cents per kilowatt hour. Why? Okay, supposing you are a customer in a state in 1996 and you had six cents per kilowatt hour electricity, and over ten years it increased by two cents, that's 33 and a third percent, so almost 34 percent. So, if you went from six cents per kilowatt hour to eight, that's the same percentage as if you started at 12 cents and went to 16.

So, you can call that the same, I do not. You have to make a judgment. What is the fairer way to address the price increases over time? And while there are all kinds of differences, it seems to me that a percent increase is not the way you would do it. If anything, you would expect, all other things being equal, you would expect the low cost states to have increased by a higher percentage off that low base.

And I have other maps that this is too short a presentation to include, but in point of fact, it is the high cost states that started out in '96 as high cost, that went even higher, and also have, in fact, the higher percentage, I believe.

This is looking at total retail electricity rates over time of the deregulated states and the regulated states, and what you can see is that the deregulated states started high, that's probably why they got into this experiment, but they got higher. That is the gap has widened.

The question, though, is, why? And here is where we have heard a raft of basically nondefinitive studies I would say, and I think that's correct. We are not in a position to say definitively, at least based on the studies done thus far, what was cause and what was effect and to isolate all of the different elements, and other people have mentioned them, so I am not going to.

But I do think that you can analyze the fundamentals and derive some insights as to what may be happening, and this is a page I want to dwell on.

The first is, scarcity pricing is in direct conflict with the reliability mandate for nonscarcity. Any electricity system, correctly, is going to have a cushion. That means that there is nonscarcity. Imagine in the airplane business if all of the airplanes had to hold 15 to 20 percent of their seats empty, and in fact, if they ever started to get kind of full, we would send up a few more airplanes.

It is not that competition necessarily threatens reliability, but reliability or the needs for reliability undermine competition because they create nonscarcity, whereas competition wants scarcity pricing.

Similarly, another term for scarcity pricing is volatility. A competitive system wants scarcity pricing or wants volatility. Consumers do not like volatility. They just do not like it. The reason we buy auto insurance or house or fire insurance or any other kind of insurance is we do not really want to face the catachismic event. We, as consumers, are generally willing to pay a little bit more overall to get a predictable, stable rate.

This third point, I think, is very important. It is the dimension of time. In competitive markets, there are cyclical prices, but it is, in consumers' opinions, unfair. It is not right to make one generation of consumers pay at the high side of the cycle and let another generation pay lower. Why? Because they are not actually the same consumers.

Businesses come and go, they fold up and close down. That's why in a regulated system, if you have a 30-year plant -- as a matter of fact, in your house mortgage, if you have a 30-year mortgage or a 15-year mortgage, you pay for that asset over all those years and that translates into a fair rate for those consumers over all those years. You front load a peak onto people, they go out of business themselves as consumers.

Now, that's assuming there really are cycles that go up and down. It is not all clear that is going to happen in the future, because we have, in the RTO areas, a marginal cost pricing in an inclining cost era, arguably. I think that is well argued. If so, then we are going to have that kind of dark spread factor or people are going will be paying higher than the average underlying cost for a long time, versus the advantage in a regulated system of paying average costs, and consumers can see that advantage and they are seeing that. That is why some big industrial customers are locating themselves in regulated states and not the competitive states.

The short-term price signal versus long-term investment needs, consumers do not pay signals, they pay prices, but that price is supposed to be a signal to somebody else to invest more. Again, the dimension of time has been lost. A high price today is supposed to signal somebody to build a big plant that takes maybe three years to permit and another three years to build and will last 30 years. By which time, three or five or six years from now or even a month from now, that signal might look quite different. So, there is a mismatch between the timing of those signals.

Worse, what is the real incentive? Theoretically, there is a price signal to get investors to invest more, but that, as I said, is kind of a long-term proposition. What's the immediate incentive? The immediate incentive is very powerful to keep things the way they are, to keep things a little congested, because you make a lot of money that way. And if you do not have genuine effective competition where you can get somebody into the market the next day, you are going to set up the system that seems to be working, that is evident right now, that this is making a lot of people a lot of money, and the incentive is very powerful to keep it that way.

There is then the reality of the collective market behavior versus the competitive assumption. This sounds like a bad joke on economists, but you cannot just assume there is competition. There has to be competition. And, so, no matter what kinds of rules have been followed or set up, if they aren't guaranteeing real competition, you will find prices that rise, and in particular, there seems to be pretty good evidence that in the electricity industry markets, a small group of producers can drive up prices without very much effort.

Then there is the pretense of independent transmission, as if RTOs are independent. You could have three people from Mars running the transmission system, in a very fair way, but that does not make the operation of the transmission system independent from generation because of the physics of electricity. They are necessarily integrated, and we can never get out of that physical reality, which means that the generators tend to have the ability to drive up prices.

Only if you built so much transmission, as maybe Mr. Wolak wanted to do, so much transmission that there would be no possibility of any constraints anywhere might you get that ability to have the real highway over which there is competition. But if you built that much transmission, especially in the west, you would more than likely be having an uneconomic system, because it is costs more to build that much transmission than it is worth substituting generation.

A lot of people talk about customer choice and how valuable it is, but if it comes at the price of increased risk of the whole system, and the system is riskier, which then drives up the cost, because there is no captive base to pay them off over time, then a choice of a consumer of a high price and a higher price is not really the kind of choice they want. What they want is to have the lowest reasonable cost to produce the actual electricity they need.

Then you have the idea of customer choice versus genuine customer dissatisfaction, and I will not repeat all the examples, but it is odd, don't you think, that we are talking about a consumer driven competitive market and there really are not very much consumers out there who want this. There are a couple, and it is true that if you get in a certain situation of where you can take advantage of high prices, it might not be a bad deal for somebody, but it is not a good deal for the overall consumer, the average consumer.

And, finally, RTO governance, which is supposed to be independent, versus a demand for stronger public accountability, an RTO is a corporation, with no ratepayers, no taxpayers, no shareholders. There is no one there to drive the prices down. In a regulated IOU, you've got shareholders who want to keep track of the cost and you've got ratepayers in a regulated system who can exercise that pressure as well. But there simply isn't anybody in an RTO, except on occasion, I think, some of the big industrial customers who can appear at FERC to argue with FERC over what the cost might be, but that is really no substitute for a regulated state level system where there is really vigorous arguments by the customers on one hand and the shareholders on the other.

MS. STERBENZ: Two more minutes.

MS. SHOWALTER: Okay. By comparison, in the more traditionally regulated areas, by which I mean state retail regulation and no organized markets, the lines of accountability have remained intact, not only at the retail level, but also in the context of the regional organizations. Take, for example, Columbia grid. That is the regional organization in the Northwest. It is not an RTO. It is not a FERC jurisdictional utility.

The underlying responsibility and obligation of the utilities to serve their customers and of the state regulators to make them do it have not been abandoned, and it is that abandonment of the obligation to serve and the obligation of regulators to oversee the lowest reasonable cost that has driven up the cost in the deregulated areas.

Generally, prices have been lower, they were lower to start with, and they are also more predictable. It is a system that has worked for many decades in those states and nobody wants to change them. Customer satisfaction is higher. The customer base supports long-term investment, which is evident in those regions. If you go to Wall Street and you ask for $500 million or even more to build a 30-year plant, the first question is going to be, how I get my money back? And a regulated system has a very good answer. We have a regulated facility with captive consumers and a regulators who will set the rates to recover those costs as long as the utility is prudent.

MS. STERBENZ: One final minute because we are over time.

MS. SHOWALTER: All right. I will then close by saying that the big, big issue of the day, or the environmental issues and demand response, I think that the regulated community does at least if not better a job at demand response. There is no reason that regulators cannot, if it is in the public interest or if they are required to do so by legislature of Congress, require certain renewable resources or impose certain kinds of rates through rate design, but they, at least, are required to do it in a way that serves the public interest. A market doesn't have that, there is nobody there to do that. Thanks.

MR. FRANKENA: We are quite a bit past our schedule, but I just wanted to invite Betsy Moler to respond or say anything if she would like to, before we take a break. If not, we will take a break. Go ahead.

MS. MOLER: Well, since I am on the next panel, I am conflicted, so I will defer to the next panel. Thank you.

MR. FRANKENA: In the interest of trying to finish up before the sun sets, we will take a ten-minute break now. So, we will start again at five to.

(Whereupon, there was a recess in the proceedings.)

MR. FRANKENA: I just checked the Internet and I found that the price of natural gas has fallen to between two and three and I am wondering whether that would change anybody's views on electrical restructuring.

MS. MOLER: Yes, yes, we wouldn't be here.

MR. FRANKENA: Okay. So, in our third panel, the first two speakers will be still on the topic of restructuring, and then we are going to switch over to climate change. You will notice it is already 5:00, so we need to stick on schedule. I will have to be somewhat impolite and cut you off if things go beyond that because we really do have to get out of here. Okay?

So, with my apologies for that, let's get started.

MS. STERBENZ: Ted Bolema from Central Michigan University.

PROFESSOR BOLEMA: Thank you very much. You'll also see I have listed an affiliation with the Mackinac Center For Public Policy, which is a think-tank in Midland, Michigan, and it tends to be kind of free market oriented and they have had a number of writings on electricity over the years, I have done some of them, and so that is why I have listed them as well.

Okay, I will just do a quick summary of what is coming. Michigan's electricity program, it was based on legislation in 2000, so a little after some other states got involved, and I think by several measures, it is been one of the more successful state level programs for introducing competition into electricity supply.

By 2004, four years after competition was introduced, less than two years after competition actually emerged, due to regulatory requirements, well over one-fourth of the commercial sector and the industrial sector were having their electricity purchased from competitive suppliers, and average rates were actually dropping, and we put some measures in to try to give us some perspective on all that. But it has largely been reversed since 2004 and I think our competition is kind of on life support at the moment in Michigan. So, maybe not atypical in that regard, from other states.

My background is in the antitrust area, I was at the Antitrust Division for quite a few years, so I do come at it from the perspective of focusing on competition, probably somewhat more than just and reasonable rates. But, hopefully, if we get our policies right we can have both, and I think I have some evidence here that when Michigan did have its policies right that we were getting both outcomes.

Another theme I have through all this is that all restructuring is not created equally. I think the Michigan restructuring, as I hope to explain as we go along, was a simpler structure and a more economically sound structure than we saw in most of the states where we usually hear about it and did a better job of lining up supply and demand as John Anderson talked about in the last panel.

I do have these PowerPoint slides or I did have them on the table outside. If you got one, great; if you did not, give me your email or business card and I will make sure you get one right away if you would like a copy.

Michigan traditionally had the usual structure for regulation before the restructuring legislation, different territories, two main utilities, Detroit Edison and Consumers Energy accounted for about 90 percent of the state, and rates were controlled by the Michigan Public Service Commission under the usual cost plus regulation.

The perception at the time of restructuring was that customers in Michigan were paying more than the surrounding states. If you look at the data, we were probably paying somewhat less than average nationally, but compared to the surrounding states, our rates were higher. A particularly notable event was in 1997 when North Star Steel relocated a plant to Ohio and cited a major reason for it being the lower electricity costs in Ohio.

The restructuring, fairly simple sort of structure over on the left-hand side I have where the generation comes from, investor-owned utilities, the traditional source and any out-of-state generation and new entry comes in, goes across the transmission grid and then to the final customers. Basically, what works is if you want to sell electricity in Michigan, you line up your customers, and then on the other end, you line up your generation, the utilities still own their generation, they were not required to divest their generation capacity and generally did not. The transmission assets were divested. MISO owns most of them at the moment. There is a little bit of the state that is not MISO, but most of the state is MISO at the moment.

So, anyway, the basic structure was Public Act 141 of 2000 that effectively unbundled our generation, and it did impose a 5 percent rate cut and freeze on residential rates until 2005. So, we have had that freeze removed for just over a year now. So, fairly short experience at the moment with residential rates being deregulated. Then as part of the package there was a companion Bill 142 that gave some rather substantial benefits to the utilities in order to help them with the transition to the competitive world.

What we have is definitely a hybrid system at the moment, like we see in a lot of states. There is one set of rules for the entrants and a somewhat different set of rules for the incumbent and investor-owned utilities. So, the investor-owned utilities are still required to have back-up margin requirements, some mandatory service requirements; on the other hand, they get some benefits, too, from the Public Act 142. So, it is not a level playing field. In some ways it favors the investor-owned utilities; in some ways it favors the entrants and has been that way all along.

Anyway, we got off to a very promising start, which is kind of the core of what I wanted to present today in these next few slides. Entry started in 2002. By 2004, we were up to 32 percent of the commercial sector sales and 28.5 percent of the industrial sales supplied by alternative suppliers, and average customers were estimated to have saved about 15 percent. My own university, Central Michigan University did switch and did save hundreds of thousands of dollars on our electricity costs over that time, and, of course, that was passed on to all of our students and our tuition-paying parents of them.

Relatively few residential customers switched. That is often pointed out. It is very small numbers in that regard, under 1 percent.

Some new capacity was added, mostly gas plants, it was mostly supposed to be peak capacity, and did not really add a whole lot, but we did get some new capacity and not all of it was natural gas plants.

Anyway, here is a graphing. In red here we have what was happening to rates in Michigan and we see they drop very slightly on average in the industrial sector and have taken off since 2004. At the same time we see competition peaking in 2004, and since then, we have lost about two-thirds of that competition in the industrial sector.

Now, we need some sort of basis for comparing what is going on with the prices here. So, for my comparison, I looked to the nearest states around Michigan, and we see on average, or in general, rates were actually rising in the states around Michigan. Illinois was one exception, but the other states that border Michigan had rates rising during this time and national rates were rising. Yet, we see Michigan dropping from the highest rates at the beginning in 2000 to not being the highest in 2004 and, actually, being right in the mix with several of them.

Similar story on the commercial sector side. Actually, we are seeing a little stronger story there. Rates in every one of the surrounding states rose in the four years where we had competition in Michigan. At the same time Michigan rates were dropping in the commercial sector, and nationally, the average rate in the commercial sector was increasing by 10 percent. So, we get a similar picture in terms of the inverse relationship between competition and the entry occurring and rates with somewhat of a drop, but then, to put the rates in more perspective, we see Michigan being the only one that is dropping out of the ones that I am tracking here. And, of course, since 2004, that has largely been reversed.

So, what has happened? Well, a number of different things were happening about 2004, as a lot of us are were starting to think that restructuring was going pretty well. It had its flaws, the very flaws we have been hearing about all along. A lot of them apply to Michigan as well, so I do not want to sugarcoat this too much. But at the same time, there were a lot of things that were going right, which is mostly what I am focusing on here.

Anyway, there was a campaign started, largely funded by one of the big utilities, talking about what happened in California and predicting similar sort of results for Michigan. You could hardly turn on a radio or television for a while without seeing a commercial that deregulation has failed in Michigan, and now, we need to turn back, and it did lead to new legislation being introduced by the Republican chair of the House Energy and Technology Committee, who actually is still in that role today.

Some other things, too, the stranded cost surcharges were imposed at that point. They had been delayed by the Public Service Commission, and when they were announced, they were higher than anybody expected. Probably a bigger one was some new return to service rules that made it much less attractive to return to service. So, if a customer left their incumbent utility and then wanted to come back, they came back under much less favorable rules than before.

This next event, I really cannot trace too much of an effect to it, but the Public Service Commission did announce an alternative energy tax surcharge and whether it is a good policy or not is not the issue here, it is that they just decided they had this authority, and the Michigan Court of Appeals did rule otherwise on it. But kind of the point I am making with all of this is this has created a lot of uncertainty in the state, and that regulatory uncertainty continues even today.

I'll skip over a couple of things here in the interest of time.

MS. STERBENZ: Two more minutes.

PROFESSOR BOLEMA: Yes, recently the Public Service Commission has proposed some legislation that very much goes in the direction of more regulation. We can debate on the renewable energy, whether having a mandate for renewable energy is good policy or not. It is just the point that every one of these recommendations they make is in the direction of more regulation, not less regulation.

And I sent these slides in back at the end of March, since then there has been another development, which John Anderson talked about, and that is the Speaker of the House in Michigan has introduced legislation that would repeal the restructuring and go back. And, so, we are going to have hearings in the Michigan House shortly on that. I am hoping to testify there as my next project.

But, anyway, we have actually some bipartisan interest in the state in rolling back where we still have the same Republican chair of the Senate Committee. The Michigan Senate is controlled by Republicans, Michigan House is controlled by Democrats, and there are leaders in both parties that have expressed some interest in rolling back restructuring. So, we will see where we go on all of that.

MS. STERBENZ: One more minute.

PROFESSOR BOLEMA: Okay. The point I am hoping to leave you with on this is that this was not a perfect deregulation. We can all look at it and I can find ways that I would rather have things even out more, I think it would be more economically sensible to even things out more between the incumbent utilities and the entrants. So, I am not sure I would hold out the Michigan model as the model for other states, but I think there can be some lessons learned from it in terms of having a simple structure, it had some real success in the relatively short time it was relatively available.

Now, here we are in a time where we have a lot of regulatory uncertainty with these prices going up as I showed you a moment ago. Maybe I cannot go back to that. But, anyway, with the prices increasing for a lot of potential entrants, it is now very financially attractive to enter the state. However, no one is entering, and I think regulatory uncertainty is a big factor in all of that.

So, anyway, I am hoping this can be an example or a key study on a type of restructuring that I think can have some success. It is not ideal yet, but it goes in the right direction. And when we hear all the stories about the other states that required divesting of generation capacity, and other sort of structures that do not really strike me as making a lot of economic sense, I think the Michigan structure is pretty simple.

It did not really mandate anything. No one had to enter in Michigan, and yet, entrants did come in. So, hopefully, that sort of approach could be more of a model for other states going forward.

Thank you.

MS. STERBENZ: Thank you so much. Tyson Slocum.

MR. SLOCUM: Thank you very much. And thanks to all these very brave folks who have stuck with us for a very long day. I hope I do not disappoint up here. And, again, thanks again to the Federal Trade Commission for putting all of this on.

Betsy Moler had raised some concerns earlier with some of the numbers in my research and, first, I just want to thank her for actually reading some of my research. I did not know that anyone actually was going to read it and, so, I am flattered.

MS. MOLER: I do my homework.

MR. SLOCUM: Yes, I appreciate that. The report that I am referencing, it has another neutral title, it is available out there, the Federal Trade Commission was kind enough to make copies, it is called the Failure of Electricity Deregulation: A History, Status and Needed Reforms.

And I believe that the numbers that Ms. Moler were referencing are on page 6. I am sorry, I do not have a PowerPoint presentation, I am kind of old school and, so, I am just going to talk about it, if that's okay with everyone.

In it, what I did, and I provide source material and a link to the Energy Information Administration website to the actual direct link to the Excel spreadsheet from where I downloaded this data. So, the data is very easy to obtain, and I explain exactly what I did. I compared states that are deregulated on the retail level, meaning consumers, households, are paying rates that are exposed to the wholesale level, and compared those rates over time with those 38 states where retail rates remain regulated. So, that would mean Alabama, that would even mean a state like Pennsylvania. Even though Pennsylvania is within the organized market of PJM, most retail rates for most utilities in Pennsylvania remain regulated by the state. The caps have not come off.

And what I find is rates have risen in all states, but they have risen much faster in those states where rates are deregulated, meaning they are subject to the wholesale market. And the reason for that is actually articulated by the Energy Information Administration. On page 7 of my report, I quote directly from the Energy Information Administration, from a document that they call the Annual Energy Outlook 2006. And on page 82 of that document, they say, "Customers in states with competitive retail markets for electricity see the effects of natural gas prices in their electricity bills more rapidly than those in regulated states because their prices are determined to a greater extent by the marginal cost of energy, the average operating cost of the last most expensive unit run each hour, rather than the average of all plant costs.

So, what this confirms is what some other speakers have articulated, is this linkage in deregulated energy markets to the marginal cost of production, and, increasingly, that is set by natural gas power plants, natural gas has seen very volatile price increases for its fuel. And, so, you have a situation where generators that have low-cost facilities, like a coal-fired power plant, a nuclear power plant, are earning record rates of return on those facilities, and I am going to get into that in a second about how I think that creates some problems for consumers and for competitiveness.

Public Citizen believes that the crux of the problem here is that the Federal Energy Regulatory Commission is not doing its job. Its job under the

Federal Power Act is to enforce just and reasonable rates. And what FERC is doing right now is assuming that all markets are competitive, and it assumes because markets are competitive, that any rate charged by any generator or power market or within a competitive market, is going to be just and reasonable, because it is the result of a perfectly competitive market.

The problem is is that markets are not competitive. So, as a result, it should not come as a surprise that rates being charged by sellers, particularly sellers operating very low cost facilities, are earning rates that definitely exceed anyone's common sense definition of just and reasonable rates. And it is not just Public Citizen raising these concerns, there are states raising these concerns.

And earlier, folks were concerned about why people have been belly aching about deregulation, well the fact is that the only reason that states are contemplating a return to cost-of-service regulation is because FERC is ignoring their pleas, and this should be a lesson to FERC. And I hope that the Federal Trade Commission is able to weigh in on this as well. This would all be alleviated if FERC would do its job and enforce just and reasonable rates.

States would not feel that they had to take matters into their own hands if they felt that FERC had their backs, but right now, FERC does not. And I am going to go through some specific examples of where states have raised very, very specific, articulate examples producing documented research showing that rates are not just and reasonable, showing the lack of adequate competition, and in every single case, all of their concerns have been rejected outright, and in all cases but one, rejected without the opportunity for a hearing, which is very, very alarming.

MS. STERBENZ: Two more minutes.

MR. SLOCUM: Excellent, thank you. I will go very quickly. Illinois, there was a representative here from the Illinois Attorney General's Office, who asked me a question earlier. I cannot remember who you were, unfortunately, my memory is that bad. But the Illinois Attorney General, on March 15th, issued a very interesting filing at FERC documenting some problems with the recent power auction in Illinois, and among other things, they noted that one of the largest generators in the Illinois market was earning up to 260 percent rates of return on some of their facilities, that they had won 95 percent of the long-term auction, meaning the 41-month contract.

So, that clearly is not evidence of a

competitive market, and the Illinois Attorney General was asking FERC to show that the auction is not competitive.

In Connecticut, there have been a number of appeals by the Attorney General of that state documenting that operators of low cost generation units, coal and nuclear units, were earning at least 100 percent rate of return, and the Connecticut Attorney General argued that that is not just and reasonable. His concerns were rejected by FERC.

MS. STERBENZ: One more minute.

MR. SLOCUM: Okay. Montana, a very similar situation where one company owns most of the assets, the Montana state officials raised concerns. In New York, the independent system operator of New York filed a document at FERC showing that at the same time that the New York Power Authority introduced a thousand megawatts of new generation, that power producers in the State of New York withdrew a thousand megawatts of generation. So, as soon as the state provided needed supplies, large power generators took those supplies off the market, economic withholding. It is rampant not only in New York, but elsewhere.

Another issue that I would like the FTC to examine, and this is my final point, is the issue of market monitor independence of these organized markets. There was some incredibly important testimony on April 5th at FERC, it is kind of whistleblower testimony, by the market monitor for PJM, his name is Joseph Bowring, and he made allegations that are very, very serious, saying that PJM's managers were directly undermining and threatening the independence of the market monitor, forbidding him from being truly independent.

MS. STERBENZ: Half a minute.

MR. SLOCUM: Thank you. And one of the problems with this is that FERC is increasingly relying on these market monitors to enforce just and reasonable rates. FERC is placing PJM and other systems on the front lines of enforcing just and reasonable rates by putting them in charge of market monitoring. And if we have testimony from a market monitor, from America's largest unit, saying he does not have adequate independence, this is a big problem for consumers. And I hope that the Federal Trade Commission is able to investigate that a little more and incorporate that into the work that you are doing.

Thank you very much for the time, I appreciate it.

MS. STERBENZ: Thank you, I appreciate it.

Bryan Hannegan?

MR. HANNEGAN: I am going to walk quickly here because I have an idea of the time constraints that we are under. You know you never want to be at the bottom of the hill, you never want to be at the end of the queue, but we will make the best out of it.

What I want to do is take a few minutes to just share with you some of the recent work that we have been doing at EPRI focused on the role of electricity technologies in a carbon-constrained world. So, we are moving out of the regulatory competition deregulation space into the climate space, and this is some work that we have presented first at CERA Week a few weeks ago down in Houston, and we have been talking broadly in the public domain ever since.

What I want to do is kind of reset, for those of you who weren't here at 12:30, the work that we have done on generation technologies and investment decisions as a world that has carbon constraints, and then I want to talk about the second part of the question, which is, if we do not have the things that we need right now to achieve CO2 cuts in the electric sector at a very low cost, what are the R&D needs that we have to undertake with urgency to get there.

And if we are successful with all of that R&D, then the third part that I will quickly look to is the technical feasibility. What do you get if you take all of this great R&D and you deploy it out there in the marketplace at a rate at which we think is technically the upper limit? How quickly can we reduce our CO_2 emissions from the electric sector?

So, in brief, for those of you who were not here this morning, what we do is determine a life cycle cost of electricity for various generation technologies, which is the left side of the chart at this zero line for our cost of CO_2 per metric ton. We adjust that to reflect CO_2 costs based on the emissions profile of the technology, and we get flat or upwardly sloping curves, depending on the carbon exposure, of various technologies. Here I show for pulverized coal in red and IGCC in blue.

If you take all of those technologies and you do the assessments and you put them all in the same chart, you get real clear the notion that at a low carbon constraint, zero to $10, pulverized coal is the low cost option, nuclear energy is not too far behind, and it certainly wins out as you strengthen the carbon constraint going forward, a higher price. IGCC, natural gas at $6, and wind energy are all fairly competitive, but some of them fade away in terms of the higher cost of carbon going forward.

Again, as I mentioned this morning, if you have licensing concerns or delays in construction over nuclear, then your three options in today's world really are pulverized coal, coal gasification, or natural gas at $6, and if it is at $4, natural gas certainly wins out. But the bottom line is that at least in the near term, we are going to be relying on fossil fuels without CO2 capture and storage for the bulk of our new capacity coming online in the next 10 to 15 years.

Without renewables, because they cannot compete in the marketplace, except for wind, at a subsidized level, in the best locations, and except for nuclear power, if we can get that online, great, but at this point, it is questionable whether it will be there by 2015. Very limited opportunities for significant economic CO2 reductions because we are relying on fossil fuels in the near term going forward.

To get beyond that, we have to address four key technology challenges and there is much more beyond what I am about to show you. The first two are really to focus on the grid, and to reinvent today's electric grid into something that is much more distributed, much more decentralized, something that is capable of handling new distributed load centers, as well as devices that serve the load as well, and in this case, it is smart end use and demand response, it is distributed generation and plug-in hybrid vehicles. It is also a grid infrastructure with the capacity to handle intermittent renewables.

We have seen experience in Denmark now as they approach 15 percent of their market share with wind. They are beginning to have reliability concerns and it is a whole new generation of grid management challenges that they are starting to face.

And, then, on the centralized generation side, we know we are going to need nuclear power going forward as a large scale source of non-emitting electricity, and to enable coal and to avoid an increasing dependence on imported natural gas, we know we are going to have to deal with carbon capture and storage in a carbon-constrained world.

We have briefly, at EPRI, outlined a number of funding increments that will take us from where we are today with those technologies moving forward in each of those four areas to a point where we have a low carbon/low cost portfolio of options to address climate change. As you see in the bottom right-hand corner of this chart, the estimated missing gap in terms of research and development is on the order of about $2 billion a year, in addition to what is currently being funded.

And our view it is not a spread the money like manure situation, we really want to focus on some targeted applications to take technologies that are in their infancy right now and move them out into the marketplace so that Wall Street and the investor-owned utilities, as well as the publics, will have the ability to invest in them with confidence.

If you do that, our view, technically, is that you can take the curves I showed earlier, that are fairly well all over the map, and you can develop the curves on the chart that I show here, where you have a range of technologies, both coal, nuclear, and wind, all of which are non-emitting and all of which are low cost, between five and six cents per kilowatt hour electricity in real terms, to the point where you now have a portfolio which is largely insensitive to the kind of carbon constraint that you are laying under, the prices that are out there in the marketplace. By and large, it allows the electricity sector to decarbonize and then become the engine for addressing CO2 in many of the other sectors.

The question is if you have all of that, then what can you do in terms of deployment? How quickly could you begin to decarbonize the U.S. electric sector?

And what we did here is we took the EIA Annual Energy Outlook as our baseline, that is the emissions curve shown here in gray. We recognize that it includes some assumptions about how these new technologies are placed into the market, but what we did is we took those assumptions and we put them on steroids. We said, what is the highest level that we think reasonably and rationally, from a technical standpoint, we can push it?

Can we make two-thirds of the country have per capita load growth in electricity flat? Like in California, bringing a nation-wide averages down to 1.1 percent per year. Can we build 70,000 new one megawatt wind turbines somewhere in the United States over the next three decades, 50 new nuclear plants? Can we upgrade half of the existing coal fleet for higher efficiency? And can we build best in class for every new coal plant going forward to efficiencies approaching 46 to 49?

Can we have carbon capture and storage widely available and deployed after 2020? Can we sell upwards of ten million plug-in hybrid vehicles between now and 2030? And can we remove 5 percent of the baseload off the grid through distributed energy resources, including distributed solar and PV?

All very aggressive, all pie in the sky, if you do that, you can walk through the emissions cuts that would result and add them all up, and effectively, what's possible is you can take today's emissions trend and slow, stop and reverse that emissions trend, returning the electric sector emissions back to roughly 1990 levels by about 2025, 2030, but only if you are successful at all of this research and development and only if you are successful at deploying all these things to the maximum amount.

MS. STERBENZ: One more minute.

MR. HANNEGAN: The largest share there from CO2 capture and storage, which we think is a linchpin to getting this done. It will not be easy, it will not be cheap, but we do have the technical potential to significantly cut CO2 reductions, and we can do it in a way which allows for continued growth in electricity usage and it also enables a future for coal. Here, 53 percent of the generation mix under our approach compared to 56 percent in EIA's base case.

But, again, and here is where I will end up, you need to address all four of these key technology challenges, many of which we would address with the tools that are not even in place today, or are in their infancy in today's research laboratories.

So, as you think about the challenges that we face even in today's markets, recognize that climate change, if we take it seriously and we try to address the policy demands that are out there, it is a massive new set of challenges, a massive new set of investments and infrastructure, and a massive new expenditure on the part of the industry to really only get back to a level which politically is about 10 to 15 years later than what is being debated here in D.C., and I look forward to your questions.

MS. STERBENZ: Thank you so much. And Betsy Moler.

MS. MOLER: I am going to be in my Andy Rooney mode for those of you who are 60 Minutes fans. I am feeling older and crotchetier by the day. But, anyway, I want to try briefly to relate the climate change issue to competitive markets. You all may think that is weird, but there actually is a very important thing to recognize here.

We at Exelon believe that climate change is real. If there was any doubt, you just have to look at the photos and the conclusions in the recent IPCC report, and we support, and have for years, mandatory federal legislation, either a tax on carbon or a cap-and-trade system of the type that has recently been endorsed by the bipartisan National Commission on Energy

Policy. It is not a federal commission, it is privately funded, but it is a bipartisan commission.

And we think you need to have carbon intensity requirements, targets, and in the words of the people use these days are slow, stop, and ultimately reverse. They were just used by the previous speaker. Greenhouse gas emissions, it needs to be economy-wide and national in scope.

For the electric sector, we believe you should have a portion of the allowances simply allocated for free, and not to the generators, we give it to the LDCs for the benefit of their customers. So, there is not a question about big bad generators benefitting from free allowances. And we would sell the remaining ones and evolve to selling over time.

We also believe the auction should have a safety valve that should not create windfall or distort price signals to consumers, but it should be high enough to induce the technology change that we just heard, over time, starting lower and increasing over time.

The Edison Electric Institute, that just say no crowd historically, in terms of carbon legislation, has had a sea change just this year and they are now recognizing the inevitability, I think, of the climate change on the Hill with the change in the majority of both Houses and they are talking about economy-wide with a safety valve, and you can see on the EIA website, should you care to go there, their climate change principles, and it is a big change for those of us in the industry.

Now, what does this have to do with competition and RTOs and all that sort of stuff? If you look at the data we have seen and the experience that we have had in RTOs and competitive markets the last few years, we see that RTOs are much better, and organized markets and broad organized markets that have ancillary services available and back-up services available are much better places to be incubators and developers of the types of technology that we need to address the climate change issue.

There is a recent letter to FERC chairman Joe Kelliher from over 20 leading environmental organizations, I am going to give it to Jola for the record, I did not append it to my slides today because I did not have electronic copy of it last night, at 6:00, but I will find one. And they concluded that "well-structured wholesale markets operated independently allow far greater amounts of renewable energy and demand response resources to be integrated into the nation's electric grid." This is not a trivial thing, this is a very big deal when you are talking about the kind of challenge we have ahead of us.

I would just cite one example, and I remind you of that map to those of you who were in the room earlier today, from the fellow Mr. Arent, NREL, National Global Electricity Energy Lab in Colorado, where he sort of piled up the kinds of resources that are available. And if you look at where the resources are, you find that not a lot of the wind, the physical wind, blowing wind, is located in areas of the country that have RTOs. Actually, it is only about 44 percent from NREL's thing.

But you find that 73 percent of the wind development that has actually happened in this country has happened in RTOs, and that is because of the structure of these large regional organizations with diverse resources, different places that peak at different times, encourage the development of these kinds of resources.

And the leading environmental organizations and the alternative generation developers, this isn't big, bad Exelon, this is the American Wind Energy Association and so forth, have concluded that independently run regional grid operations can foster renewable energy and demand response development far better than the traditional marketplace. You see it is physically evident from the slide, and that is where you have the wind development, it is coincidence with RTOs.

So, I hope it is an interesting way to tie up the subjects that we have been discussing all this day, all of today, and food for thought as we embark on a really important debate about climate in our future. Thank you.

MS. STERBENZ: Thank you very much.

MR. FRANKENA: Because we did not devote very much of the afternoon to climate change, and we have a few minutes, I just wanted to invite questions on the topic of climate change, if anybody has any.

AUDIENCE MEMBER: I would just add to Betsy's presentation that the same is true for solar.

MS. MOLER: Yes, it is.

AUDIENCE MEMBER: Solar basically gets the true marginal cost or marginal price of its output when it is in an RTO, because there is a true price, and solar happens to be very coincident with the high prices, and it basically creates less of a need for subsidy for solar. Solar can actually benefit from the true marginal price of electricity. And in most non-RTOs, that's not the case.

MS. MOLER: And if I can elaborate on that, and for people who talk about reregulating generation and all generation, if you think about solar, if you think about wind, if you think about this inducing the kinds of resources that we have to bring to the market, that is not the way to make that happen. Nuclear, for that matter, as well.

MS. SHOWALTER: Well, just as a counterpoint, if the RTO regions serve, I forget what the figure was, what percent of customers.

MS. MOLER: Two-thirds.

MS. SHOWALTER: Two-thirds, okay. Well, it is not that surprising, then it is 70 percent, that is roughly a proportionate share that wind is producing. To the point of the wind industry liking RTOs, obviously, if you create head room for people to get in under that head, that is attractive to them. The question is, is the head too high, is it artificially high? From a consumer's point of view, you do not want to be spending more than you need to. So, if you are paying a high price for depreciated coal plants, as well as others, you could spend the consumer money better if you simply funded the cost of whatever was deemed to be appropriate to pay.

MR. FRANKENA: I have a question just for information purposes, this is for Mr. Hannegan. In your aggressive scenario, if we went ahead and did that research and if it got the results, and then we produced power in the way that was possible with those results, have you thought about what are the costs going to be of that energy?

MR. HANNEGAN: Right. We are in the process right now of doing some economic work that extends what I literally rushed through, and I would encourage you to visit our website at www.EPRI.com. You'll see on the front page there many more details behind the work that I have summarized today.

That economic modeling is showing that effectively there are two worlds, there are two ways, let me put it that way, in which you can meet a carbon constraint in the electric sector. If you do not have CO_2 capture and storage for your coal units and you do not have nuclear as an option, advanced light water reactors, then you rely on a very high price signal, something like 25 cents per kilowatt hour nationwide average, as opposed to five to six kilowatt per hour nationwide average in the case where you do have those two technologies in particular in a grid that is also smarter with respect to energy efficiency and demand response.

As a result, in the case without technology, you have lots of fuel switching, you do not grow the electrification in the economy, the electricity used 25 years from now is about the same as it is today. And in the case where you have technology, you can grow that electrification by 40 percent, but you can also do so at a cost to the U.S. economy that is anywhere between a half to two-thirds less than in the case without technology.

So, there is a lot of value in doing this R&D and it brings your marginal costs back down to the kinds of rates that consumers are enjoying today, as opposed to those that would be significantly impacted by the high carbon prices in the market.

MR. FRANKLIN: Do you have other questions?

AUDIENCE MEMBER: Given some of the information we have had related to energy markets and, as Dick alluded to, the fact that some of the new technologies that are in the mix of climate change solutions -- this is to the panel -- is it possible for energy markets, in a going forward sense, to operate without a significant share of the marketplace at the retail level, having demand response, seeing price signals?

MS. MOLER: I think you need both. I think you need significantly stepped-up demand response programs. I agree with the comments that have been made earlier that they have to be appropriately compensated, and I think FERC is beginning to look at that issue. But if you have enough demand response at the very top of the dispatch curve, when it gets to be those really hot days, it can have a very significant impact on the overall bill that people pay.

I think there are ways to structure it that are still consistent with the kind of technology development that we need for other alternative energy resources and alternative generating resources.

PROFESSOR BOLEMA: I also note that often the capacity extra margins that are required by states are typically measured on the coldest day of the winter, hottest day of the summer. So, to the extent you have demand management, you could lower that amount and, therefore, lower costs fairly substantially.

MR. HANNEGAN: From a technology standpoint, that is why the first two of our four technology challenges really do focus around the grid. We have done some analysis of what we think our reasonable energy efficiency potential is out there at a market price, and it is not the amount that you would want if you were trying to use efficiency as one of your principal levers to get there on climate change.

What you have to do then is enable much greater demand response, much greater consumer decision making, at the end use level on what the prices are for the electricity that they are using, and how do you get them into a framework where they are perhaps investing in an advanced technology and then recovering those savings over the life cycle. Right now, a lot of consumers do not buy based on life cycle, they buy based on sticker.

And, so, without that information and without that education process, the amount that you can squeeze out of the system through efficiency gains, just by swapping appliances, it is not going to do the trick in order to get you there, and,so, that is why we think grid investments are warranted.

AUDIENCE MEMBER: In terms of grid investment, is there a technical limit on how far you can transmit electricity efficiently?

MR. HANNEGAN: Well, the further you transmit it, the more line losses you have. So, the real question is, how much are you willing to lose in the process? We can mitigate that somewhat by investments in the transmission technologies themselves, and that certainly should play a role in any effort by the power sector to minimize its use of fuel for CO_2 purposes.

But I don't think you will ever avoid entirely the to transmit electricity from large central station plants. What you will see, in our view, is more of a hybrid model where you are taking some generation and putting it at the point of use, but you are also continuing to serve that through transmission lines, and the question of distance really starts to become less and less of an issue going forward.

MR. FRANKENA: Okay, the last question here.

MR. TATUM: Well, thank you, Ed Tatum. I am the not-for-profit guy, Old Dominion Electric Cooperative. My kids are 18 and 16, so we are having a lot of these Al Gore and Convenient Truth debates and on and on. The question I have for you, and it comes from the earlier question about the costs of these programs, are there any evaluations going on that will assess whatever we need to do with regards to carbon dioxide that is going to assess what impact that would have on our competitiveness in the global economy and the fact that we can certainly legislate ourselves, but we cannot legislate the rest of the world?

Is there any consideration given to that aspect and how that might fit into any type of climate change policies?

MR. HANNEGAN: Yes, that's a very good question and one that has been a hallmark of climate change policy analysis for the last decade, and I know in my former positions here in Washington, I was here on the receiving end of a lot of that.

One of the things that we are doing for our work for the power sector is we are not just looking at the economic implications for the power sector in the United States, but we are actually building that into a global economic framework where we are looking at natural gas prices and the effect on gas intensive industries, for example, in the U.S., and whether there is inadvertent off-shoring under a case without technology, and with technology, are we preserving and keeping those jobs here.

When I talk about the macroeconomic costs, those are the net costs to the U.S. economy in a global context. So, it accounts for all of the shifts in resources under a scenario where really only the industrialized world is making commitments. We are going back and doing some analysis now and saying, okay, how does that value of technology change, if at all, under a world in which we are also seeing cuts out of the developing world and they are competing with us in the marketplace for new advanced technologies?

One of the things that is driving price increases right now in new bids for nuclear and for clean coal plants is, we are out there competing with China in the marketplace for personnel and materials, and, so, that is driving up the cost of doing these advanced technologies and making them even further to justify on a low cost basis.

So, there is a lot of moving pieces on this, and the only thing I can say to you is stay tuned, we will have more to say.

MR. SLOCUM: And I think just from a strategic standpoint, we absolutely have to re-engage with the rest of the world to work in cooperation to deal with climate change strategies, because if the United States and Europe go alone, that's not going to be the most effective way to achieve the result. We are going to have to re-engage with the rest of the world and make sure that other big energy consumers are working with us in some sort of formal agreement.

MR. HANNEGAN: And let me add one more thing. You are also going to want to know whether the value of the dollars that you are investing in all these clean technologies and so on is worth the price of the avoided cost that you would not otherwise suffer from climate change, and that is an area in which EPRI used to have a very significant program. We are reaching out to those who do this kind of integrated assessment modeling and saying, if we deploy all these technologies and achieve all these emission reductions, what do we think the reductions and potential damages from climate change might be and does that investment make sense in sort of a global cost benefit sense?

I cannot tell you where that work is going to come out because I don't know, but it certainly should be a very interesting result.

MR. FRANKENA: I think it is time for me now to release the hostages that we have been holding since 8:30 this morning. I would like to thank everybody. I would like to thank all the members of the three panels who all shared their time, their expertise, their ideas, their evidence. We really appreciate it. And have a good evening.

MR. SEESEL: I just want to thank all the panel members we had today. We will convene tomorrow morning at 9:00 for more of the energy conference. The doors will open at 8:00 in the morning. Thank you.

(Whereupon, at 5:50 p.m., the workshop was adjourned.)

C E R T I F I C A T I O N   O F   R E P O R T E R

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CASE TITLE: ENERGY MARKETS IN THE 21st CENTURY

COMPETITION POLICY IN PERSPECTIVE

DATE: APRIL 10, 2007

I HEREBY CERTIFY that the transcript contained herein is a full and accurate transcript of the notes taken by me at the hearing on the above cause before the FEDERAL TRADE COMMISSION to the best of my knowledge and belief.

DATED: 4/30/07

SALLY JO BOWLING

C E R T I F I C A T I O N   O F   P R O O F R E A D E R

I HEREBY CERTIFY that I proofread the transcript for accuracy in spelling, hyphenation, punctuation and format.

SARA J. VANCE