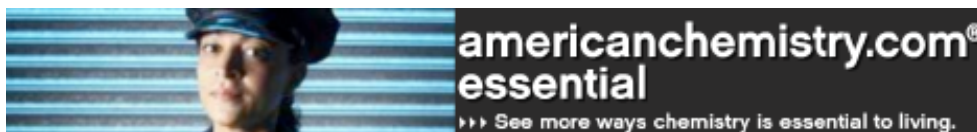


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## **Carbon Sequestration: Panel addresses key regulatory, liability issues associated with carbon capture and storage (Event Coverage, 10/08/2008)**

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## About this video



What kind of regulatory framework needs to exist for carbon capture and storage (CCS) to become commercially viable? Who should be held liable for issues associated with CCS projects? How do public acceptance issues factor into the deployment of this technology? During today's E&ETV Event Coverage of the 2008 Gasification Technologies Conference, panelists address the non-technical issues associated with carbon capture and storage. Roundtable participants include Kipp Coddington, partner at Alston & Bird; Chiara Trabucchi, principal at Industrial Economics; and Kevin Book, senior vice president at FBR Capital Markets Corp. The panel is moderated by E&ETV host Monica Trauzzi.

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## Transcript

**Jim Childress:** I'm going to turn this over to you Monica. Monica Trauzzi is the managing editor and the host of E&ETV for those of you who subscribe to any of the E&E products, especially E&ETV.

She does an excellent job with this and this is a role of the dice because I just had a conference call with these three people last week, but they know what they're talking about, more so than I, which is why I'm going to slip here.

But Monica, let me turn it over to you and we're going to not impose artificial time limits. Just to let everybody know, we started a little late and we're going to expand things throughout the day. We always have the reception at 6 p.m., so we will shift things back.

Now, the last panel may be under some pressure, but we'll adjust schedules throughout the day so

everything works. Monica, let me turn it over to you. Is everybody miked yet? Great, thank you.

**Monica Trauzzi:** Thank you. Thanks Jim. As Jim mentioned, the first panel is going to focus on the non-technical issues relating to gasification technology and these would be economic, legal, regulatory and liability issues.

And GTC has assembled an excellent panel of experts that are sort of going to walk us through these issues. First up we have Chiara Trabucchi and she is with Industrial Economics.

She regularly consults on the interplay of financial responsibility and environmental disclosure requirements on various statutory regimes, including emerging policies for climate change.

And how we're going to work this is each panelist is going to talk for about five to seven minutes and then we're going to have a general discussion and open it up to the audience. So, with that, I will hand it over to Chiara for her comments.

**Chiara Trabucchi:** Hi, good morning. I'd like to start just by predicating a few thoughts on risk management and talking a little bit about the importance of risk management in new and emerging technologies.

And, first, just to say that risk management, for those of you in the group who need a little refresher course, is forecasting the range of possible outcomes, recognizing that forecasts can be wrong, weighing the consequences of being wrong, and then hedging your bet.

And what we're talking about today, how do you hedge your bet? There's emerging consensus, especially among those experts in the field that the existing regulatory structures, legal remedies, and financial insurance mechanisms offer a template to create a risk management framework that addresses the risks associated with CCS.

An important challenge, however, I think, would be to design a rational financial risk management framework, is resolving issues of fit, interplay and scalability.

And what I mean by that, in terms of fit I'm talking about the physical system, the engineered structure, and who or what issuing institution is responsible for regulating and managing it.

In terms of interplay, as a gentleman earlier asked the speaker about three environmental statutes, there are several financial, engineering, and environmental statutes that govern CCS.

And unless we craft a financial risk management framework that creates an interplay across those statutes, it's not going to result in, I think, the financial responsibility and liability management that CCS requires.

And then, lastly, this issue of scalability. Whether or not you agree with the issue of global warming or climate change, CCS will result in large volumes and a great magnitude of CO2 sequestration should CCS take off.

If that occurs, we need a financial risk management framework that addresses scalability. In my opinion, the eventual financial risk management framework for CCS must align to the project lifecycle.

It's generally accepted that the project lifecycle -- there's an operational component and then there's a long-term component, a post, post closure component.

I would offer that the owner/operator should remain responsible financially for that operational structure. There are well tested, first-party assurances that exist in the markets currently to address the financial responsibility needs of that operational period.

I think what's at issue currently and the challenges that remain is how do you address compensatory and other potential damages that may result after the owner/operator is released from responsibility at the site?

And these present certain questions. First of all, who should bear financial responsibility for paying claimants win damages occur over the long term? And if payment results from a public fund, how should the fund be financed, in what amounts, and by whom?

Which I would offer is a fairly timely set of questions in recent economic events. There have been a number of advocates and stakeholders who have called for a national trust fund.

And while that may, in fact, be an appropriate risk management solution, I would offer that unless contributions to the trust map to the expected value of expenses and delimited compensatory damages likely to be incurred over the long term, there is little financial insurance that the balance of funds residing in the trust will be appropriate to the long-term need for funds.

I would further offer that arbitrary limits on liability that do not map to the evolution of the risk profile for CCS sites, from early movers to commercial scale deployment, can result in inadequate coverage and substantial financial exposure to both the federal government, the public and issuing financial institutions.

Your financial community is looking for a return on its investment. Unless and if that return on investment is defrayed by the long-term cost of CCS, it's going to be very difficult for you to find financial venture capitalists willing to invest in CCS.

So, regulatory and financial certainty and risk certainty is a must. Finally, and perhaps most importantly, I would offer is the issue of moral hazard.

No structures should insulate owners, operators, or corporations and result in poor operational decisions. Questions that are key, I think, in the issue of the CCS dialogue, will the CCS developer be better off in the event of loss or failure?

Is the CCS developer indifferent that you'll have a risk management framework that essentially does not foster sound operating decisions?

And is the CCS developer motivated to increase the risk to be the worst case scenario because it bears little or none of the financial consequences?

I would conclude by saying in any discussion that introduces the concept of blanket indemnification for injected CO<sub>2</sub> needs to be carefully considered in terms of whether or not it creates the appropriate incentives for good CO<sub>2</sub> storage reservoir management.

Any eventual risk management framework must foster strong site selection design and criteria, strong operating criteria, strong financial responsibility provisions that ensure flexibility for the corporations that are undertaking these projects and, thereby, avoid the manifestation of potentially greater long-term risk from adverse site selection due to moral hazard. Thank you.

**Monica Trauzzi:** Thank you Chiara, those were some interesting points about the regulatory and financial certainty that's needed to propel this technology forward. Next up we have Kevin Book.

Kevin is the senior vice president and senior analyst for Energy Policy, Oil and Alternative Energy at Capital Markets Corp. Kevin forecasts and interprets domestic and global economic and policy trends likely to impact energy sector investments. Kevin?

**Kevin Book:** Thank you Monica. Good morning, I'm Kevin Book and I work for FBR Capital Markets Corporation. Although, I suppose with enough bank consolidation there will one day be a company just called Capital Markets Corporation.

To make a point about what I do, I think it was mentioned earlier during the opening speech that financial investors tend to be a nervous, particularly recently, but generally cautious lot who don't like to take risks on things they can't understand.

And, because they are stewards typically of other people's money on the asset management side, tend to look to analysts like me to explain what the big picture looks like and what it will cost.

So, I'm tasked ultimately with the proposition of trying to figure out will happen next and then figuring out what it means financially, which gives me the chance to be exponentially wrong.

Finally, just to put it in context, if you've seen *Syriana*, I have essentially the same role that Matt Damon has as an oil analyst in that movie, which I think exemplifies the difference between Hollywood and reality.

I am no Matt Damon, so please be kind. The modeling of gasification projects is something that's been done greatly and with an incredible amount of academic and computing power.

And, at the same time, the actual question that an investor asks is will this make me money? The easiest way to make money is to sell something there isn't enough of.

And there's no question right now, the Dow opened down 2-1/2 percent, oil prices at \$91 a barrel, the cataclysmic shortages that were predicted for liquid fuels for transportation just a few months ago now seem to be very eerily towards surplus as global economies start to stagnate and contract.

That doesn't last forever. OPEC cuts demand returns. And middle distillates, diesel fuels, the things that fly jets and move trucks, they're the stuff of economic recovery.

And so when you look at a process that yields economic value, you start to think about gasification in the context of liquids. When you look at energy security you think about coal because we have a lot of it and not just coal, but also biomass and other feedstocks.

My wife asked me to explain to her what gasification was in a way that was polite enough to use around our daughter.

And I explained that essentially the way I look at it from an economic yield perspective to make a liquid fuel, you're taking something that's really carbon intensive and adding in some hydrogen until it's liquid enough to combust in the infrastructure you have right now.

Now, there's a lot of other applications, obviously, chemicals, power generation. When we modeled coal to liquids last year we had four different scenarios, recycling plants, non-recycling plants.

But really, the questions that we should be asking, I think, are still the big questions. What is the price of oil in the future? What do you think it's going to be, because that will determine whether or not there's relative economic benefit.

Second, what are your capital costs? I would suggest that they're going up right now, liquidity crisis and credit crunches. What are your feedstock costs if coal is your feedstock and coal is not only the stuff of energy security here at home, but also the power generation fuel of choice for an emerging world?

Well, you're coal prices, depending on what coal you use can make a very big difference in the project economics. If you're using stranded resources that would otherwise not to be known as coal, then your costs are very low and it sells the idea of waste gasification as a good idea.

Cheap feedstock is a big part of it. And, finally, the policy and just to try to put some numbers on this, if you think about what we're talking about here we just passed into law a few interesting things for liquid fuels particularly.

We've extended the coal to liquids credit. It wasn't called that, it was called the Alternative Fuels Credit, by something like 90 days. But attached to it until its expiration in December of 2009, is a 50 percent carbon capture and storage requirement.

Which means that you get your 21 bucks a barrel in subsidy, but to do it you have to do something that you haven't done with refineries of any type of fuel, conventional or otherwise, before deliberately in this scale.

You have done it of course for enhanced oil recovery and other applications. It also includes a \$10 per metric ton credit for sequestering and capturing carbon dioxide for EOR, enhanced oil recovery.

And 20 if you stow it underground to keep the world from warming in secure geological storage. These are new economics to start to consider.

And it really is a legitimate question if you think about you've heard estimates I'm sure that capturing and storing carbon dioxide might start out -- I think EPRI suggested in the \$80 to \$120 per metric ton range.

Policymakers in DC have talked about bills that would impose carbon costs of between \$5 and \$15 per metric ton. Suddenly you ask the question will that change behavior?

Or looking at it from an investor's eye, is this the sort of thing where I can make money if it costs me \$115 to do something more than I could potentially make from it in the open market? And it looks pretty discouraging at the first blush.

But if we look at demand recovery, if we think about the prospect of perhaps cleaner fuels as a policy picture that has a non-economic benefit, that's being enforced by enduring law, you can start to get to some numbers.

If you didn't take an astronomically high oil price and you assumed that there would be refineries built somewhere in the world that kept you from having extremely rich refining margins, you can do a goal to liquids project without any sort of capture and storage or sequestration in a reasonable \$60 to \$80 per barrel range and still make a decent return on your money, a 12 percent to 15 percent return.

If you get a \$21 a barrel credit it takes \$21 a barrel away and it's cheaper now. Your economics work better.

If you are required to reduce the footprint of your fuels to the level that was established by last December's Energy Independence and Security Act, 20 percent below comparable petroleum fuels.

So your carbon lifecycle goes from it's been estimated to 200 percent of conventional to 80 percent of conventional. You have two ways you can do it, either you do it physically, we don't know whether that will be required exactly, or you pay to offset it.

Well, let's just talk about paying to offset it. At \$10 per metric ton that's a cost of approximately -- well, let's go \$20 per metric ton. Let's try to get closer to behavior changing. It's about \$4.60 a barrel surcharge just to get to that target.

So you've now lost some of your \$21 incentive right away. The point I'm trying to make here is that from a financial investor's perspective this is a problem in four very big unknowns; oil price, credit costs, feedstock costs, and the way policy variables can then change the overall return profile.

Certainly, regulatory stability will be easier to handle when you have a clear picture of demand and you have a clear law that tells you what carbon is going to cost. I don't think the world is running out of oil at the prevailing price.

Our price forecast for the long-term is about \$85 a barrel. That means that these projects are feasible as long as the cost of carbon storage isn't too high or forced to be borne entirely by the project sponsor and off-siting policy mechanisms will get you there.

So, just sort of for grist for discussion, I think what was said earlier was that there was a question for Speaker Gingrich's panel. It said something to the effect of these projects didn't work when you took away the funding because they weren't economic.

So the question is, will you spend \$120,000 per barrel per day of capacity to build a coal to liquids plant in a world where you could build a refinery for conventional fuels at \$30,000 per barrel per day?

And if so, why? And I think that probably frames the next speaker's talks on policy and some of the policy implications. Thank you.

**Monica Trauzzi:** Thank you Kevin. Next up, Kipp Coddington. Kipp is a partner in the Energy Infrastructure, Climate Change and Technology Group at Alston & Bird. Kipp represents project developers in various major infrastructure projects involving carbon management such as coal to the liquids. And he's frequently asked to advise on issues related to carbon capture and storage in both the United States and abroad.

**Kipp Coddington:** Thank you very much. It's a privilege to be here. I'm going to be very brief. I would imagine, during the breaks during this conference there will be a lots of deal making going on. People will be talking about off-take agreements.

There might even be term sheets exchanged. There's going to be lots of discussions about the technology of gasification in which all of us profoundly believe.

The issue though is, and this is my mandate to all of you in this room, that we need to ensure, collectively, that the regulations and policies and laws are at such a state to enable that commercial activity to occur.

And if you don't know already, there are substantial questions on the legal and regulatory side precisely

regarding how these types of projects that you'll be discussing during the breaks today I'm sure, how they will be regulated and how the liabilities associated with them will be addressed.

And if you could just take some brief bullet point notes here I think it would be helpful or maybe we could get some T-shirts printed up with these notices on them.

First of all, in terms of how carbon capture and storage would be regulated, and when I refer to carbon capture and storage I'm referring primarily to the subsurface piece.

I think folks are quite comfortable with the capture aspect of it as well as pipelines and the like, because certainly in terms of EOR, CO2 pipelines are now fairly common, at least in some parts of the country.

In terms of the subsurface piece, at the moment it's uncertain how that is going to be regulated. And you have strident differences of opinion amongst the potential pool of regulators. So in many of the states, as you know, they're going forward with their own regulatory plans.

And these are in some states where you might expect to see some of these infrastructure projects built. On the other hand, you have federal EPA who has just proposed their injection regulations and there were just hearings held in Denver and Chicago last week.

And there were some key differences and potential conflicts between how the federal government is going to approach the subsurface piece or may approach the subsurface piece and how some of the states want to do.

And just to give a couple of examples, and I'm not saying what the answers are or whether this is good or bad, I'm just highlighting differences. If you look at existing environmental law, one of which is RCRA, Resource Recovery and Conservation Act, which is the cradle-to-grave, hazardous waste act.

And if you look at Superfund, which we all know and love quite well, EPA in its proposed rule of just a couple of months ago for the underground injection piece of deep saline storage, has said that RCRA and Superfund may apply.

Now, if you just think about that for a second. So, following up on our prior speakers, you're the CEO of a major company. You're going to make a \$10 billion investment in a CTL plant.

Then you have to turn to your lawyer who's going to write the legal opinion and that lawyer is going to be asked what are the long-term regulatory liabilities associated with injecting how many tens or millions of tons of CO2 per year?

And a lawyer, at present, is going to have to come back and say, "Well, Miss CEO, actually, Superfund may apply and that aquifer in which that injection is occurring may become a Superfund site at some point in the future."

And I think that's interesting to ponder as to whether that project is going to go forward with that uncertainty hanging over them. A second issue is liability and this was alluded to by our first speaker.

Again, I think those of us who have been in the carbon capture storage realm for some period of time, as a matter of technology, people are very, very comfortable. So, when we refer to liability, it's not that we're saying we are really anticipating problems.



As folks know, the Intergovernmental Panel on Climate Change has said that it is very likely that 99 percent of the injected CO<sub>2</sub> will stay permanently stored in an appropriately sited and regulated reservoir, both over a period of time of 100 years as well as 1000 years.

But still, this is America. There are plaintiff's lawyers. It's just the nature of the beast. So you can anticipate that lawsuits will be brought. At the moment, there are no schemes to address those long-term storage liabilities, although many ideas have been floated.

There was a funny article, not so funny, it was an article on liability I read a couple of weeks ago and it was entitled, "What the World Needs Is a 1000-Year Termed Insurance Policy." And I don't know whether that insurance policy will ever be written, but we very well may need one.

And lastly, before I sit back down, just one of public acceptance of carbon capture and storage, in particular the subsurface piece of it, because public acceptance is tied into the regulatory environment.

If people perceive that the activity is appropriately regulated, then public acceptance generally follows. I had a conversation last week with a senior regulator in one of the states and I won't identify this person.

This was the head of an agency that would not have been directly involved in the potential future regulation of carbon capture and storage, but would have played a role. And I asked this person, what's your sort of view of carbon capture and storage?

And this individual had a media knowledge of it. And the response I got back was this, that it was perceived to be a "Planet of the Apes" technology, by which this person meant, it was just so far out in the future it was sort of hard to comprehend.

It was futuristic. They also thought that every time you put CO<sub>2</sub> into the ground you would be creating more oil and this was outside of the context of EOR.

You're sort of putting carbon into the subsurface and you're facilitating the production of more oil, and this person also assumed, well, that of course it was going to be hazardous.

That you're going to be putting in a hazardous waste. So this individual sort of shrugged and said, as a matter of public acceptance, they didn't perceive how this could ever, ever really happen.

So given that all of us are collectively counting on and, as we heard from Speaker Gingrich, the nation needs this new billion-dollar infrastructure to come online. All of us collectively have a very challenging road ahead of us to work with policymakers to ensure that the appropriate laws and regulations are put into place.

And also, in terms of public acceptance, to make sure that the public is appropriately educated about this infrastructure and what is actually truly involved in the risks that do exist.

And I'm somewhat pessimistic that if these steps aren't taken we may see a slowdown in some of these projects. So I think the time to act is now. And I very much appreciate your time, thank you.

**Monica Trauzzi:** Thank you, Kipp. I think I will take the opportunity now to throw out a few questions to the panelists. And I'd like to actually start off with Kipp's last point about the public acceptance issues that carbon capture and storage will face. How concerned are you about these issues and how do you overcome the potential liability factor?

**Kipp Coddington:** This is for me?

**Monica Trauzzi:** The other two and if you want to weigh in as well.

**Chiara Trabucchi:** From my perspective, I think, especially in light of recent events in the last 10 days to two weeks, I think public perception is enormous when you're talking about devoting public resources, either in the form of indemnity or in backstopping long-term liability or in backstopping some sort of financial responsibility on the part of the private sector for new and emerging technology that they may not understand.

And I think Kipp's anecdote, I've heard similar situations. I deal with Ph.D. doctorates a lot in economics and finance and the first time I brought up the concept of sequestering CO2 they were like I don't think that's a good idea. And I think part of that is education.

And then with that educational component saying it's a willingness to pay. What is society's willingness to pay for climate change and willingness to pay for clean coal or for energy fuel or energy independence? And I think CCS is a strong step in that direction, but that educational component is still very much needed.

**Kevin Book:** Well, yeah, I think the simple answer is that investors buy return. They never pay for unlimited liability. And so who is going to invest in something that could be bankrupted by unforeseen circumstances? Very few people.

There's a certain type of investor for whom that is a well structured idea. Public acceptance will start to shape the way investors look at risk. I think that there was an important point Speaker Gingrich also made, which is the Democrats represent the lot of coal states.

Particularly looking at energy security and economic growth, public acceptance at the right point in history can start to show up when we start to look at the need for transportation fuels and the need for jobs.

And the resource we have a lot of and the technology being funded, at that point in time, would really benefit from strong public perception.

**Monica Trauzzi:** Kipp, did you want to weigh in?

**Kipp Coddington:** No.

**Monica Trauzzi:** Chiara, you had touched on the need for regulatory and financial certainty in order to propel this technology forward. How do decisions like DOE's FutureGen decision impact something like that and sort of foreshadow what we may see down the line?

**Chiara Trabucchi:** In my opinion, I think at some level the DOE FutureGen decision was a little ahead of its curve. And the positive side, the beneficial side is that it's really fueled the dialogue.

And a lot of folks started looking at the FutureGen site, looking at how much money had been put behind that, what resulted, what was the accountability? And, again, to point back to the speaker's comments, what were the metrics?

What was being done with that financing and how much was it really pushing forward this issue of clean coal? So, in some respects, I think the FutureGen situation was beneficial to the dialogue.

I think on the other side it really requires, again, that notion of interplay. It's not just a DOE issue. There are other federal institutions. There are other state institutions. I think the cross jurisdictional issues here are enormous.

And so without that regulatory certainty and that certainty of who's responsible, when are they responsible, by how much are they responsible?

Unless those decisions are answered or those questions are answered with some clear decision that the public can accept, I think some of those early mover projects, those demonstration projects, may find difficulty in getting their financing.

But I think those demonstration projects are absolutely critical to move that scalability of sequestering large volumes of CO<sub>2</sub> to mitigate climate change, which is, I think, part of the discussion.

**Monica Trauzzi:** This is obviously a very politically charged issue. What should the next president and Congress be doing to adequately address this topic?

**Chiara Trabucchi:** Why is everybody looking at me?

**Monica Trauzzi:** I'm looking at all three of you. Anybody else?

**Kipp Coddington:** I'll certainly jump in. I think you do need, clearly, and this goes back to the FutureGen question too, you do need a technology roadmap that there clearly is a role for the federal government here in making sure that the appropriate R&D investments are made.

And, certainly, one of the really good things that came out of the FutureGen story was in the public acceptance, in that you did have at least a handful of sites in which those communities really engaged and wanted that infrastructure.

Indeed, it was similar to the competition for the General Motors auto manufacturing plant. And part of that was because the state geologists and a lot of other smart people in those communities literally were going door-to-door with physical tools explaining what sequestration is and that you're injecting it into a rock and this is what a pore space is.

It isn't going in as a balloon. But I would say if both candidates are truly in favor of a clean coal agenda, they need to take a hard look about how carbon capture and storage, in particular the subsurface piece, is going to be regulated.

And give a hard look about are we really going to call carbon dioxide a waste and what that might mean and that's not to say you would be arguing for exemptions or preferential treatment and the like. Clearly not regulating this right would be terrible.

No one is arguing for that outcome, but an appropriate level of regulation and also an appreciation as to how these projects may proceed. And one last point and then I'll be quiet. This is what I call the CO<sub>2</sub>-EOR surprise of 2012.

I would also predict that many of you out here are going to be signing term sheets during the breaks over the next two or three days, I bet probably 80 or 90 percent of those will involve CO<sub>2</sub> going to enhanced oil recovery.

And what you may not appreciate is that the way the carbon capture and storage rules are being developed now, I don't believe that CO2 EOR is going to be deemed sequestration.

Which means that you're going to get that off-take agreement put into place with that industrial source that's going to have its emissions capped in 2012 and then it's going to be looking for that off take agreement to be its compliance scheme under the cap-and-trade program.

But by that time, the laws will be such that CO2 EOR will either be disfavored or maybe totally discounted as a means of compliance under cap and trade, which means that industrial source, to go to the economics, is going to have to go back into the market.

It's going to have to buy allowances and on and on and on. So we would hope that a new administration would also sort of understand the potential role of EOR here and that you need to treat the oil piece the same as the deep saline piece.

You don't want preferences for one or biases against the other, but to exclude EOR out of the gate may leave a lot of potential early projects stranded if you will.

**Chiara Trabucchi:** Can I just add something? You know, one thing that I was intrigued to see in the bill that was passed last week and I don't know how many of you are aware of this, but there was a \$20 per metric ton tax credit for qualified CO2 storage in what's termed secure geologic storage zones.

I think what was interesting about that is I see that as a positive in some respects, although I would have preferred a different vehicle, a positive step forward in addressing the financing issues and the cost issues associated with CCS projects.

And I think the second piece I would just offer to any congressional or presidential candidate is fossil fuels and coal are a significant part of our energy infrastructure. It's not going to go away.

A recent statistics said there's close to 200 years left of legitimate coal that could be used for energy purposes. And there's China and India, and we can't forget the fact that they are very much advanced in the use of coal as part of their economic infrastructure.

So, for us to remain economically competitive in an international environment we need to figure out solutions for the coal question. I think one of the fundamental questions is how do you measure a balance, a tax credit of \$20 per metric ton, against the cries for release from long-term liability, whether it's a RCRA CRCLA indemnification or broad-scale indemnification cross all environmental statutes.

**Monica Trauzzi:** Did you want to weigh in on the politics? Who should be bearing the financial responsibility for paying claimants when damages occur over the long term?

**Chiara Trabucchi:** I'm sure we probably don't all agree on this one. I'll go first and then I'm sure Kipp has, perhaps, an alternate viewpoint. I strongly believe that any project developers should remain financially responsible during the operational period.

I think there are well tested, first party assurances in the form of insurance, sureties. Letters of credit, appreciating the recent credit crunch, availability may be constrained. But those assurances are designed for the very purpose of mitigating financial risks.

And I think these risks, to the point Kipp has made and to some degree Kevin, the infrastructure has been

used in the past. It's tested, which suggests to me that during that operation all period you can quantify the costs, you can assess the risks, and you can use these first party assurances.

So, in my opinion, squarely with the owner/operator while they're generating their cash flows. At the point where the project ends, whether it's been general acceptance that with the risk profile injection ceases, the risk is at its maximum point.

I think at that point is where things get a little tricky. And, in my opinion, with a fellow colleague, we put forth a proposed structure, a public policy structure, where we can envision an oversight board. We can envision release of the project to that oversight board.

And, as part of that release, a calculation of the expected value of future expected long-term expenses and compensatory damages and financing a fund. However, I think it's absolutely critical that any financing of any long-term fund must map to the risk profile and the expected value of consequences.

Otherwise, the opportunity cost of loss of economic resources is too high. To just put in a dollar per ton fee arbitrarily, does nothing. It needs to map to the risks and on a case-by-case basis. And you need enabling legislation and that's to your prior question.

There is no environmental statute that provides the authority to any federal agency to manage the breadth of financial consequences we're talking here. EPA simply doesn't have that authority under any of its existing statutes, nor does DOE. So in enabling legislation is absolutely essential.

**Kevin Book:** I'd like to hear the counterpoint and then I can respond.

**Kipp Coddington:** I'm actually not certain, speaking personally, that I really disagree with that. I think my mom always taught me if you make a mess you should clean it up.

So I don't think folks or even in industry, folks are looking for exemptions or preferential treatment or some buy or pass that we want to be excluded from all environmental laws.

That said, I do think you need to take a very close look at precisely the nature of carbon capture and storage in that this is being done in pursuit of broad societal goals. And these are goals that are even beyond the borders of the U.S. These are for purposes of the international good.

So it seems somewhat punitive and maybe not economically rational to expect private-sector actors to take that on. That really isn't what private-sector actors are equipped to do, number one.

And, number two, if you do look at the risk profile it very much is true, the initial risk is at its highest when the injection has initially ceased. But still, there is going to be some requirement to ensure that that CO<sub>2</sub> stays down there forever.

And companies don't last forever. Governments don't last forever. So there needs to be some means by which that tale is addressed.

And if you look at how this has been debated in a policy sphere, even in Europe for example under the draft storage directive that is wending its way through the EC, they provide, after a period of time, that the storage site becomes the responsibility of the state.

If you look at Illinois and Texas in FutureGen, the state took responsibility for the project. If you look at the

IOGCC model rules, they also envisioned a role for the state.

So I don't think we're looking for a pass on the environmental requirements and we certainly would agree that you have to measure the precise risk and make sure you have some mechanism to accurately address that risk.

But asking the private sector to shoulder all of that, I fear, may end up just as another impediment to projects that will be difficult to surmount.

**Kevin Book:** Well, so from what I understand, we're going to have to operate the concession profitably for the first 75 years. Is that about how long we'd -- 50?

Fifty, 25 to 50 years, and all along pay into a fund, something that could potentially fund either cleaning up the mess afterwards or some sort of financial penalty, I guess, if you think in terms of carbon price.

It, in theory, sounds great. You know, in theory it sounds like just another operating cost and if the margins work, they work. In practice, there's two potential adverse consequences.

The first is that the price is too high and you come up with a number that just deters that marginal profitability that makes the project work. And the second is that it's too far away and investors -- the U.S. Congress thinks in 10-year windows.

That's how they budget things. So if you extend a credit outside that 10-year window, they don't count it. It's free money. Investors sometimes think in five year windows.

I think increasingly that will be changing as they start to look at longer-lived investments, particularly infrastructure investments in this brave new world of credit costs.

But the long and the short of it is that 25 years out may not seem potentially that meaningful to somebody who has to think about the long-term cost, unless it is represented as an ongoing operating cost high enough for people to see.

And so you go back to scenario one, which is that it's really expensive to potentially deter projects. But, it really depends on what that number is. It sounds like an eminently fair way to do it.

**Chiara Trabucchi:** I actually think Kevin brings up an excellent point, which is what's the materiality of the financial consequences? How much are we really talking about?

You know, there's clearly long-term care expenses after the project's released, well, what are the potential compensatory damages? Who are the potential claimants? Released from what, tort, negligence, leakage?

I think one of the issue areas that we haven't necessarily explicitly touched upon is under a potential carbon regime with a price on carbon, leaks out of the storage zone could result in an economic benefit to certain actors to the detriment of other actors.

And how competitive is that? And how do you address that? And so I think it's a bit of a thorny issue to resolve. I think one of the issues that I would advocate, if in fact a trust or a fund were used, is there should be a floor and there should be a ceiling.

And once that fund hits that ceiling, you know, contributions to the fund cease until it gets below the floor.

This is well done in practice.

The Oil Spill Liability Trust Fund has been operating this way for years and, so far, barring any unforeseen events, has been well-managed and well-funded. So I think there are lessons to be learned from past models.

I don't think we need to reinvent the wheel here, but we need to be careful in how you structure it. To your point, you don't want to scare away the investors by saying, oh, here's this enormous tax that you carry for 25 years.

I agree with you, but I think there needs to be something, again, to get back to that public perception issue.

**Monica Trauzzi:** I'm going to throw out my last question. I think we're going to open it to the audience after that. So if you do have questions and you want to start lining up by the microphones, please do so.

I'm just sort of wondering if there's a specific industry that you can look towards as an example for how to address the risk management issues associated with CCS? Is there any example out there?

**Chiara Trabucchi:** That have worked?

**Monica Trauzzi:** That have worked or those that haven't?

**Chiara Trabucchi:** That's a tough one. There are elements. As I said, the Oil Spill Liability Trust Fund is a good model. There are certainly components of Price-Anderson under the nuclear model that are well worthy of consideration.

But that said, I'm not advocating a Price-Anderson model for this. I think, and this is provocative, but I would offer that there are aspects of the CRCLA model that you could learn lessons from.

And I think it's the combination of those lessons for new and emerging technologies such as this, I think this is one of those few instances where you really do have stakeholders on the left who are true enviros and on the right who may not be as environmentally aware who want CCS to work.

And so I think there's a way to bridge that dialogue and I think that's what we're really talking about. I think that's one of the interesting and, frankly I think, challenging aspects of all of this, is developing a framework that bridges those two very disparate stakeholder groups. And I think it can be done. I just don't think it's easy.

**Kipp Coddington:** I would just posit that if Yucca Mountain is a model for how long it will take to appropriately regulate deep saline injection, we'll be waiting a long time and I'm not sure that's the right way to go.

**Monica Trauzzi:** So, no to Yucca?

**Kipp Coddington:** I just think it's an interesting observation. That's the model where CO2 is viewed as an extraordinarily hazardous material that you have to contain for a long time.

And a cynic could say we're sort of creeping down that path already and I'm not sure, given the percentage of CO2 that in this room right now, that that's necessarily the right path. But it is a model.

**Kevin Book:** I would say that if you think about what we've just discussed and what we're not talking about, which is that there's a climate law being written sometime in the next few years that will auction off credits.

Embedded in that credit price is a source of capital for managing long-term liability, as well as a number of other things.

And the only risk, I think, and it's an important one, is to look at what happens when \$300 billion over 10 years walks into Capitol Hill intended for green power and ends up going to other things.

Because that leaking underground storage tank fund was capped, until last week, at \$2.7 billion and they removed the cap because that small, but meaningful tax on each barrel of oil is now going to go to fund something else.

So there are definitely ways to do this that's I think you can look to previous models for, but you're going to have to think about if you had done the sulfur program for example, where you were going to be paying for the long-term care of something.

At the same time, how would you have structured the option of credits? Would you have made them more expensive? Would you have made the phase 1 program shorter and given away less in the way of free credits?

There's a program architecture that you might be able to get it to pay for itself under the auspices of the government and have everybody sort of spread the risk and cost.

**Monica Trauzzi:** I think we're ready to take audience questions if there's anyone who wants to ask questions of the panelists or not.

**Question:** Hi, I work for a company called Mubadna in Abu Dhabi, so I come with a slightly more international perspective. The discussion we've been having seems to be quite U.S. centric, these funds and liabilities. But how does it work across the world?

I mean CO<sub>2</sub> stored here or generated in the U.S. affects Asia, Asia affects the U.S. So how would these liabilities or these things we've been talking about at the moment, how would you roll these out across borders, across the planet?

**Kipp Coddington:** I can take a crack at that. Under a international climate regime for example, if you have the Kyoto Protocol in effect all over the world, at least the climate aspects of those liabilities would be addressed under that international treaty.

There are international agreements with respect to underground storage such as the London protocol for example which sets forth rules and regulations regarding certain seabed activities with respect to CO<sub>2</sub> injection.

So, in the absence of an international agreement or treaties, it would turn on domestic law. And if the whole federal cap-and-trade scheme went away, then it would really just be a matter of national legislation in any particular country regarding the environmental aspects associated with that activity.

**Kevin Book:** I might add to that as well. The protocols that are out there now, the Montreal protocol, Article 20 of GAT, B and G, sub-paragraphs B and G talk about how you can essentially use trade in a lot of ways to penalize noncompliance.



I think we're moving in the international discussions towards a world where trade is the balancing mechanism, because the global, one-size-fits-all wrapper around everything industrial, even with a global one-size-fits-all cop to enforce it, and the Kyoto cop doesn't exist.

But trade gives you a balancing mechanism. Trade gives a country who has a vested stake in compliance, done tastefully and moderately mind you, not in a way that shuts down global trade as we know it, gives it an opportunity to go after a noncompliant or a liability related issue in another country, whether it's through surcharges, tariffs, however it works.

**Monica Trauzzi:** Next question?

**Question:** Yeah, my name is John Doyle. I'm with DKRE Advanced Fuels and I was just going to question, a quick question on Kipp's comment that, first, why do you think EOR is not being considered for a viable means of CCS given the fact that it seems like the nearest term option?

It seems like the most economic option given there's a revenue offset. And I think the second part of that is for the panel, what is the oil and gas industry doing to address all these issues?

They've been putting CO2 in enhanced oil recovery for 40 years, taking revenue from that and selling the oil. They must be dealing with this liability somehow and there must be insurance available.

There must be a way to address it. I'm just curious whether there isn't already a vehicle for managing this risk, whether it's deep saline or it's enhanced oil recovery.

**Kipp Coddington:** On the first question I entirely agree with you. I think many people understand that the reason why oil and gas is found where it is is because it's a natural trap. So that might be where you would want to start.

So, factually, I think people have great comfort regarding the nature of this sequestration activity that's going on in an oil and gas reservoir. The issue, just to cite an example, again, I'm not passing judgment on the proposed rules.

But if you look at EPA's proposed rules that they came out with this summer, what it says is that they only apply to deep saline activities. They aren't applying to EOR.

They also say, effectively, I'm not quoting EPA and there very well maybe someone from the agency here in the audience. It would be wonderful to get their observations.

These are just my observations. The agency basically says you can't be doing sequestration, quote unquote, and EOR operations at the same time, number two.

And then, thirdly, if you get to the end of EOR operations and you're depleted, and you might ask an oil and gas person if a reservoir is ever depleted, then, in terms of converting over, only a small part of those rules give you grandfather protection.

And that's the well construction requirements. So I think it's going to be very difficult for an EOR operation, certainly during operations to say they're complying with the EPA's injection regime and I think that's a problem.

And then at the end, I think it's going to be very difficult for that operation to convert into something else. And you may even be disqualified from the very beginning.

So, for example, under EPA's rules it says, "A storage site has to be beneath the lowermost drinking water aquifer." And many oilfields are actually above the lowermost drinking water aquifer.

So, from day one, you would be disqualified. And then you would sort of have to be arguing then, well, we're still doing sequestration even though we're not complying with what EPA has said you need to do to be engaged in sequestration.

And you're going to have to be making that argument in 2012 for 2013 or 2014 after you've spent \$10 billion. And I think that's going to be a difficult argument to make. But I think the time to address this is now.

I think this issue should be framed out. People should be going forward and saying this is how we view EOR for the next five years.

Everyone recognizes it should be deemed sequestration. Let's sort of do that piece of it now. But in the absence of that push and regulatory clarity now, I think it could be an issue.

**Chiara Trabucchi:** I'd like to follow up a little bit on that second question. I have two thoughts. One is the notion of storage versus extraction. Currently, under EOR, and EGR you're using CO<sub>2</sub> to extract a natural resource.

There is no presumption that that CO<sub>2</sub> is going to remain stored there for the long-term. With CCS you're talking about long-term storage, potentially in perpetuity.

The idea being that there's an economic benefit under a carbon regime as well as climate mitigation benefits. So, that's one area that I think your regulators think of this in two very different ways.

I'm not placing a value judgment whether that's accurate or not, but I think many regulators think that way. The second point I would like to make is that currently EOR and EGR are regulated environmentally under the Safe Drinking Water Act.

The statutory authority of the Safe Drinking Water Act is non-endangerment of underground sources of drinking water. And so the liability framework, the financial responsibility framework is very narrowly defined.

And, again, this gets to my point of interplay, that when you introduce CCS you're talking about many other statutes in play, just a difference in EOR. And then lastly, I promise, is the notion of scale and volume.

I think in order to really achieve the benefits we're talking about for climate change, you're talking inordinately larger scales of CO<sub>2</sub> sequestration than you would have with EOR.

So what I could envision is a likely joint venture, where you have the utility that has the need to sequester large volumes and an oil and gas producer or an EOR firm who has the infrastructure and the technological experience. The union of those two might be a nice corporate marriage.

**Kipp Coddington:** I would add, I was on a panel with a gentleman from a large oil and gas company who is doing an EOR project. He was asked that very question, DKRW. It's a great question. And his answer was

that they self-insure.

They comply with existing statutes and they spend what they have to spend to make sure they're compliant. If those statutes changed that might involve recalculating their risk and reconsidering whether or not they would want to bear that risk and self-insure themselves.

**Chiara Trabucchi:** Well, and that's the first party assurances I'm talking about, that operational period. Your BPs, your Shells, your Exxons, they're all self-insuring through a financial test or corporate guarantee and I wouldn't propose changing that.

**Monica Trauzzi:** I think we have time for one more question.

**Question:** Scott Mast with Energy Policy TV. Well, sort of a two-part question. One is how would the Boucher-Upton CCS bill that's currently coming together, particularly because it is a very bipartisan bill, how would it address some of the concerns that you guys have raised?

And then what are some specific sort of concrete constructive steps that can be taken so that CCS sort of avoids the whole Yucca Mountain problem that we were talking about?

**Kevin Book:** Scott, I'll get to your second question first. In terms of what steps you can take to avoid the Yucca Mountain problem, coal, in particular, has become a four letter word.

I mean it is of course a four letter word, but I don't know that there's been a serious reality check on what we're doing here.

In the United States, 1 to 2 percent power demand growth, 50 percent of it fired by coal right now, 1100 coal-fired power plants in operation that will all need to be retrofitted or replaced.

I think an honest discourse about the importance of sequestration, in the context of what we're doing now and just keeping doing it, to say nothing of doing something cleaner or better, would probably help to bring people around to think about this as a priority, not an afterthought.

**Chiara Trabucchi:** I would offer that, I think, the legislation that has been drafted recently, and by recently I mean the last 12 to 18 months, has progressively fleshed out this issue of long-term liability, financial responsibility, and the potential for a carbon structure.

I think the public perception issue can't be lost and I think it will need to be something that's bipartisan. It will need to be something that addresses and shares the burden across all of the stakeholder groups.

And I think, again, getting back to my original point, where this is one of those interesting intersections where you have hard-core enviros and hard-core non-enviros very much working in concert for the same ultimate goal.

And so my last read of the Boucher legislation suggests that we're getting closer to that common agreement. Are we there yet? I don't think so.

But I think that we're definitely closer and I do think that whatever legislation is contemplated will have to address the fact that we're talking sequestration in perpetuity.

And companies have natural physical lives, so what do you do at the end of the natural physical life? Who's

responsible? Who's going to pay? And I think what are the materiality of those consequences?

And that's a question nobody has really answered. How much are we really talking about? Is it really material? And I'm not sure that it is.

**Monica Trauzzi:** OK, I think with that we will wrap up the panel. Thank you panelists for that excellent discussion.

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