UNCONVENTIONAL OIL: ILLUMINATING THE GLOBAL PARADIGM SHIFT TO NEW PETROLEUM FUELS

WEDNESDAY, FEBRUARY 8, 2012
WASHINGTON, D.C.

WELCOME/MODERATOR:
David Burwell
Director
Energy and Climate Program at the Carnegie Endowment

SPEAKERS:
Brenda Pierce
Program Coordinator
Energy Resources Program-U.S. Geological Survey

Jim Burkhard
Managing Director
IHS CERA’s Global Oil Group

Juliet Eilperin
Reporter at the Washington Post

Deborah Gordon
Nonresident Senior Associate
Energy and Climate Program at the Carnegie Endowment

Transcript by Federal News Service
Washington, D.C.
DAVID BURWELL: OK, I think – why don’t we get going? It’s 9:29 and in honor of all you folks who came actually exactly on time, let’s get started. I know Juliet Eilperin is in the building. She will be here – she’s probably on the telephone. Thanks for coming and – to what I – is bound to be an interesting and illuminating discussion on unconventional oils. I’m David Burwell with the Energy and Climate Program here at Carnegie.

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And the goal of the day is not to discuss policy or pipelines or – so much as it is to simply address some of the basic issues relating to the facts around unconventional oils. What are they? Where are they located? How are – how have the penetrated the market? What are they? What’s the taxonomy of them?

Given the fact that these – what they’re also called is new oils, primarily because – not that they’re new, they’re actually very old, but they’re new in terms of the fact that they’re coming onto the market very fast. Technology and the price of oil has – you know, the price of oil has gone up enough and the technology has developed so that these new oils are now commercially marketable and are already, in fact, in the market.

So we want to find out more about them. For folks who have attended our event with the IEA on their 2011 World Energy Outlook, there was a whole section devoted to these types of oils. And they pointed out – I think, one of the most interesting graphics was the fact that over the next 20 years, you know, we’re going to lose about 47 percent of the production capacity of our existing producing oil wells. And most of the replacement oil for those – that lost production is going to come from these new oils or variations of them.

So it makes sense to know as much as we can about them, where they’re located and what their content is. And the fact that the Keystone issue has raised the profile of these oils is, I think, regardless of the merits on one side or the other, has had the benefit of bringing it to their attention and the need for more illumination on the subject.

So that’s the goal today. This is the first of several events we’re going to have. Carnegie is launching a long-term analysis and discussion on these oils as part of our Energy and Climate Program. So we’re very pleased to have this group here to be our kick-off panel.

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We will – the format is about 10 minutes of discussion from each of our panelists and then Juliet Eilperin, the national environmental reporter for Washington Post, will lead a lively discussion, I’m sure, between the panelists and you folks about some of the questions raised about these oils.

So first we’re going to have Brenda Pierce. Brenda Pierce is an energy resources program coordinator at the U.S. Geological Survey. More topically, Brenda has led a global assessment of unconventional oils and their taxonomy, typology, extent. And that’s brand new, so we’re looking forward to that presentation – explanation of what they are.
After that Jim Burkhard from HIS-CERA will give a discussion about the markets for these oils, to what extent are they being used, and how the future markets are going to be addressed—engaged in the exploitation of these new oils—or whatever you want to talk about. (Chuckles.)

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Then Deborah Gordon—Deborah Gordon is a senior associate with Carnegie Energy and Climate Program. And she is a chemical engineer by training, so she’s going to talk about the makeup of these oils, the chemistry of these oils and kind of an analysis—what are the carbon footprints of these various types of oils. Debbie has quite a career. She’s worked every—from every—from one hand from Chevron to the Union of Concerned Scientists and ClimateWorks. So she’s gotten all sides of the political spectrum.

And so I look forward to this. It’s a great panel. And then Juliet will take over and ask probing and illuminating questions, I’m sure. So that’s—let’s get started. And Brenda—

BRENDA PIERCE: Well, thank you. Thank you for having us. And I’m sorry to jump right into geology, but to understand the differences between these conventional and unconventional oils we need to do that.

Is there a pointer?

MR. BURWELL: Can we find—Hannah, can you try to find a pointer? We should have that.

MS. PIERCE: So—I should have asked earlier.

So the U.S. Geological Survey conducts research and assessments on unconventional and conventional oils. And when we talk about unconventional oils or gas, we are talking about shale gas, tight gas, tight oil, coal bed methane. So we’re not talking about gas hydrates, though we study that, or oil shale. So this conversation today is going to be—at least mine—confined to those—and obviously oil, for right now.

Oh, thanks so much.

So if you’ll bear with me just a moment—and apologies to those people who already know this—oil and gas forms in the subsurface. And you have to have several things—you must have several things or it simply won’t form. You need to have organic material in enough abundance and rich enough in the subsurface or you won’t form oil and gas. That oil and gas has to be heated—what’s called a source rock. It has to be heated to within a certain temperature range or it won’t form oil and/or gas. To little it won’t form oil and gas, too much it’s cracked beyond the oil and gas. So you have to have that temperature as well.

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Then you have to have, because oil and gas is buoyant, it wants to move up to the surface—we all know there’s oil seeps both in the Gulf of Mexico, in Alaska at the—
surface. It’s buoyant. It wants to move up to the surface. So you have to have migration pathways through the rock surface. And then you have to have traps that have impermeable layers on top of the trap and areas where the oil and gas can form into these pore spaces. This is conventional oil and gas.

So by definition, conventional oil and gas has already moved up through the system and been placed in these traps. So it’s already somewhat fluid. It has moved. The major difference between conventional and unconventional is that these unconventionals have stayed in the source rock. They have not moved from here.

They are – they are so tight a formation, and the pore space is so small and it’s entrapped in such small pore spaces, and there’s no interconnectivity that it has not been able to move from the source rock up into these other traps. So the conventional resources are not necessarily easy to produce, but they’re easier to produce that unconventionals, because they have been trapped in the source rock and just haven’t been able to move.

And I want to take you through and show you some photomicrographs – some photographs under the microscope to illustrate some of these changes. So this is the pore space in a rock of a conventional resource. You can see the blue is the pore space. It’s interconnected.

And so when you drill into that oil reservoir or gas reservoir these are interconnected, and so the oil or gas will flow to the well bore and be produced to the surface – this is a hand sample – whereas if you look at a continuous reservoir, so I’m – we call it a continuous instead of unconventional, because what is unconventional, is it gas hydrates, is it oil shale – continuous across the landscape – continuous on a much broader scale. So sometimes you’ll hear people talk about that.

These unconventional or continuous reservoirs are much finer grained. This is a different scale but about the same. You see these pore spaces are much, much smaller. And they’re not interconnected. These are the hand samples; these are the microscopic graphics. Then look at two compared. These are basically the same scale – a little bit different – so .5 millimeters, .2 millimeters.

This is an unconventional or continuous and this is the conventional. The blue is the pore space, interconnected. There – you see teeny, tiny pore space. And they’re not interconnected. It is that pore space that the oil and gas is in. And that has to be connected. That’s why we have to hydrofrack. That’s why you have to introduce technology – or more technology into the unconventionals than the conventions to produce it.

So basically that’s – there are other differences, but that’s primarily the difference. So the source rock has stayed in place and has not migrated. And so this is just yet another one of even – this is an order of magnitude smaller scale. There’s oil and gas in these microscopic pores that must be connected to a well bore in order to produce it. And so
that’s why you hear so much about hydrofracking, and that’s why the revolution in unconventional oil and gas. And that’s what made a lot of these things technologically producible that were not technologically producible in the past. These are both gas but they’re similar for oil.

This is a Marcellus development plan, and then another one. And you’ll see that there’s less footprint because you can drill down and drill horizontally and then vertically. But there is significant footprint under the ground. And there’s significant technology that goes into these to interconnect that pore space to produce the oil and gas.

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So these continuous or unconventional oil and gas really have been enabled by the technology development of directional drilling and hydraulic fracturing. It is what made these economically available now, and so much so that more than 50 percent of the domestic gas production is from this. So it’s a huge sea change in a relatively short period of time. And just one field – one oil field, the Bakken formation, is about 7 percent of the U.S. onshore oil production. That’s huge, in a very short period of time.

There are concerns over environmental impacts. And I don’t think that’s the point of today, but you’ve heard about them, so we should mentioned them. There’s water supply and availability. It is consumptive use. It will use oil – or use water in the process. There’s potential aquifer contamination. There’s landscape and ecological impacts because it takes more drilling than conventional. And there is potential for induced seismicity from waste disposal fluid, but that’s true for conventional as well.

Let me back up a minute. The next graphic will show you the huge change in the Bakken. So the Bakken is an oil field in North Dakota and Montana. It shows you production over years and just this huge sea change in how much production has happened relatively recently. So if you watch this video, the year is up in the upper right-hand, production is down here. But these are the wells that have been drilled. And you just see the astronomical growth, just even in the 2000s.

MR. BURWELL: Is it going to keep on going up like that? You think so?

MS. PIERCE: So says industry. So, I mean, it’s just a phenomenal – and part of this is the price of oil. I mean, this is oil and not gas. But it’s just an amazing phenomenon, frankly.

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And so for that very reason, resource assessments change over time. Now, what the USGS does is conduct research and assessment on undiscovered but technically recoverable resources. Now, these are resources, not reserves. Reserves are the economic portion of the resource endowment. It’s the production that you saw in the previous slide. Reserves are what’s traded on the stock market. It’s the economic portion. Resources is a bigger endowment, but what we look at is the technically recoverable – of what’s technically recoverable with today’s technology and industry practice.
So turning again to the Bakken, we assessed the Bakken in 1995 and determined that there was about 150 million barrels of technically recoverable oil at that time. And I don’t think we were wrong, because as of a few years ago there was only 100 million barrels produced from the Bakken. But you saw that huge growth recently. And so we reassessed in 2008. And our assessment determined that there was 3.65 billion barrels of technically recoverable.

So what changed was what is technically recoverable in that time – huge sea change in technology. So the horizontal drilling, the fracking that had been applied to the gas was now applied to the oil in the Bakken and made significantly more resource technically recoverable.

You’ll see these numbers here. I don’t want to dwell on this, but what is we do is when we produce a resource assessment, we give a probabilistic distribution. So we give a 5 percent chance, a 95 percent chance and a mean. That’s because there is uncertainty. These are undiscovered. And so there is at least a 3 billion barrel oil chance there and as much as 4.3. And we’ve actually been asked to reassess the Bakken, so there may actually be more now as well, since technology does keep changing. So just a phenomenal thing that technology can do.

This is a bubble map of the USGS resource assessments that we’ve looked at of these mean unconventional or continuous oil resources. And that’s the Bakken up there, it’s just huge. So size of the bubble equates to size of the resource. And we do have a lot. We have not assessed everything. We’re just going to come out soon, in the next couple months, with some unconventional look at North Slope resources. And we are reassessing some of the others. And so this will change. But we have a lot of unconventional oil in the United States.

The Bureau of Ocean Energy Management assesses offshore. And they have not assessed unconventional yet because offshore, it’s really not a realistic goal yet. We’re still producing conventional offshore.

So what extent is this North American experience applicable elsewhere? I think that’s the great unknown. I think that a lot of people don’t know. No two shales are alike – that’s true for gas, that’s true for oil. They all respond differently to production technologies because the geology is different. So we are continuing to assess the resources. So as was mentioned earlier, we have embarked on a global unconventional resource assessment. We’ve just started. We have a few basins around the world done. It’s just going to take a while to do the world.

But we are looking at those numbers. Technically recoverable is significantly less than the in-place numbers – because you see numbers all over the place. So you have to really look at what those numbers are. Are they in-place numbers on every single molecule
in the ground? Are they technically recoverable? Or are they the reserve base – the economics. So you’ll have a spectrum. And each of those means something and each of them is important. But we have to keep in mind the terminology and what all those mean.

This is just to talk again – to reemphasize that each shale is different. This is Woodford Shale, it’s a gas, but you look at – these are acre spacings and you’ll see how different the density is for the drilling. So again, these are very different than conventional plays – very different. Some take incredibly dense spacing, some don’t. They’re just not as homogenously distributed as conventional resources – that’s a generality.

But – this is a production profile of the Barnett Shale. Again, a gas, but you’ll see – these are quarterly productions, but you’ll see they’re very irregular and some of them drop off very sharply. And so again, we’re still learning about these resources. They react differently than conventional resources. Each one is different. So we’re learning as we’re going.

So the USGS assessment is geologically based. And I won’t dwell on this. We do have a screening and a geological analysis of every basin that we do. It’s not a literature search, it’s not an economic analysis, but we build a geologic model for each and every basin. We evaluate well performance based upon analogy to similar geology in the United States. And we do a statistical simulation and we do an aggregation of the results to get those results. And we’re – we have one in Uruguay done. We have one in India. We have on in China coming out. So we are getting there in terms of unconventional resources around the world.

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And we have a catalogue of shale analogs that we can – as I said, we have real production in the United States that we can, by geologic analogy, make to geologic basins around the world, so we might know what is technically recoverable. So with that, I will leave it and turn it over to the next speaker. (Applause.)

MR. BURWELL: I feel like I’m back in college. (Laughter.) There will be a test at the end here, so I hope you’re taking notes – very interesting. And now, Jim Burkhard from IHS CERA will talk a bit about markets.

JAMES BURKHARD: Thank you, David.

And, Brenda, thanks for that presentation. The U.S. Geological Service (sic), for those who may not be avid consumers of what they do, that’s a really valuable service that they provide in helping shed light on the resources around the world and including in the U.S.

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I love it when conventional wisdom gets overturned. It often always does; it’s just a question of time. And when you look at conventional wisdom in terms of U.S. oil production over the last 40 years or so, the conventional wisdom was the peak in U.S. oil
production that we hit in 1970, that meant U.S. production was just going to go down, down, down and down. There was no – it wasn’t going to stop. The decline in U.S.
production was not going to stop. And the U.S. would have to import more and more oil
each year. And that is indeed what happened for most of the period from 1970 till about
2008.

But beginning in 2008, we saw the beginning of what we refer to as the great revival. Now, if you're from the South and I – you hear the world revival you may think, is this guy
going to talk about religion? I don’t intend to. If you want to ask about religion later in Q-
and-A, fine. But we’re – when we’re talking about the great revival, it’s the great revival in
U.S. oil production. From 2008 to 2011, so over the last three years, U.S. oil production
grew. To be more technically precise, U.S. liquids production, liquid fuels, increased by 1.3
million barrels per day. Now, how big is that? There are very few times in the history of the
oil business where we’ve seen a single country increase its oil production by that amount.

So over the last three years, U.S. production grew 1.3 million barrels per day. Over
that same time period, the number-two country for growth – the number-two country for
growth was Russia, which saw its production grow by about 500,000 barrels per day. So the
U.S. was the number-one country for oil supply growth, believe it or not. And it was by a
longshot. And it was a really, really large increase.

And some folks say: Well, that must be ethanol, right? We’re producing a lot of
ethanol. And that’s what it – that’s what it all is. No. A little bit of it is. The vast majority
of this increase that I’m talking about is crude oil and natural gas liquids – stuff that we
typically refer to as oil. And again, a little bit of that was ethanol.

And what’s driving this? What's behind this big increase in U.S. production? It’s
three factors – market signals, innovation and access. What this means is the rise in oil
prices that we’ve seen over the last decade – that’s certainly been a factor. As prices rise,
that’s an incentive to go out and try and find more and produce more. And innovation –
Brendan mentioned hydraulic fracturing and horizontal drilling. Those are two of the
technologies that have helped to unlock resources that previously may not have been
economic to extract.

And then access – up in North Dakota where the Bakken is – the Bakken play in
North Dakota – you can go up to Farmer Joe in North Dakota and say: Farmer Joe, you
know what? I want to drill on your land or have access to your land to try and find some oil
and gas. And you know what, Farmer Joe, you’re going to get a cut of what I get when I
produce oil there. The U.S. is truly unique in the world. I can’t think of any other country
in the world – I got to be careful about absolutes; there’s a lot of countries in the world –
192, 193. But the U.S. is really rare in the sense that mineral rights – so the stuff below
ground – those rights, if it’s private property, can belong to private citizens.

So you have this alignment of market signals, higher prices – certainly higher than
they were in the past, technology innovation, and access. And it may sound really simple,
but it’s a very powerful reminder of when you combine those forces what can happen in just about any market you’re talking about, including oil.

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And when we look at what’s happening in Canada with the oil sands, when you look at the growth in the U.S. and Canada over the last couple of years and look at what could happen realistically to 2020, the growth in oil production between the U.S. and Canada from 2008 to 2020 could be around 4 million barrels per day. That’s more than what Iran produces today. The growth in U.S. and Canadian production in that 12-year period has the potential, reasonable potential to exceed what Iran produces today. Iran is the fifth biggest oil producer in the world today. This is big stuff. And it’s already happening. And there are risks to this growth. It could fall short. I won’t get into that. We can certainly talk about the risks to that growth. But it’s not based on some fanciful assumption about more oil being discovered than what we currently know. This is stuff that we know exists.

This great revival in U.S. oil production is also been reflected in U.S. gas production. In fact, what we call the “shale gale,” the boom in unconventional gas production in the U.S., this great revival – it’s the oil – the equivalent of what’s happening on the gas side. And the growth in U.S. gas production over the last decade is probably one of the biggest stories in global energy, not just in the U.S., but in global energy. And it’s going to reshape – has the potential to reshape gas markets around the world, just like the great revival, which will spread elsewhere around the world – may not, perhaps not with the same intensity, but it will spread.

The U.S. is not the only place in the world with these tight oil resources. There are many other places that have this potential. But again, the pace of development may be a bit less than what it is in the U.S. because of that unique combination of resources and assets and private landownership that we have. So this will spread.

And you know, there’s a belief right now that oil prices can only go higher. If you look at a lot of price forecasts, oil prices go up, up, and up till the end of time. That’s never happened before in the history of the oil business, and it won’t happen again this time. There will be at time when we have significant downturn of prices. It may be due to weak demand. And this year, no doubt, there’s lots of economic – the global economy is in a fragile state. And we could experience another severe recession, which obviously would push global oil demand lower. But with this great revival and depending on the pace at which it spreads around the world, this will act as a moderating influence, perhaps a downward influence, on oil prices over time. By that, I mean looking out over the next decade. Probably not this year or next, but within the decade we see this acting as a source of downward influence.

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And when we look at the geopolitics of oil today, we all know about the Iranian situation and how in 2012 it really could come to a head. I was a reading one article about the U.S. declaring economic warfare on Iran. The date of the article is June 23, 1995. So the Iranian issue has been around a long time. But it could wreak – come to a head this year.
Lots of concerns on geopolitics on the economy. But what this great revival also means is creating jobs. Oil, gas and extraction is growing a heck of a lot faster than the overall economy. And it’s leading to a much higher continental oil supply.

One last point about unconventional oil is a lot of the stuff we’re talking about, like Brenda talked about the Bakken where there’s unconventional gas, when you take it out of the ground, it’s like any other oil. In fact, the oil produced in North Dakota in the Bakken is a light, sweet crude oil. It’s a high quality crude oil. The shale gas – when you get that out of the ground, it’s like any other gas. The oil sands in Canada is a bit different. But when we talk about unconventional oil and gas – and in unconventional, there’s a wide spectrum of potential definitions, if we talk about unconventional – but this tight oil boom in the U.S. is, you bring that out of the ground. It’s like any other type of oil and can be processed into gasoline and diesel, just like any other oil.

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So – well, just conclude by saying the great revival has been a big sea change in oil and energy markets. And if it continues – and it certainly has the potential – it could really reshape oil trade flows, geopolitics and boost employment and improve the trade deficit in the United States if it were to continue. Thank you. (Applause.)

MR. BURWELL: Thank you, Jim. As a lawyer, I hadn’t thought about subsurface rights issue and property rights to oil. And it is kind of interesting. It makes it very difficult for policy to intervene when, you know, the access issue is distributed and the power to (determine ?) it to every American citizen or landowner. So that’s another very interesting subject.

MS. : Keep talking, David.

MR. BURWELL: OK. (Laughter.) And in property law, I got a –

MS. : Oh, I see. It’s – no – it’s in the center. I was looking on the side.

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MR. BURWELL: Anybody have a factual question they’d like to answer – ask? Just –

Q: What is the total energy capacity (of unconventional?) oil versus the energy capacity of our coal reserves?

MR. BURWELL: The energy density?

Q: Yeah. If you take all of the energy in – (inaudible) – that we have about now, how does that compare to all the energy, you know, about in coal that we have in the United States?
MR. BURKHARD: It – they’re both very large. I don’t have the specifics, but both are very extensive. The U.S. – the U.S. is one of the top three countries in the world in terms of coal reserves. Coal reserves are massive.

MS.: A first.

MR. BURKHARD: And – but that said, also the unconventional oil and gas is also turning out to be very, very large as well.

One last point – sorry, I just – the – when we talk about energy security, 80 percent of the energy consumed in the United States is produced in the United States. When we talk about energy security, we’re talking about oil supply security, because most of the energy is indeed produced – that’s consumed here – is indeed produced here. A lot of that’s coal.

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DEBORAH GORDON: Thank you. I wanted to just draw your attention to the left of the screen is the first addition of what will – I think it illustrates this boom, this change of conditions that we are now experiencing in oil markets. That’s the first edition of the Petroleum Economist’s unconventional oil and gas map. And I predict that we will have many versions to come that will keep changing and with our knowledge.

And just to build off of what Jim was saying, we’ve been thinking a little bit about this project in an unconventional wisdom type of way, because a lot of what we’re going to learn about these new oils is going to be new information. And that was the idea behind kicking off today’s panel.

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I’m going to continue my conversation on the taxonomy of what these are. I guess I come to it with my background in chemical engineering, but also have a lot of interest in the climate impacts because of the policy implications. And I think that it’s going to be important for us to drill down and do this with our eyes wide open, to find out a long – a long time – you know, Brenda was talking about the continuum of resources. There’s a continuum of knowledge here as well of what we know and what we don’t yet know. We’re going to learn over time on this brave new world of oils, which are changing before our eyes.

So we talked a little bit about what unconventional oil is to try to get a taxonomy of this evolving field. And Brenda spoke a little bit more about (this is ?) synonymous with what can be produced and transported, the physical nature of getting to oil, which is very much the geological aspect of oil – that was a part of her definition of unconventional oil. But the transition to unconventional oils can – they can be viewed technologically and economically. Jim spoke to economics.

But the redefinition of these oils, from my point of view that I wanted to talk about, is really their chemical makeup, because it’s their chemical makeup as that changes that will change climate, because what we’ve been doing for years on conventional oil is going to be
potentially very different on what some of these oils – maybe not the tight oil, but a lot of the other oils around the world that are vastly different in terms of their chemical makeups.

So I wanted to just probe a little bit here. This is – sorry, if you didn’t like chemistry in college – (chuckles). But conventional oils that generally flow are quite – they’re relatively simple, although complex enough – believe me, having worked for years at Chevron – complex enough to deal with. But they’re hydrogen-rich hydrocarbons. Hydrogen as fuel – that’s what we want. If we can only be – live on hydrogen, we would be so much better off in terms of climate change because all we really need is hydrogen to move us around and do work. What goes along for the ride in hydrocarbons is carbon. Carbon is waste.

And so with conventional crude oil, you have relatively fewer carbon atoms bound to more hydrogen. So that’s what makes them a good – you know, a very good gamble in terms of packing a punch to drive our cars, drive our trucks, and to give them a high value. And historically, there’s been a continuum of crudes, but we most like – you’ll see in a later slide – the light sweet. Light means that they have more hydrogen; hydrogen is light. They have less carbon; carbon’s heavy. Sweet means they don’t have as much sulfur. Sulfur is poisonous and it comes with a lot of crudes. And it’s a – really bad. So these crudes have makeups that go into marketable products that we need today – gasoline, diesel, check fuels, chemicals – all of those things.

Oil sands we didn’t talk very much about. This is Canada tar sands, oil sands, heavy oil. And then it goes into a continuum again, because these crudes aren’t any one thing – Brenda alluded to that geologically but also chemically. There’s a continuum of what they are. So we go from oil sands and heavier oil, or I should say heavier to extra heavy oil, which is oil sands. The heavier they get, the more solid they get. You can see it in the picture.

But what’s really remarkably different about these is if you look at the formula, you end up with not 60 carbon atoms but 200. You know, maybe three times the amount of carbon goes along for the ride to get the hydrogen out. Sometimes they’re called bitumen. Sometimes they do or don’t need synthetic processing. They can be recovered by very different types of processes – we’re seeing this in Canada – either mined or actually liquefied in the ground because they’re so solid. But what I really want you to draw from this is the carbon, because that’s climate.

In terms of what we didn’t really talk about and we don’t know and won’t know globally how economic this will be is what we have in the Rocky Mountain states, in elsewhere around the world is oil shale – not to be confused with the next slide which is shale oil, which is very confusing. The oil shale is basically oil tied up in rock. So you’re talking about even more carbon for the amount of hydrogen that you’re going to have to mine or liberate in terms of getting the oil out. This is kerogen. It’s a totally – it’s – as Brenda was saying earlier, it’s really like immature oil. It hasn’t – it hasn’t withstood the test
of time to become liquid oil yet. It’s still in its rock phase. But if we need it, it’s there. And there’s a lot of it around the world.

And then what we’ve been talking about just now, which I think is the least of the transformations in terms of oil, is the tight oil. The tight oil is the shale oil that goes with the shale gas that we’ve been hearing a lot about. I still think that there’s going to be a lot of unknowns in terms of around the world. Brenda alluded to the fact that shale formations are different around the world, so we know that the petroleum or the oil contained in them are going to be different. But it does tend to look and act a little bit more like the crude oil we’ve already accessed. The big difference is accessing it. There’s a lot of carbon tied up in getting it out of the ground, because it’s not pooled; it’s in fissures. And so it takes a lot more energy to liberate it.

So again, I mentioned the difference between heavy and light. That’s a – that’s a big facet in the changing formation of oil. When oil is heavy, again, it has a lot of carbon. And this has – this has four main issues in terms of climate change. When you have a lot of carbon, then it means that you are using – and it’s heavy; you need a lot of energy to get it out of the ground. So that’s carbon. Carbon in to process the extraction, processing, refining, transporting. Then you have the fuel combustion itself, when you actually use these fuels in whatever motor vehicle. Then you have the other greenhouse gases that, like black carbon, that’s tied up with the – you know, because these are carbonaceous materials.

[00:36:40]

And then the – one big unknown of bringing some of the heaviest oils to market and making them for – making them useful products is the waste byproduct that goes along with it, because we know that bitumen, for example, is mostly carbon. And so what’s left over when you take it out is coke. You have petroleum coke. And now you have a product that’s really all carbon and you have to do something with it. So we’re seeing now examples of trying not to waste (not ?). You see that coke is being shipped to other countries to be burned.

So you’re taking this heavier oil out of the ground and the carbon is actually finding its way into the atmosphere. And when I was thinking about this, I realized, you know, these products that we’re going for – the immature oils, especially, and the bitumen – are really nature’s way of carbon capture and storage. So they’re in the ground right now bound up and the carbon can’t get out. And what we’re doing is, potentially, and why we need to know about this is that we’re really uncapping the capped carbon that’s in the ground. We’d love to turn it around and use geoengineering and put the carbon back in the ground, but we’re reverse engineering what nature has done. These oils were not ready to flow, but we are starting to take them out of the ground beforehand.

[00:37:55]

The graph to the right is interesting because it shows that there is this heterogeneity in the oil – in oil streams, in oil markets. So we’re going from a pretty well-known hundred-year product, conventional oil – a lot of technology, a lot of knowledge built up – to now dispersing what oil is. Oil is changing before our eyes. Its makeup is changing. It’s
becoming more sour, more heavy. It’s changing in so many ways. And those are the questions that I think we really need to understand in order to be able to manage the climate change impacts.

So as oil quality changes, so do the processes needed to refine them and, interestingly, the products they yield. So a lot of the products that are yield – are being yielded now – I circled gasoline as the example – of course that’s not going away. But the precursor to gasoline is changing before our eyes. Bitumen is much different than crude oil, so it has to still yield gasoline. What will be very confusing, I think, to the public and policymakers is gasoline for a very long time is probably not going to change to our eyes as consumers. But everything that came before will be different. And it’s going to be hard to ask the questions when we feel like, you know, it’s business as usual, when we know we need unconventional wisdom to deal with a lot of what’s changing in the oil patch.

[00:39:17]

In terms of greenhouse gas emissions, we hear a lot about lifecycle emissions. And there have been early attempts – very sophisticated minds are going into starting to try to unbundle what it really means in terms of tracing what the carbon lifecycle is, in terms of producing CO2 and climate gases for these oils. A lot of this work was done, interestingly, not to compare unconventional to conventional oil, because the unconventional oil boom, as we’ve heard, is very new. It really has come upon us very quickly and very recently. A lot of the work that California and others have done to really understand life-cycle emissions was really to compare oil vehicles to electric vehicles in order to understand how we consider which is a better climate bargain – to electrify, and depending on how we get our electricity, what that will mean for our transportation system, or whether to use oil.

A lot of this work was done, interestingly, not to compare unconventional oil to conventional oil, because the unconventional oil boom, as we’ve heard, is very new. It really has come upon us very quickly and very recently. A lot of the work California and others have done to really understand life-cycle emissions was really to compare oil vehicles to electric vehicles in order to understand how we consider which is a better climate bargain – to electrify, and depending on how we get our electricity, what that will mean for our transportation system, or whether to use oil.

So we’re going to have to refangle (ph) these tools somehow to understand how to evaluate conventional oil to unconventional oil, and to understand what the different types of conventional oil mean in terms of their carbon footprints. Because that, I posit, is something that we still really don’t know anything about.

And you’ll hear oil sands are 5-15 percent more carbon-intensive than conventional oil. But if you remember the chemical skeletons, the compositions I showed you, it just stands to reason that if you’re liberating a fuel that has 60 atoms of carbon and comparing it to one that has 250 atoms of carbon, you can’t say something has four times more carbon but it’s only 5 percent more carbon-intensive.

[41:05]

It’s something – the carbon is not going away. The carbon is not – you know, it’s being conserved in matter. So that’s one issue that I really wanted to leave you with. When you compare per barrel, or per unit of energy, the production of these fuels that are so different, they can be three, seven, or 22 times more carbon-intensive than conventional oil.
So managing climate impacts from conventional oil are going to be a very big deal, not just because the climate impacts of each of these fuels are different, but the volumes are so incredibly large, as we saw with what Brenda and what Jim was saying. I mean, we really have this changeup in industry. And when something changes and you multiply it by a big number, a small increase becomes a big deal. And that’s what’s going to matter so much about really understanding what unconventional oil means in terms of carbon footprints.

The paradigm shift to unconventional oil that we’re in right now – this whole entire transformation – really begs for a comprehensive assessment and understanding and continuous probing of what this is going to change in terms of greenhouse gas emissions. Certainly, there are other environmental and social factors, but the interesting thing about climate change and unconventional oil is climate is global and unconventional oil is global. These are going to be the confounding issues that are global.

So even, interestingly, when I saw this, I seized right on it, but even the National Petroleum Council will say that it’s critical to understand the greenhouse gas emissions and water effects of unconventional oil, because we don’t yet know enough about what these will really mean to us and our well-being.

And the last slide is just to say, underpinning a lot of what we’re starting to think about here is that these are new fuels. And the new fuels require new rules. We have 100 years of rules based on conventional oil – what it is, how it works, how it might hurt us, how it helps us, how it moves, how the economics settle out. Everything’s changing, and we’re going to need new rules to deal with them.

And if you look at the Exxon projection of how much of this it is going to replace, you can see the bottom orange is conventional oil. So really, all the growth looking ahead – all the growth – is unconventional of sorts. And each of those strata are a different thing, with different impacts – and different impacts on the climate.

So understanding and managing greenhouse gases for unconventional oil matters a lot. It matters for maintaining 2 degrees Celsius. It matters for climate – more than, probably, almost anything else that we’re going to do going ahead. I agree coal is a huge issue. We’re not really changing up coal right now. All the play is really in gas and oil, and oil’s going to have a huge impact on climate. So with that, thank you. (Applause.)

MR. BURWELL: Very interesting, and a bit depressing. And so I think we’ve got more than enough facts onto the table to have a robust discussion, and I’ll turn it over to Juliet.

JULIET EILPERIN: Great. So, you know, one of my full disclosures, in addition to the fact that chemistry was not necessarily my strong suit in high school, is that I joke – I cover the environment for the Washington Post – but I always joke with my colleague Steve
Mufson, who covers energy, that I have become an energy/business reporter by accident – because, of course, so many of these environmental issues are now tied up in things like what we’re talking about today.

And so I certainly – and one of, of course, the most interesting things that has drawn me into this world is really covering the Keystone XL pipeline extension and the debate over that, and how that really – that, combined with, say, debates about what kind of low-carbon fuel standards you might have in different states, or potentially, eventually, on the national level – you know, what implications does that have for this emerging industry.

So I wanted to clear up one factual question that was raised in Jim’s presentation. One thing I love when – so I spend much more time talking to Canadians than I have previously done, purely as a result of what’s happening in the oil sands. And what I love is, Canadians – and I say this – my husband did his postdoc in Canada – are very, you know, they are constantly talking about how different they are from the United States, except when they talk about oil, where apparently we’re one country, which is what Jim did as well.

So when you say that U.S. and Canada combined will, you know, basically, between 2008 and 2020, produce an additional 4 million barrels per day, I’m curious if you could give us the breakdown for both. I mean, is that purely between Bakken and the oil sands? Or are you also including natural gas? Can you give us the breakdown there? Because I think particularly when people are thinking about this, it’s very helpful to know, what – you know, how much do the oil sands potentially dwarf what’s happening in Bakken? Or, you know, how much is it shale gas that we’re talking about? Can you – could you clarify that a little bit?

MR. BURKHARD: Yeah, it’s – what I was talking about is oil. The U.S. is self-sufficient, and largely self-sufficient in gas, and could even become an exporter in the next decade. But in terms of the relative contributions of that growth, most of that growth – the biggest chunk of – the biggest single chunk of it will come from the United States. And of the growth in the United States, most of that comes from tight oil.

And again, tight oil is this – it comes out of the ground, it’s a high-quality crude oil. The Bakken has been mentioned. But this – it’s a national story, or at least, it extends well beyond the Bakken. The Eagle Ford in South Texas – the Utica in Ohio is an emerging play, along with several others around the country. So the U.S. is the biggest part of it and tight oil is the biggest part of the U.S. growth. In Canada, it’s about the oil sands.

MS. EILPERIN: OK. But so – but the majority of that, of that growth you’re talking about, is actually U.S. tight oil, not oil sands?

MR. BURKHARD: It’s the U.S. overall, and tight oil is the biggest share of that.
MS. EILPERIN: OK. OK, so I think one – and I'll channel, to some extent, my readers at this point, because I think there are a few things that come up. I think one question, given that, you know, obviously, it is more energy-intensive, as everyone’s alluded to, to get to this tight oil, is it would be helpful to get a sense of, at what price does this make sense?

Since obviously you – Jim, you alluded to price fluctuations – we’ve seen that – I think it would be helpful for folks to understand, when is it economical to exploit this oil? And maybe, you know, if a few of you could chime in on that, I’d love to get a sense of that.

MR. BURKHARD: There is a – when you talk about tight oil, it’s quite a bit different from the oil sands in Canada. And there is a pretty wide range of costs. There are some so-called sweet spots where it’s relatively easy to extract, and then there’s more difficult spots. And that’s – if you go anywhere in the world, that’s always the case.

If you look at what is the oil price required today to justify investment and get, say, a 15 percent rate of return – again, there’s a wide range here, but to give you a sense, you’re looking at 40 (dollars), 50 (dollars), $60 a barrel for tight oil. And one of the pressures on the oil industry globally, regardless of what it is you’re producing or where it is produced, is the cost pressure, because there is a – there’s a missing generation in the oil industry when oil prices were low, companies were shrinking, and those cost pressures, those human resource pressures, the equipment pressures, have been pushing up costs quite a bit over the last decade. But the short answer is 40 (dollars), 50 (dollars), $60, generally speaking, for tight oil in the United States.

MS. EILPERIN: And could you give what would be the comparable for oil sands?

MR. BURKHARD: The oil sands – there’s a lot of different types – there’s two main types of ways to produce oil, one – in the oil sands – excuse me, two ways to sell it. One is where you take the bitumen out of the ground, which is the very, very heavy, extra heavy crude oil, and you can essentially begin to refine that into what’s called a light synthetic crude oil. That’s one version. That’s one way.

The other way is to extract it out of the ground, the bitumen, add some very light hydrocarbons, light liquid hydrocarbons – like a condensate, which is often associated with gas production – to lighten it up so it can go be transported by pipeline. That way this kind of bitumen – we call it bitumen blend – is you’re looking at, you know, around $60 to $70 a barrel. That’s the price you need. If you instead do the synthetic crude oil path, you’re looking at prices that are 90 (dollars), 100 (dollars), 110 (dollars), $120. There’s not a whole lot of that activity going on right now, but it’s more the bitumen blend type of process that is being invested in.

MR. BURWELL: A corollary question – Debbie, you first.
MS. GORDON: Well I was just going to say – (off mic, inaudible) – I was just going to say, there’s the price to produce and then – this was the question of if we have regulation and new rules. Because if you produce first and the rules follow, it becomes really contentious to do the right thing and to produce these oils in a protective way – because they’re not in the calculus. There’s no economics of what the regulations might be or what a carbon tax might figure in.

So that’s one of the arguments for trying to get the rules to be – at least be understood and developed along with the fuels, because then it’s into the bottom line. What’s economic depends on what governs the – it’s not – right now it’s really mostly technology, but in the long run, that’s not really going to protect us.

MR. BURWELL: A related question was, if you talk to a lot of the oil companies, they say that they know that there’s a climate problem and they’ve already factored in, in their feasibility studies, a price of about $40 per barrel – $40 per ton – for carbon. And if it doesn’t pan out with a 50 percent profit or more, assuming a $40 per ton carbon price, they don’t go. So I was just wondering, is that 60, or $40-60 per barrel just simply the actual cost, or does it include a(n) implied carbon price?

MR. BURKHARD: Those are the costs today.

MR. BURWELL: So it’s the lifting cost?

MR. BURKHARD: It’s the finding, development and operating cost.

MR. BURWELL: Yeah, with no – with no –

MS. GORDON: And it’s worth noting that, so, Shell has disclosed that they put a $40 per ton price on their carbon. I don’t know whether all oil companies are –

MR. BURWELL: Not all, not all. But more than one.

MS. GORDON: Right, exactly. OK, more than one, exactly.

[51:42]

MS. PIERCE: I just wanted to point out that it’s an excellent question, but it only covers so much. That’s only market and economic forces. Ninety percent of the world’s oil is controlled by national oil companies. Only 10 percent is controlled by Shell, Total, Chevron, ConocoPhillips. And so you have considerations that are perhaps not market, not economic – you have political considerations, you have self-sufficiency. You have other things that need to – that may or may not consider economic evaluation or purely market. But there is that whole other global perspective.

MS. EILPERIN: Then, actually, following on that global perspective – and maybe, Brenda, you could kick it off again – obviously we’re pretty focused on what our resources, in terms of unconventional oil, is here in the United States and North America.
Could we just give folks an overview of what’s happening – Debbie, you mentioned in one of your last slides – you know, what’s happening elsewhere and what’s the pace? Jim, you alluded to it. It’s obviously slower in some other countries, but obviously, they’re kind of lining up. Could we just give a kind of global tour of what else is out there right now?

[52:46]

MS. GORDON: So we can add to it, but Venezuela has extra-heavy oil. Jordan has a bunch of – I think it’s oil shale. Russia also has quite a bit, China not as much – which is interesting. I would think that could drive a lot of what goes on in the world as well – in terms of China being a great demander of oil, but not having much conventional or unconventional oil will be a really interesting factor.

Where else? I’m trying to think around – where else globally?

MR. BURWELL: Australia.

MS. GORDON: Australia.

MR. BURWELL: It’s on that map, probably. The map’s right there.

[53:25]

MS. GORDON: And the map – the map, actually, just to decipher it because you’re far away from it – the green is unconventional oil and the red is unconventional gas. And in certain cases, like the tight oil, they’re together. Conventional oil fields produce both, but the unconventional, it depends on the field. Sometimes they produce both, and in the case of, say, the oil sands, it’s really an oil play. It’s not a gas play, yeah.

MS. PIERCE: And while I think there’s lots out there, I’m not sure we know yet how quickly they’ll be developed, if they will be developed – or maybe more, how quickly – because you need certain considerations, and I think there’s still a lot of unknowns. I think that’s a map of potential, but we need to look at it more in detail of, really, what’s there and what are the parameters and what are the drivers.

MS. EILPERIN: Right. Jim, did you have anything to add, or should I go on?

MR. BURKHARD: In terms of other sources of growth, a lot of which is conventional oil, Iraq has enormous potential. Again, whether that’s fulfilled is another question, but there’s no – enormous, enormous potential. Kazakhstan is another really important source of supply growth. Brazil is as well, and that’s before we talk about the potential for this tight oil story to spread elsewhere.

MS. EILPERIN: Great. And so – and Debbie, this kind of – maybe you could start off with this, but clearly, you know, one thing you alluded to is the uncertainty about the greenhouse gas impact of some of these oils. And I guess I think one of the questions is, we obviously – we seem to be at a moment of, to some extent, scientific uncertainty about their impact. There’s a lot of debate over, obviously, the emissions associated with this.
What implications do you think this has for policymakers that, you know, again, are trying to decide what’s the impact of – you know, should we build this massive pipeline or not. You know, do we need a standard, you know, for our fuels, whether we’re talking about in Europe, in the States. Can you give a sense of, you know, your sense of what are the policy implications – where do we go from here?

[55:24]

MS. GORDON: Well, I think that the last graph from Exxon shows it all. I mean, if there really is – you know, and I think a lot of us have been living in the world of peak oil for a long time, thinking that the first thing that would happen would be we’d run out of oil and we’d have to switch to alternatives. Well, this changes up everything. I mean, if there’s that much unconventional oil and the economics are favorable, then we’re going to find it.

So this transformation of oil – that will have different climate impacts than we have been – based our assessments on, the conventional wisdom that Jim talked about changing – I think that really, everything is changing. Everything in the oil patch is changing. Everything about the carbon impacts are changing. Not all the unconventionals will be higher, but many of them are so much higher that – like the oil sands – that it’s really a concern.

And it’s a concern to me also, what other byproducts from taking these new feedstocks out of the ground – what other byproducts are we now going to create? Like, I mentioned the petroleum coke. That’s the bottom of the barrel. You throw it away. But when you’re producing so much of it up in Canada and there’s so much carbon impact and you can’t even throw it away – where are you going to throw it away? They have stockpiles of it up in Canada. And now they’re going to ship it to Asia and find new ways to burn it.

[56:45]

Then we’re basically – we’re recarbonizing. That’s what, you know, I’ve really come to realize – that we’ve gone from peak oil, where we would decarbonize – the point was to get closer and closer to hydrogen and alternative fuels, maybe biofuels, and decarbonize transportation – now, with this whole play, we’re recarbonizing.

MS. EILPERIN: Other thoughts?

MR. BURKHARD: One, you know, the world is consuming more fossil fuels this year than it was 10 years ago. And 10 years from now we likely will as well. But just two points. This increase in consumption is largely occurring outside of the OECD, outside of developed markets, and it’s a reflection of the stunning increase in global prosperity that we’ve seen.

[57:30]

Now, it may seem a little odd to talk about prosperity given these economic times here in the United States. But over the last decade, we’ve seen the greatest number of
people globally lifted out of poverty than we’ve ever, ever seen. That means lower infant mortality, higher life expectancy, more opportunities — especially for girls, young women in a lot of these places. And when you have that greater prosperity, you have higher energy consumption. That is the reality.

And one last point on this particular question, the — Juliet, you mentioned the Keystone XL pipeline. And it was surprising to many — certainly, me — about the attention that that pipeline project got. The U.S. imports 2.2 million barrels per day of oil from Canada. It’s the largest source of foreign oil by far. Importing oil from Canada, and oil sands from Canada, is not new. There are many, many pipelines that already do this.

But one reason why it may have gotten so much attention is the lack of a carbon framework in this country. There’s no — we have not decided yet as a government or a society, how do we want to deal with carbon. Is there a price attached to it? If there’s no framework to — you know, global framework to deal with it in this country, then the debate often gets bogged down in very specific infrastructure projects.

Should our carbon policy be dictated by whether a pipeline comes into this country or not? Probably not. But it’s a reflection of absence of framework; this is what the debate often is focused on.

MS. EILPERIN: And then one last question, then I’ll open it up. I wanted to ask briefly about the politics of tight oil. And what I find interesting — you know, and Jim, you alluded to this — is the idea that, you know, here’s this thing that we’ve seen a lot about controversy about fracking, whether you’re talking about in Pennsylvania, in New York, and elsewhere — you know, here in Virginia and West Virginia.

You know, don’t hear a lot of complaints coming out of North Dakota or Texas. And I’m just curious if any of you can observe — is there — you know, again, is that a function of politics? Is it because people are more favorably inclined towards fossil fuels? Is it because this isn’t happening in people’s backyards as much, or if they are, they are just not as many people around — it’s not happening in more highly populated areas?

[59:51]

Could, you know, people give me a sense of, is there any backlash against tight oil here in the United States? Or are you not really seeing that? I just am curious of why there might be a disconnect between that and fracking.

MR. BURKHARD: Well, there is the whole hydraulic fracturing issue, which certainly is raising attention and questions — legitimate questions around the world and around the United States. But unemployment is probably the biggest issue in this country right now, the rate of unemployment. And oil and gas extraction — it’s capital-intensive, but nonetheless it is creating jobs. And in places like North Dakota, Ohio, Pennsylvania — this isn’t just Texas and Louisiana; it’s many other places — it is creating jobs.

In fact, last year oil and gas extraction added about 150,000 jobs in this country. One of our sister companies, IHS Global Insight, estimated that in 2010, shale gas extraction
supported about 600,000 jobs. So I think, given the unemployment situation and the fact that oil and gas extraction is growing and creating jobs, is an influence on the debate.

01:01:00

MS. : (Inaudible) – any thoughts?

MS. GORDON: I was just going to say, I think a lot of the conversation started with gas. And the conversation on oil, especially tight oil, is lagging in terms of that. And it’s going to take different equipment, you know, moving in. So even though they’re commingled, they’re different products and you don’t produce them similarly. So it’s – I think that that’s – it’s to be had, that conversation on unconventional – the tight oil.

MS. PIERCE: And I do think there is a difference. I mean, I’ve been to North Dakota; I’ve been to Pennsylvania; I’ve been to Texas. And you’re right. We’ve been hydrofracking for a long time, especially in Texas. And there doesn’t seem to be the same issue; and we – we’re hydrofracking now in North Dakota, and there doesn’t seem to be the same issue. And there’s just a fundamental difference in approach.

01:01:43

I think part of it, as Jim said – I think part of it is population density. I think part of it is a different populace. And I think that especially Texas has – is used to development. And a lot of these countries – or states – New York, Pennsylvania – are not. And it’s happening so fast. And they don’t have the regulations; they don’t have the people to oversee it. And it’s just – it’s a sea change so quickly. But there’s different hydrology, there’s different geography, there’s different population centers, and there’s a much more dense population. So I just think there are differences, because hydrofracking isn’t new – (inaudible).

MS. EILPERIN: Excellent. All right, so I have more questions, but I’m sure we have questions in the audience. So could I see – I’m sure there’s a hand or two. Yes, sir.

MS. : And do you want people to identify?

MR. : (Off mic.)

MS. EILPERIN: Yeah, if you could identify yourself as well, so –

Q: Marco DiCapua. I used to be the counselor for scientific affairs at the U.S. embassy in Beijing. I was a colleague of Steve Mashon (ph) actually at that time, and also I served time in India. The question I have is – has to do with hydrogenation, which is actually very energy-expensive. If you look at your graph back there, where you have both a cold-to-liquids and you have the oil sands, is – if, for example, one was to apply small modular nuclear reactors to deliver processed heat that is non-global warming, how would that change the equation of hydrogenation, to be able to go from tar sands to liquids, and to go from cold to liquids?
MS. GORDON: There’s long been the discussion of using, throughout these processes – the tar sands, for example, in Canada have been known for, you know, generations. They’ve been up there with the natives. And there were studies that I saw that the Canadian Oil Sands corporation – they were talking at one point about actually sinking nuclear reactors in the earth to liberate – to melt – to liberate the oil off the sand. So there’s a lot of discussion of using nuclear throughout these processes. There’s also discussion on tapping the vast gas up in the Arctic and building a pipeline that would actually use natural gas – vast amounts of natural gas to liberate the oil sands as well.

[01:04:02]

I think that there will be a lot – if this is something that I believe will turn on, there are going to be new technological twists and turns to this for a very long time. And of course, if climate gets priced, then other options that are low – lower climate impacts become questions. And then they raise yet other concerns. So it’s really one of those stories that I think is going to evolve over time. I just hope that we’re somewhat ahead of it asking questions.

MS. EILPERIN: (No ?) questions?

Q: Hi, my name is Shella Biallas; I work at the Department of the Interior. I’ll direct this question at Brenda, but others may be able to answer this. Brenda, you mentioned that USGS is going to be putting out an assessment for unconventionals on the North Slope. I didn’t know if you could answer the question – if there’s technology even available at this time to do unconventional exploration and extraction in the Arctic environment, and if other Arctic countries are currently doing the unconventional exploration and production above the Arctic Circle.

[01:05:11]

MS. PIERCE: There is no production of unconventional resources outside of North America, so outside of the U.S. and Canada there just isn’t any. Whether there’s technology – there’s certainly the conventional technology, and I think – I don’t want to say all you’d have to do – but moving the horizontal drilling and the hydrofracturing equipment up there, which is a relatively minor thing. You know, if there’s unconventional oil, and the oil is – the trans-Alaskan pipeline is not at full capacity, that’s another driver, that may or may not be purely economic, that may drive it. So, you know, when we come out, we’ll see how much oil and gas potential there is there on the North Slope. And then those questions are very viable.

Q: Yes, very interesting presentations, thank you. Francisco Sucre from the World Bank. My question is, there’s two policy things happening in California and Europe. One is called the fuel quality directive, and the other one is –

MS. : Low carbon fuel standard?

MS. : Low carbon fuel standard.
Q: Exactly. What do you see the implications on this aspect of trying to set up a – and the – and the ramifications to the different types of greenhouse gases attached to the sources of oil?

MS. GORDON: So the three policy handles, I think, that we’re going to need to access to deal with unconventional oil are going to be standards – regulations – and you talked about the two, one in Europe and one in California, that are developing – low carbon fuel standard – clearly, if we’re going to use regulations on a – on issues that have global importance, they can’t just be in California. That’s not going to be so useful. There’s discussion of maybe a national low carbon fuel standard.

[01:06:55]

The second one is carbon pricing. And it’s not – these are not mutually exclusive. You know, fuel – low carbon fuel standards might get you part of the way there, but you might still need a price on carbon – especially in terms of these byproducts – you know, because low carbon fuel standards tend to look at – right now they’re measuring per mile driven. They’re really on the tailpipe. And that’s almost like the tail wagging the dog on this issue. It’s really important, but it might not be a complete way to keep – to really manage them.

And then the third one that we’ve thought a lot about – or started to think a lot about – are clearinghouses, information clearinghouses – so that we have a better and better idea over time on these different geographies globally – on what these different resources are, in terms of their chemistries and their carbon footprints. So I think all three are going to be – actually be very important. And the low carbon fuel standard seems to be the first out of the box – or out of the gate, in terms of starting to think about how to manage carbon.

[01:07:54]

MS. : (Off mic.)

MS. : Yeah.

MR. BURKHARD: One – yeah, on the whole carbon policy issue, I think it’s always important to try and identify what is the objective and why. And there’s a lot of numbers put out there about carbon emissions. And I think understanding what is it you are measuring, and how – what is the quality of the data – the oil sand is a great example of this. If you look at life cycle emissions from a source of fuel, now what does that mean? It means all of the greenhouse gases that are emitted from the finding, development and production of that fuel, to the time where it’s consumed, where it’s burned. Life cycle emissions.

When you’re talking about a fuel like gasoline, 70 (percent) to 80 percent of the emissions – the life cycle emissions of that fuel – are burned in your engine. Seventy (percent) to 80 percent of the life cycle emissions for gasoline are burned in the engine; regardless of whether it’s a gasoline that comes from the oil sands or from Saudi Arabia or anywhere else, it’s going to be the same. Where there are differences – and that’s where the
5 (percent) to 15 percent figure on the life cycle greenhouse gas emissions from the oil sands comes to – is related to the life cycle, the totality of the emissions.

Where there are more – where there’s a greater divergence in emissions is on the so-called upstream portion: the development, the extraction of that fuel source of energy. And that’s about 20 (percent) to 30 percent of the life cycle emissions. And in that portion, there are more significant differences, according to the type of crude or synthetic crude you’re processing.

[01:09:35]

MR. BURWELL: Can I ask a question about that?

MS. : Yeah, all right, you’re up. Yep.

MR. BURWELL: I mean – may I – just seems to be a kind of a disconnect here – because you said, Debbie, that when it gets down to gasoline, it’s pretty much – all gasoline doesn’t reflect the – it’s whatever is in the gasoline. But it’s all upstream when the relationship to the carbon footprint of unconventional versus conventional sources for gasoline. That would seem to me that a gas tax or a carbon tax that is applied – since oil is – you know, transportation is 95 percent run by oil – a price at the pump is not going to really capture the distinction between the carbon, and that you’d have to go upstream to really have an effective carbon price. Is that right?

MS. GORDON: I agree. Yeah, I’ve been thinking more about this. You know, the idea of regulating tailpipes – we also have a fourth thing, which is regulating tailpipe emissions. And that can actually account for some of the upstream as well. But the reality is that we have new byproducts from these new fuels. And if we’re only considering oil – if we’re only considering gasoline and diesel in a low carbon fuel standard, pretty much, because those are the transportation fuels – we’re somewhat missing what the fractionation of all of these byproducts of unconventional oil are. And there have to be regulations – if it’s truly going to be life cycle, on the whole entire amount of carbon developed, you have to follow it up.

So I think we’re a little bit stuck now, like I said, with having developed regulations in California to try to dissect different transportation fuels before we started realizing that oil itself was changing. And we might have to backtrack a little bit, because the numbers that Jim cites are definitely out there. And I think that they’re good numbers, but I think the basis of them might not really draw the circle around all of the carbon that’s being liberated in order to have that gasoline come to the pump from new sources, especially oil sands.

[01:11:33]

MS. EILPERIN: Also it’s worth noting – because I just recently wrote about this – that obviously the EU is pressing ahead with its fuels directive. And we’re seeing considerable opposition to what’s happening in California. Both there’s ongoing litigation, which currently is – that California is going to appeal it, but right now the judge has issued an injunction for enforcement of their standard. And you have an organized lobbying
campaign that’s really pushing back, in terms of the adoption of this standard – both on the national level, which right now is really off the table – we’ll have to see what happens with the elections, to see if it gains any momentum.

But both in the Midwest and in the Northeast there’s – while both of those regions were looking at modeling something – and actually I should include also Washington and Oregon – all of – all of those regions were looking at modeling something after California, and they’re certainly on hold at this moment, kind of waiting for greater certainty of what’s happening.

MS. : In the back?

[01:12:30]

Q: Great, thanks. Hi, Arbor Johnson (ph) with Itochu. I wanted to ask about flaring, particularly in the Bakken, and what regulatory and/or market forces might lead us to other alternatives, and what those other alternatives might be.

MS. : (Off mic.)

MR. BURKHARD: Yeah, I assume you’re talking about the flaring of natural gas, which is not a – where it’s a big issue is in places where there’s no market for natural gas. Flaring does occur; it’s pretty small in the United States, because there’s a very large and extensive pipeline network to ship gas anywhere – to where it needs to go. So flaring is not much of an issue.

It is an issue in places around the world like Nigeria, where there is not a natural gas market. Crude oil – you can produce crude oil off the coast of Equatorial Guinea; it can go anywhere in the world. You put it in a tanker; it can go anywhere. Natural gas, it’s not quite so easy. You either need it put in a pipeline, or to turn it into liquefied natural gas, which requires a very large capital investment to turn the gas into a liquid.

So it’s not much of a – it’s not a big issue in – let me put it this way. The amount of gas flaring in the U.S. is minimal, and it’s much more of an issue where there are undeveloped local markets or not enough capital to develop liquefied natural gas and ship it to where it can be consumed.

MS. GORDON: It’s a really good question, because the associated greenhouse gases like methane and black carbon – they – they’re not only just physical elements; they’re also geopolitical elements. So in certain countries, when we start developing these unconventional oils, they’re going to have very different footprints from each other – not just based on their chemistries, but based on the capacities of those countries to manage them.

[01:14:21]

MS. : (Inaudible) – questions, yes? Go ahead.
Q: Another question here is –

MS. : Wait, wait for one second, if we could just get the microphone.

Q: – is regarding the water – oil nexus and water energy nexus – to what degree this is coming to the fore, in terms of the amount of water usage to – surface water that goes into producing these unconventional resources.

[01:14:44]

MS. : (Could ?) one of you – (inaudible).

MS. GORDON: Yeah, I mean, I’m not a water expert. I’ve spent way more of my time over the years – even when I was at Chevron – doing air quality and now what’s become climate in my mind. But the water uses are inordinate. And that was raised by the National Petroleum Council. And pumping water is really energy intensive, and especially if you’re developing some of these in arid regions – you know, Jordan or the Rocky Mountains. So you’re talking about pumping water long distances also. And then you have to manage the water, which then again is moving it to manage it and reprocess it.

So these – I think that that – those are the associated emissions that supposedly are part of the calculation on a fuel – on the fuel cycle. But I think that we are going to figure these things out as we have more exposure to them.

MS. PIERCE: I think water is a big concern, especially in the Eastern states where there’s more opposition than elsewhere. And it – hydrofracking is consumptive use of water. I mean, it does eat the water eventually over time. And right now many of them are using potable water. And so it’s not just the hydrofracking, though. I think it gets tarred with a lot of things that are really whole well bore completion and whole – the way you do things. And so best practices really do have to be looked at and looked for alternative uses for not potable water.

MS. EILPERIN: I have a refining question I wanted to ask real quickly because – both because this comes up when I write about this but also just broadly speaking. The refining industry in the United States, while obviously is part of the oil industry, does not make the same huge profits that, you know, we see from the big international conglomerates. And clearly they’ve been excited about this great revival, as you – as you talk about it.

[01:16:28]

Can you give a sense of what are the implications for the U.S. refining industry in terms of these finds, and also what is it – the question that consistently comes up when I write about Keystone is – every time I write an article, someone says: Why can’t either Canada just build refineries and be done with it or could we do them in Michigan? Why does there need to be a pipeline to bring it down to the Gulf coast.

So, Jim, had something.
MR. BURKHARD: Yeah. Wow, there’s a lot of different aspects to that question. I'll try and tackle a few of them. I think it’s important to understand the U.S. has seen peak oil demand. U.S. oil demand – U.S. demand for liquid fuels peaked in 2005 and has been falling since. And we don’t think we’ll ever get to that level again in the United States. In fact, all of OEC demand is in decline – flat to declining.

So take that as a starting point, then you have a large and very sophisticated refining system in the United States – the most sophisticated in the world. There’s very simple refineries that you process the – you – it’s like chemistry, you boil it, you get what you get. Sophisticated or complex refineries can take some of the lower-value products and turn it into more high-value products like diesel and gasoline.

The U.S., because of this flat-to-declining demand in the U.S., and yet we have a very sophisticated refinery base, and you have growing oil demand elsewhere in the world. So the selling refined products – refined products has become a big source of export growth in this country, particularly to Latin America.

Now, what does this great revival mean for refineries? And I’ll – excuse me for getting a little – maybe a little technical here. A lot of this oil from North Dakota, Eagle Ford in South Texas, it’s light sweet crude oil. A lot of refineries in the U.S. are geared to process what’s called heavy crude oil from Mexico and Venezuela. And one reason why there is this desire – this need to ship more heavy oil from Canada, that’s the oil sands, to the Gulf Coast is because those refineries, they spent billions of dollars to become sophisticated.

The equipment you need to turn low-value products into high-value products, it costs billions of dollars. So if you spend a couple billion dollars upgrading your refinery kit to process heavy crudes, you want to use heavy crudes which are priced less. So this great revival, at least in the terms of the Canadian oil sands, that is – a lot of investment has been made based on the assumption that more heavy oil will be available.

Now, in terms of the light – the great revival in the U.S., the onshore, the tidal and the light sweet crude oil, it’s possible that – it’s conceivable, it’s not a laughable matter, that the U.S. could export some crude oil in the next 10 to 15 years out of the U.S. Gulf Coast. The U.S. will remain a net oil importer, let me be very clear. It will remain a net oil importer. Sometimes it makes sense to import oil; sometimes it makes sense to export it.

But for the refiners, very sophisticated refineries in the Gulf Coast, they need that heavy crude oil feedstock, which traditionally has come from Mexico and Venezuela. That production is falling and the oil sands is one source of replacement for it.

MS. EILPERIN: Sorry, please.

MR. BURWELL: One more question then I got to wrap it up here –
Q: James Sang (sp). You pointed out that the new fuels that are the subject of this seminar are – became economical due to new technologies and new knowledge. With all the new problems that you’re talking about – traditionally, the energy industry has been very, very low in R&D intensity. Is there a need for more R&D in this field?

MS. EILPERIN: Brenda?

MS. PIERCE: No, the USGS doesn’t have a position on that.

MS. GORDON: I mean –

MR. BURKHARD: Perhaps I can – but I didn’t quite grasp the question.

Q: (Off mic) – data on R&D intensity per industry – per sector. The energy industry, which includes utilities and stuff like that so it’s a little tricky, has traditionally been very, very low in intensity, and partially because it’s been very static. Now that you’re no longer static, does this suggest that the industry should be increasing its investment in R&D?

MR. BURKHARD: Well, I think, you know, how R&D is – I don’t know how precisely how R&D is measured. Different surveys may come up with different figures. But I think what you’re saying is, you know, in the ball park. But there certainly is innovation in the field that occurs, whether that’s counted or not. It’s in the self-interest of any company in any industry to try and produce more efficiently and more cheaply. So I think there certainly is an incentive there.

Q: (Off mic.)

MS. GORDON: Right. And there’s not necessarily the inclination to ask those questions first or along with the technological, resource questions. Yeah. I mean, from my experience in the oil field, there was a lot of solving going on on the ground, and a lot of the oil service companies, Schlumberger comes to mind, would come and solve problems. I mean, it just – you get into a bind and you’d come solve a problem. But they’re not the social problems that this is going to bring up.

MR. BURWELL: OK, I’ll take the prerogative of the moderator to ask the last question. And it’s a kind of a complicated question as well, very interesting – and I think has been a terrific panel. I’m coming away with what we do here at Carnegie thinking a lot about this and what’s the policy framework we want to address dealing with these new oils.

So there seems to be, you know, several factors pushing the production of these new oils – obviously the supply boom from technology primarily and new discoveries. There is the demand boom as well, given – at least outside the OECD countries – given the fact that the world is developing very rapidly. There’s also the price issue, and this is one thing we’ve
been looking about, is the fact that the price of a barrel of oil continues to go up regardless of the supply.

[01:22:03]

In a very interesting article – I think it was in Petroleum News, I don’t know if – (inaudible) – you know this – but, I don’t know the exactly figures, but it is kind of – it’s a (monopoly ?) to a certain extent over Canada in terms of clients, which is the U.S. But it’s kind of a quasi-monopoly and – (inaudible) – supplier, at least big enough so that they can control the price in relationship to the amount of excess capacity they can raise it or lower it to affect the price.

And there was an article – it was interesting that the effect of the Arab Spring alone, and the amount of budget that the producing countries need to devote to social services to keep social unrest manageable, has raised the price per barrel of oil from a break-even for a – from a budget standpoint from about the low 70s to the low 90s per barrel in one year. Is that correct – (inaudible)?

So we have these kind of externalized factors here, that we have another signal that because of a certain category of producers has to have a price per barrel that’s sufficient to meet their political issues; it’s created this market signal that almost everything is exploitable because it’s a very high price. And does anybody want to have a comment about that? I – we can’t quite figure it out – how to address the fact that the market is just giving a price signal that we should exploit everything.

[01:24:36]

Oh, you know, by the way, I have one more fact. If you read the world economic energy outlook, there is the statement made rather unequivocally by these folks who represent consuming countries, is that we must – in order to avoid a 2 percent increase, we must fundamentally move away from the exploitation of fossil fuels as an energy source by 2017; that the $500-plus billion a year that the energy companies use for capital expenditures should move dramatically away from fossil fuels by 2017, or we’re basically at 550 or 650 within the next 20 or 30 years. How do we address this problem?

MS. GORDON: I don’t think it will realistically happen. So we’re going to need to learn how to manage it. It’s – I think that we’re going to be on oil – I wrote “Two Billion Cars,” a book with Dan Sperling a few years ago and talking about doubling the world’s cars in the next 20 years – the cars on the road. And the idea of cars going away and oil away is almost unimaginable. So we can put our heads in the sand or we can learn how to manage it better.

[01:25:55]

MR. BURWELL: Kevin from Carnegie. Maybe you have the answer to this problem. (Laughter.)
Q: Kevin Tu from Carnegie Endowment. When we talk about unconventional oil I would like to say the pricing signal (wasn’t?) their only consideration. When looking at China, one of the most important oil economy in the world, when – because energy security there is certainly a bigger concern in China, now they start to use coal to produce oil.

However, because the Chinese government also start to look more on environmental issue such as – (inaudible) – carbon emissions and the heavy water intensity of coal-to-oil production – so they start to become very conservative about unconventional oil production from coal. So that’s why in the future when they need to affect more environmental consideration into the unconventional oil production. Thank you.

MR. BURKHARD: A lot of – David – is to touch on these – your point and these other points being made here is, people respond to incentives. People respond to price signals. And wishful thinking, hopes, desires, that is not going to change how the world is. The – what I think is the biggest greenhouse gas policy initiative that the United States has put forth, at least in recent years – what I think, my personal view, is the higher fuel economy standards that were first – the increase in the fuel economy standards for cars and trucks that was adopted by President Bush in 2007. And President Obama has further raised those.

Now, you may not think of the previous administration as being one that would promote, you know, global efforts to, you know, attach a price to carbon. Just set that aside, what caused that? Price signals – high oil prices led to one of the big – a policy that is going to have a profound impact in moderating and indeed lowering petroleum-based oil demand in the United States for the next 20 years. Price signals, price signals, price signals.

[01:28:35]

Economic incentives matter quite a bit. And as I mentioned earlier, society – whether it’s the U.S. or the world – has not come up with the framework which creates meaningful economic incentives to accelerate a drive to a different energy system. I think that’s very, very important to remember. It’s not going to come free or through wishful thinking.

MR. BURWELL: Well, they say that climate is the mother of all externalities. So I guess there’s got to have a lot to think about over the next months and years. So again, I want to thank this panel, thank the audience. Thank you for coming. I think this was a terrific discussion. (Applause.)

[01:29:25]

(END)