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THE AMERICAN PETROLEUM INSTITUTE AND THE COLORADO SCHOOL OF MINES HOLD A NEWS BRIEFING ON THE DEVELOPMENT OF U.S. OIL SHALE

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TEXT:

KENNEDY: Hello, everybody. Thank you for coming.

I -- I have to do a quick apology upfront because we had wonderful PowerPoint slides planned for all of our presenters. And unfortunately we don't have the capability in this room.

So everyone will be a little bit on the fly today. But I think it'll still be a good discussion.

I'd like to welcome everybody to today's oil shale forum, sponsored by the American Petroleum Institute and the Colorado School of Mines.

My name's Emily Kennedy. And I'm a policy advisor with the API Upstream Group.

I would like to recognize the members of the API Oil Shale Subcommittee whose support, counsel, and hard work allow us to gather here today to discuss this important resource, which impacts energy, security, jobs, and the U.S. economy.

API formed the Oil Shale Subcommittee to direct issues associated with oil shale development and to educate

policy-makers and the public at large on the importance of oil shale as an energy resource.

Our Oil Shale Subcommittee members, many of whom are represented on this panel today, are committed to delivering technologies and best practices to develop oil shale in an environmentally sustainable manner.

We'd also like to thank Congressman Lamborn's staff and the Capitol host staff for their assistance in securing our venue, and providing us with the opportunity to meet with you today.

The goal of this forum is to educate and examine current developments in protection technologies for oil shale both globally and specifically here in the United States.

Today's program has three parts. We'll start with presentations on our world energy outlook and on oil shale as a resource, followed by a panel of industry experts who'll provide brief overviews of their company's technologies.

And lastly we'll have a moderated Q&A session with the panel to discuss their oil shale developments.

To start off the forum, I would like to introduce Mr. Guy Caruso who will provide us with an overview on the United States and the world energy outlook.

Mr. Caruso is a senior advisor in the Energy and National Security Program at the Center for Strategic and International Studies. He has over 40 years of energy experience including serving as the administrator of the Energy Information Administration and as the director of the National Energy Strategy Project for the U.S. Energy Association.

Mr. Caruso has also worked at a Paris-based International Energy Agency, first as the head of the oil industry division, where he was responsible for analyzing supply and demand in the world's oil markets and developments in the oil industry. He then served as the director of the Office of Non Member Countries where he directed studies of energy related developments in emerging economies.

Please help me in welcoming Mr. Caruso.

(APPLAUSE)

CARUSO: Thank -- thank you very much, Elizabeth, and good morning ladies and gentlemen. It's a pleasure to be here on -- especially among so many experts.

I'm not a -- as you'll soon find out, I'm not an oil shale expert. Everything I know about that I learned from Tony Dammer and Dr. Bach in the Colorado of Mines.

And I want to provide an overview about some of the -- the global -- I would call really more geopolitics of energy. I mean -- and why I think oil shale and other unconventional liquids and -- and gas can play such an important role in the -- the quite uncertain future that we see from a perspective of, in this case, a think tank and my former jobs at EIA and the IEA when I was directly involved in the global outlooks. You know, the world energy outlook from IEA, the international energy outlook that EIA publishes every year.

And then of course some of the companies in the room here have -- have their own -- like Exxon Mobil and -- and others.

So I think we all tend to agree what the big picture is going to look like in -- in global energy. And especially oil and -- and gas. And that is one dominated by the emerging economies on the demand side.

And we've been talking about this for, it seems to me, a long time. China's coming other emerging economies are -- and indeed it's actually happened. And we're now looking -- facing a world where most of the growth, I think, the latest EIA outlook is 85 percent of world energy growth is China, India, the Middle East and other emerging economies.

So you've got a robust world energy outlook, maybe 50 percent growth over the next 20 years, and most of that is these emerging economies.

So, you know, there'll be -- there's going to be a demand for the liquids. Question really depends on the supply side where it's going to come from.

And, you know, up until very recently, we -- we've been -- the mantra had -- had been at -- at almost everywhere that the concentration of the resources in the Middle East and North Africa will continue to provide most of this -- these liquids.

I think those of you in this room know how much the revolution in the nonconventional oil and gas -- and unconventional now has become such a now, I think, a misnomer.

EIA's latest outlook has shale gas at or -- or even maybe above 50 percent of our gas supply by, I think, 2030, 2035. It may even get their sooner.

And so when does the unconventional become conventional? I -- I don't know.

So I think that's -- that's really the key.

And when you look at how will those liquids and -- and gas -- natural gas be -- be developed?

For me the key geopolitical and economic question is will the investments be made on time in the right places. And -- and that, I think, is the -- the biggest uncertainty.

When you -- when you look at, you know, where the reserves are, of course, you know, Middle East and North Africa continue to be dominant for conventional. But now we're seeing this enormous -- I think it's not really hyperbole to talk about a shale revolution in -- in -- in not only North America but having talked to some of you in the audience, you know, other places in Asian, South America, even Europe, like Poland, Hungary.

So this certainly has the potential, this unconventional source of oil and gas. And I lump tight oil and -- which is the Bakken type production coming out of North Dakota with shale oil. And that unconventional, as well as the oil sands of Canada certainly has the potential to change, you know -- to change this picture.

Why I think it's so important is that resource nationalism plays such a big role in the investment picture in those countries from the Middle East and others where national oil companies are dominant.

Not that I'm bashing or impugning national oil companies. There are many very excellent national oil companies -- Saudi Aramco and -- and a number of others.

But let's face it, when you're not sure exactly where your capital budget is going -- going to be coming from, I -- in a country like Mexico where Pemex relies on parliament to pass budget for them to do the exploration and development it needs.

So what happens is with -- you wind up underinvesting. Let's face it, Mexico should be investing in shale gas. There's no reason why Eagle Ford stops in -- in Texas. It certainly -- geology carries over into -- so I think that the investment to me is the -- is the key issue. And -- and will it be made on time and in the right places.

And then, you know, when you think about the geopolitical risks have Iranian negotiators meeting in Moscow as we -- as we speak here today about the Iranian nuclear program and what is going to happen in Iran. And what might the outcome of these negotiations be.

We have Iraq which is certainly has enormous potential and could well be an issue there.

So I think, you know, when -- when you look at the -- the picture for unconventional oil and gas, it seems as though it's -- it's still pretty far out when you talk about shale oil with the economics being relatively -- still pretty tough in -- in today's market.

But what we also have seen is the technology that is moving so -- so quickly. And when I joined EIA in 2002, there was no significant expectation for tight oil, the Bakken in particular.

There was a relatively pessimistic view about shale gas. So I do think that the technology, you know, has the potential to change that picture. And many of you -- and we're going to hear about that very soon.

But -- so I think technology -- the geopolitical risks and the -- the economics are what's going to, you know, determine the -- the -- the outlook for shale oil as well as shale gas and -- and tight oil.

The other thing is that if one -- well, looks at the National Petroleum Council's study that was recently released. It's about -- it's about a year now.

You see what the experts from the -- all around the North America who participated in that study concluded that we could be well looking at a doubling of liquids production in North America in the next 10 years, so -- 10 to 15 years.

So I think the potential list there. And oil shale was part of that picture as well.

And if you look at that study, it was delivered to Secretary Chu. And I think you'd come away quite optimistic.

The other thing I think in this political season since we're in this house, the map of where the shale resources are in this country now exceeds 22 states.

And, you know, the old days, I'm talking about political influence of the energy states tended to be limited to Texas, Louisiana, Oklahoma, and then Alaska joined in. Four or five states and, you know, the old -- you're -- the -- the routine during the time of the oil embargo in the '70s. Oh let the Yankees freeze and (inaudible) and that kind of thing. And it was kind of us versus them.

Well if you get the 20-22 states who become oil and liquids producers, whether the shale -- oil shale, gas, you know, I think it changes the political -- it may change the political landscape.

You know, you've got a state like Ohio, a state like Pennsylvania which now are players, and will play a very important role in this election.

So I think the -- what we're going to hear about today from the real experts on shale oil and the companies that are involved in implementing and developing new technologies has the potential to change the geopolitical landscape, not just in North America, but I think globally.

And so once again I'm grateful to be -- be here this morning, and to be part of this seminar and conference.

And I look forward to hearing -- hearing from the panel and -- and others.

So thanks very much, Elizabeth, and ladies and gentlemen.

Have a great...

(APPLAUSE)

Thank you.

(APPLAUSE)

KENNEDY: Thank you, Guy.

Our next speaker is an important and well-known figure in the oil shale industry, Dr. Jeremy Boak.

Dr. Boak is the director of -- of the Center for Oil Shale Technology and Research at the Colorado School of Mines. And co-chair of its annual Oil Shale Symposium.

Dr. Boak is also a nonexecutive board member of the San Leon Energy Group.

Before joining the School of Mines, he was a project manager at the Los Alamos National Laboratory and the U.S. Department of Energy Yucca Mountain Project, and an exploration geologist at ARCO Oil & Gas.

Please help me in welcoming Dr. Boak.

(APPLAUSE)

BOAK: Geologists are three-dimensionally graphical sort of people. And so I have to warn you that because I don't have projection equipment here, I may engage in graphical language.

It's a parental warning for you all.

I'm hoping to fracture a few myths about oil shale. And I will start with terminology.

There's a huge amount of confusion about the terms oil shale, gas shale, et cetera. And part of it comes from the fact that people are confusing rock bodies with products.

So I'll start with oil shale.

The first thing most people hear about oil shale is that it's a misnomer. This comes from a misunderstanding of the English language.

And I'll respond to that by saying, if you think that's a misnomer, because there's not oil in oil shale, ask the next person who says that to you, how much wine is there in wine grapes? OK?

The English language is nothing if not connotatively flexible. That's why we have so many poets and that's why we have so many lawyers.

(LAUGHTER)

So for more than 100 years, the terms oil shale and shale oil have referred to this immature, organic rich sedimentary rock that yields oil upon careful processing, in this case heating. A lot of people talk about pressure being important in generating oil. It's really heat. It's cooking.

And the English language doesn't care whether you call it oil shale if it yields hydrocarbons on cooking, or whether it yields hydrocarbons on highly sophisticated pressurized fracturing.

It doesn't really care, so essentially precedence goes to the original application which predates production of liquid petroleum in the U.S. It goes back to the -- the Scots were cooking oil out of oil shale before Colonel Drake dug his first well.

Technology has advanced in both arenas.

That's another critical point here. Today's oil shale production is not the oil shale production of 1982 or 1964 or of 1919.

If you think that's really -- if you think that's not true, then I would suggest that you also ought to think whether wind turbines of today are like those that appear in the paintings of Peter Rogal (ph).

So what would you -- what would we then call the Bakken, the Eagle Ford, the Niobrara?

As far as I'm concerned, the rock should be called oil baring shale. And the product, shale hosted oil. And that's the best way to get around the confusion we've got. Its real problem is that it's three words. And people can't conceive of using three words for this.

If I put one more in there, in Washington at least, it would become an acronym. But -- and I'll -- I argue that that's a better way to refer to it than tight oil, because I've never seen any oil that I thought was tight.

Except actually there was some burned over Monterey shale -- Monterrey shale oil that was seeping out of the ground, but it had been burned over by a forest fire. That's pretty tight stuff.

In fact just referring to it as tight requires that you know about industry slang, because what they're really talking about is low permeability. And -- and that's already two words there. So, you know, you'd really be in trouble.

Clearly and -- and -- and those rocks are rocks that have been buried into what we often call the petroleum kitchen. Buried to a great enough depth that for a long period of time they are warm enough to -- to actually break down the complex organic matter that's in them and make petroleum.

That's just a -- a slower version of the process that in situ production of oil shale, or even above ground production of oil shale does in a slightly greater hurry because we'd like to have it now, not in a million years or 10 million years.

So it is wrong, as far as I'm concerned, to call the product of retorting of oil shale a petroleum-like substance. It's oil.

Some of it's low grade oil. Some of it's high-grade oil. But it's oil.

If you bury those rocks a little bit deeper and they get into the gas window, they're called gas shales, the rocks are. And the product is shale gas.

If you hear somebody saying that it should - that the stuff from oil shale should be called kerogen oil, all oil is kerogen oil. Kerogen is not a substance unique to the oil shales. It's in every one of these source rocks that's producing oil and gas today, so enough on terminology.

I -- I could say something about shale but it opens a huge can of worms.

Suffice it to say that most of the things that are being called shale today wouldn't fit many geologists' definition of shale. In part because they have to have low clay content in order to be frackable. And so therefore, they wouldn't fit the classical definitions.

And all this stuff about the oil shale being actually milestone, first of all doesn't apply to many oil shales. It applies to the mahogany zone of the Green River formation, which is not the only oil shale in the world.

And just a huge number of things have been called shale. If you really want to go into it, I can talk for 45 minutes about shale alone.

USGS has estimated there's 4.28 trillion barrels of oil potentially recoverable from the Green River formation. That's an increase from what estimates that were made before, partly because they include a new area, and included new zones.

But lots of oil shale estimates have increased over the past six years since I've been running Oil Shale Symposia.

The Chinese have increased their estimate by 15-fold, the Israelis by more than -- by more than 10-fold, and the Jordanians by 2.5. There's just a lot of discovery going on when we start contemplating the idea of in situ production.

I have seen a slide from a major oil corporation which was withdrawn from it -- the package for the -- the symposium proceedings that suggested the possibility of a trillion barrels of oil recoverable in Jordan. So there's the possibility of that.

And those shales dip off into Syria, and I think maybe a little bit of Lebanon, and definitely into Iraq. There aren't really numbers for those shales at this point. There's a lot of change going on in the world estimates.

That 4 trillion barrels is roughly evenly divided between the Wyoming piece, the Utah piece, and the Piceance Basin in Colorado. But the stuff in Colorado is the richest and the -- the best stuff is there.

If you look at the USGS fact sheets for Colorado and Wyoming, you'll see that by the time you get to 15 gallons per ton, there's very little -- a relatively small amount in the Wyoming resource.

By little I mean only 139 billion barrels which is already nearly seven times the current U.S. booked reserves. That's a resource we don't know how much of it we can get.

If you raise it up to about 20 gallons per ton as your economic cutoff, which some people have suggest is reasonable, you reduce that still further there's relatively small amounts in Wyoming that are producible. Although at least one company I've talked to feels that they can make a reasonable profit on 15 gallons per ton rock, that would -- that would leave you with somewhere just between Wyoming and Colorado with over 1 billion -- over 1 trillion barrels recoverable resource.

How much of it will we get?

It remains to be seen. We -- the various processes recover different percentages. They produce different gas-oil ratios.

So there's still a great deal of uncertainty in how much we can get out of there. What we know is there's a very large quantity of material out there that we know we can in fact get stuff out. We can get it out of the ground.

In fact I only discovered that these fact sheets existed that showed the different grade cutoffs, how much was in a certain grade, after the deadline for the programmatic EIS comments went in. Otherwise, I would have suggested it was inappropriate to proceed -- for the BLM to proceed without doing a similar estimate for each of the four alternatives it presented. So that we could have a good idea of whether what was being put up for -- as available to industry was good stuff or bad stuff.

And I'd have to say from, you know, the qualitative look at the maps I've looked at, yes, there's 400,000 acres or more, maybe 500,000 acres. Most of it is ram pasture. There's a huge amount in there.

And the amount of really good stuff that's out there is exceedingly limited and focused in very small areas. It provides no -- very little geologic choice as to where you want to go after this stuff.

To me the controls that the BLM wanted to put in place in the process are much more important than the land allowance.

BLM never puts up all the land in an area that it's approved to put up. They don't put it all up at once. They don't put 2 million acres up for lease at one time. They offer the opportunity to -- to nominate areas.

So a couple of words about where oil shale is going in the future -- if you look at the history of oil shale, it -- oil production in terms of mined tons-- Alan Burnham has updated a figure for Jack Denny (ph) of the USGS did a number of years ago.

It peaked in the early 1980s. And a lot of the decline was the fact that the Chinese discovered oil in their own country. And the Estonian production declined seriously.

But that turned around in 2000. And it's been going up fairly steadily ever since.

And if the surface-based projects -- forget all the in situ production technology -- if the surface-based projects that people have on the books right now actually proceed on schedule -- and of course there will probably be schedule slips -- by 2025, it will more than quadruple the mined shale quantity in -- and at that peak in 1980.

So oil shale is moving ahead. We don't know exactly how fast.

The Chinese are building retorts at an incredible pace. It's just amazing -- 500 a year or more.

I also want to hit on one other topic because it's in -- very much in the news. And that's the water use which is called vast for oil shale.

And I would submit that while water use, if you properly evaluate it, I have a slide in here that shows data from a paper by King and Webber in Environmental Science and technology in 2008, shows the -- they calculated water efficiency as gallons per miles for different kinds of vehicles running on -- you know, electric vehicles, biofuel fueled vehicles, conventional fueled vehicles.

I converted that to miles per gallon. It's a much more familiar term for us.

And for conventional fuels it's in the range of seven to 20. For unconventional hydrocarbon fuels, it runs from about three to about 10. With oil shale, if you actually use the proper water numbers, which industry says are one to three barrels per barrel of oil produced, it comes up into the range of conventional.

If you look at irrigated biofuels, they're in the tens to hundreds of miles per gallon. They are immense water users.

If you have to irrigate to grow biofuels, you're using water at a colossal rate -- tens to hundreds to potentially even 1,000 barrels per barrel.

So if we're going to have a conversation about water use for this resource, I think a holistic approach is important. And we need to ask questions about how we're using water and what fuels it ought to be applied to.

This number one to three is lower than what you will have read if you have read the GAO report.

The GAO report was strongly criticized technically and responded not at all. They quote a number of 12 barrels of -- 12 barrels of water per barrel of oil produced.

That's my number and it's wrong.

It's the extreme end of a projection I did using a pilot scale project which is far less efficient than a large scaled up project.

And it uses values from -- from out-of-date literature about how much water would need to be circulated through a shell type in situ process, which are also out-of-date.

A reanalysis of that appears to be yielding numbers in the one to three barrel per barrel range. And so anyone who

suggests that it might actually be larger than 12 is completely unfamiliar with the technical literature.

And actually the report that I saw say that most recently has one citation from six years' worth of oil shale symposia, one citation of the most recent up-to-date information on oil shale.

It has hundreds of citations.

So if people are not getting the up-to-date information that they can most easily get by coming to Golden on a beautiful October week when the students are away, you're missing a golden opportunity.

And oh by the way, the Coors brewery tour is -- is right next door. So you can't miss it.

But that one to three barrels per barrel number that I mentioned, should be compared, if we're going to really do a holistic analysis, to the amount of water that's required to produce a two liter bottle of sweetened cola, four to eight barrels of water.

We shouldn't be growing any corn in Colorado if water is really a concern. The Front Range is worried that its junior water rights will be taken over by senior water rights to oil shale in the Western Slope.

Before Boulder and Fort Collins get to steal any water, maybe they ought to be talking to some of the agricultural organizations on the -- on the plains and saying, could you possibly use your water more efficiently.

Is it possible that growing corn could be done with a little less irrigation or growing something to be done with a little less irrigation?

I think the comparison four to eight barrels of water for a two liter bottle of Coke, one to three barrels for a barrel of oil is fairly clear. But I would suggest that, you know, so far the price of Coke is not quite as high as the price of oil in -- in those terms.

I think -- as I say, I don't know what the price per gallon is for Coke. But I, you know, I -- I might be conferring with Mr. Bloomberg on that, since he seems to be working on trying to conserve on water that way.

So those are a few comments. Now, I'd like to introduce our first speaker. We're starting from this side, right?

KENNEDY: (OFF-MIKE)...

BOAK: Absolutely.

KENNEDY: ... PowerPoint. (OFF-MIKE).

(RECESS)

BOAK: OK, we didn't lose too many on the break. They must have liked the food we had.

I'd like to get started again here.

Emily asked me to -- to highlight the area we're talking about here. and the area of the outcrop of the -- the area of deposition of the Green River formation that's shown on this slide with the barrels reflecting the amount of -- the USGS estimates of what the resources and the -- but we're talking about essentially the -- the corner of Utah, Colorado, and Wyoming up there.

And the -- Wyoming is the largest area, but the most lean and -- and actually on a -- on a sort of aerial basis, the least rich.

The (inaudible) basin is smaller, but has about a -- a -- I think about a third of the resource. And -- and the Piceance Basin is actually slightly larger than that.

And if you look at it at any kind of grade, it's really quite rich in the Piceance Basin. That's the richest stuff. It was the deepest lake. It was the most exotic lake. It actually precipitated natural baking soda which is almost unique in the world.

With that, I'll introduce our first panelist, Rikki -- Rikki Lauren Hrenko. Is the chief executive officer of Enefit American Oil. And prior to that, she was an environmental policy expert and project director of Eesti Energia, the Estonia national oil company and worked on international oil shale development projects.

She was the chair for the International Oil Shale Symposium in Tallinn in 2009, which Mines was the cosponsor of.

And she's a graduate with distinction from Carnegie Mellon University, with a Master's of Science in environmental policy and management. She's going to talk about their work, primarily here but also elsewhere in the world.

Let's see. (OFF-MIKE) projection here.

HRENKO: Thank you.

So good morning everyone, thank you for joining us.

Jeremy, thank you for the introduction.

I -- I'm going to start talking today about our project in Utah and our company Enefit American Oil. And then transition and really focus in on what our parent company in Estonia does in terms of oil shale.

But to start with, Enefit American Oil is indeed an Estonian- owned company or a U.S. company that was formed a little over a year ago at the end of March 2011, when we acquired a large property holding, a large resource holding in the State of Utah.

That acquisition was closed for USD 42 million. And what we're planning to do there is shale oil production or oil shale development. For that development, which I'll explain a little bit more in a moment, we have a dedicated budget of USD 84 million.

A little bit about where we are. You can see on the picture on your far right, we are located in eastern Utah; if you're familiar with the area in the Uinta Basin south of Vernal, Utah, just along the Colorado border; the property that we own, and the project that we're developing, is for a 50,000 barrel a day shale oil production project, so producing oil from oil shale starting at 50,000 barrels a day.

The resource that we either own or control is estimated to contain 2.6 billion recoverable barrels of oil. That's not in place. That's recoverable in the mining horizon. And that's contains on only 30,000 acres.

Our property distribution is varied. We have about 1.5 billion barrels in private property, which we own the mineral and the surface rights to, C title property.

We also have state leases through SITLA and we have a BLM RD&D research development and demonstration lease from 2007.

We're developing, as I said, those properties with the goal of producing 50,000 barrels a day shale oil.

In terms of our project timeline, we're in a little bit of a different position than a lot of the other shale oil companies. Not Red Leaf -- Laura's going to talk to you in a moment about some off the exciting developments that are coming on

line pretty soon.

But what we're doing is planning to have first oil coming on line in 2020. That's that first long green bar on the right-hand side of the screen.

If you look to the left there's -- there's quite a few years starting in 2011 up to 2020, and that's primarily our development period. Primarily that's driven by the environmental permitting requirements. These are long term large infrastructure projects which have quite a heavy permitting burden.

What we're also doing now in the last year today and going forward is a lot of development work. So we're doing a lot of exploration. We're doing a lot of engineering, starting our pre- permitting activities, et cetera.

So from 2011 to 2016 is our development period, where we're doing all of our exploration and engineering, the goal is to have all of the permits necessary to start construction by 2016.

Our construction period will require about three years from 2017 through 2019 with first oil production coming on line in 2020. That would be about 25,000 barrels a day. We plan to ramp up to full construction of 50,000 barrels a day by 2024.

So in a nutshell, this is -- this is who we are and what we're doing in Utah.

Key message is Enefit American Oil has projects for 50,000 barrels a day in Utah.

The driver behind that is our unique position and our experience from San Leon. This picture that I'm showing you unfortunately is not in Utah yet. This is our commercial plant that's operating today, right now, commercially producing oil in Estonia.

I'll show you some additional pictures -- just a moment.

While I'm talking a little bit more about our history in Estonia, I'm just going to let these pictures sort of run through on the screen behind me.

These are all pictures from our operations in Estonia.

There's a lot of misunderstanding here in the U.S. about what an oil shale industry actually is, if there's an oil shale industry at all. It's economically viable and if it can be done in an environmentally acceptable manner.

Our position is yes. It's commercially viable. It is proven. We're doing it on a large scale commercial production basis in Estonia and have been for decades. And it can be done in an environmentally responsible manner.

So to start with a little bit about our history in Estonia -- Enefit has been commercially utilizing oil shale for more than 100 years, both for power production and for oil production.

If we look at our main activities we can start with mining. We currently mine about 18 million tons of oil shale annually from both surface and underground mines.

In terms of power production, we are able to cover more than 90 percent of Estonia's domestic power need from oil shale based power production very similar to coal power production, as well as exporting to Finland, Latvia, and Lithuania.

We own and operate the world's largest oil shale fired power plant which has a full capacity of more than 2,000 megawatts.

And most importantly for our project in Utah, and for our activities here in the U.S., we also have demonstrated proven commercial shale oil production. We have our own proprietary technology. We have our own operating plants. And we've been operating those plants for more than 30 years. And we produce about 1 million barrels a year.

Unfortunately (inaudible) Estonia's a small country. But we are expanding. So for about 30 years, we're producing 1 million barrels.

And we're currently, as you can see in that picture, building a new plant. We're increasing our capacity in Estonia. A new generation technology that is firmly based on our proven existing 30 years of experience, but has a number of upgrades, improvements, increases in efficiency, and a larger unit which will more than double our capacity to about 2 million barrels per year.

That plant is currently undergoing cold commissioning today in Estonia. And first oil is planned for August.

So when we hear that the oil shale industry is pipe dream, or an R&D exercise or not proven, we tend to disagree.

That being said, the next question is well can you do it, and in an environmentally responsible manner in the U.S. And again, we think we can.

The U.S. heavy industry experience has developed and evolved considerably in the past. And that's very true for Estonia as well.

We have been developing oil shale for 100 years. And our production abilities, our environment performance and our reclamation have evolved over those years as well.

Similar to the U.S. coal industry, the U.S. steel industry, the U.S. mining industry, industry evolves, industry improves, and industry gets cleaner.

The Estonian oil shale industry is exactly the same way. And we're quite confident that we can do this project, that we can produce shale oil commercially in Utah in an environmentally responsible manner.

Jerry talked quite a bit about water. I would have to agree with his statements on one to three barrels of water per barrel of oil. That's a very reasonable statement.

Numbers such as 12 barrels of water per barrel of oil are very much out of context and out of scope of what is really achievable for industry today.

With that I would -- I would conclude. I know we're going to have quite a bit of time for a question-and-answer session, so we'll be happy to talk more about industry experience, environment economics during the Q&A.

Thank you.

(APPLAUSE)

BOAK: (OFF-MIKE). Thank you. It doesn't want to stop.

KENNEDY: (OFF-MIKE).

BOAK: OK, here we go. All right, all right.

Our next speaker is Laura Nelson of Red Leaf Resources.

Laura joined Red Leaf Resources as vice president of energy and environmental development in October 2007. Prior to that, she was Governor Jon Huntsman's advisor, energy advisor.

She advised him on all aspects of energy policy and emerging alternative technology, including leadership in cost cutting, environmental, and climate issues.

She participated as a representative in review of RD&D proposals in the first round of RD&D leasing in the oil shale area, and cooperated also on the review of the oil shale and tar sands programmatic environmental impact study.

She's responsible for identifying and supporting regulatory projects to promote better land use while realizing increased energy production, improved environmental quality.

She's also the chair of the Utah Mining Association's committee on oil -- oil shale and oil sands. A member of the U.S. Department of Energy's Oil Shale Industry Committee, and former co-chair of the Oil Strategic Unconventional Fuels Task Force.

She holds a B.S. and PhD degrees in economics from the University of Utah.

Laura?

NELSON: Thanks Jeremy and thank you all for being here today. We really appreciate this opportunity to talk about what I think is one of the most exciting things that is happening in energy today.

We all had a dinner last night to get ready for today. And I said, you know, this should be an incredibly exciting time in energy because I think we are very much on the cusp of what would, I think, you know, 80-90 years ago been the equivalent of turning on a light bulb.

This is going to release a massive energy source for the United States, predominantly a -- a liquid energy source which is something that I think that we are in dire need of producing more significantly for -- for ourselves.

With that said, I'll try to just go through quickly who Red Lead Resources is.

We are presently a small company. This is a list of some of our -- our leading management with a lot of experience in -- in the space of both oil shale and also just oil and gas generally.

We have a website which I'll show in and you can look up the bios on all of these different individuals.

So just a little bit of history, we were founded in 2006. So not as old as the Estonian company, but in that time, we -- we've really tried to move very, very quickly.

And we had a focus on producing high quality oil in an environmentally sustainable way, and also I a way that was economic from oil shale resources.

With that in mind, we developed our process which we call the EcoShale process. It is our technology. I'll talk a little bit more about that in a minute.

And some of the key attributes that we really wanted to incorporate in the initial design was that it was a low cost process. So you can move it forward very, very quickly. It produces a high quality output.

It's fairly simple in its design. I was talking with one of my peers last evening, and I think he called it dirt simple. So it is a very, very simple process.

It -- but with that said, I think that the -- the eloquence is really -- and this is something that Tony Dammer has said. We've all learned something from Tony in the oil shale business.

That -- that really it's -- it's eloquent in its simplicity because we don't use water in the process. We do use water for

some services like reclamation and for workers. But very, very lower water consumption, very low emissions, high quality product and integrated reclamation.

So economics and environmental attributes all built into that simplicity.

As I mentioned, founded in 2006; what have we done since we were founded in 2006?

Well, a lot of what we've done is actually raise funds. In addition to acquiring resources in Utah, we're also located on school and institutional trust lands which Rikki referred to as SITLA.

Those are trust lands owned by the State of Utah for purposes of raising funds for education. We have out 17,000 acres. So we've acquired resource. We've further developed our technology with those funds by doing extensive testing both in the lab and also in the field.

We have had, I believe, the largest field test project in the U.S. in about 25 years where we produced about 450 barrels of oil from oil shale on a very small five acre exploration site.

With the knowledge that we garnered from that, we've moved forward with permitting. We recently secured a permit for a 9,500 barrel a day project in the State of Utah.

That is being appealed. But we're moving forward on addressing those issues.

And our plan is to plead our permitting process over the next few months. And then to move towards construction of our 9,500 barrel a day project.

So within the next year to year and a half, we'll have finalized construction and actually be in first production.

And 9,500 barrels a day seems like a small amount. But it's huge in terms of identifying that this resource can in fact be developed.

So this is just, I think, an interesting map. The little red squares are the Red Leaf holdings. And oil shale generally, I mean, you hear about these massive amounts of -- of oil that are contained in oil shale. But the impact, I think, on surface is going to be very, very small.

So it's -- it's a huge resource with, I think, a very small impact as we move forward on development.

On our 17,000 acres of leases that we hold in Utah, we estimate that we've got about 1.5 billion barrels of -- of recoverable resource.

So this is kind of our general site where we're located. We're, oh, about 12 miles, I want to say, south and a little bit west of where Enefit is located. So -- so similarly located in the Uinta Basin.

We have validated our resource at our current site where we're moving forward with our 9,500 barrel a day project. We estimate that there's about -- on that project, 114 million barrels of oil in place. And that in fact we'll be able to recover just over 91 million barrels of the oil at that site.

Everyone knows that, I think, you know, or a lot of people understand and certainly Dr. Boak explained, we know how to get hydrocarbons out of oil shale by heating. The question is really whether or not you can do it in a sustainable manner.

And sustainability means that you can do it in an economic way. And you can also do it in an environmental way.

And as I talked about our technology, I mentioned that that really is our objective to do it in both an economic and

an environmental way.

I'll try to walk through this really quickly.

We target a predominantly surface minable resource. In Utah alone, there's about 55 billion barrels of surface minable resource. That means resource that's very close to the surface.

We mine the ore. We (inaudible) it. And in the same place where we mined it, we construct an impound that we layer with a bentonite amended soil which is an impermeable barrier that we use to protect any surrounding ecosystems.

We replace the ore back into the same area where we've mined it. We insert some collection pipes and some heating pipes. And then we wrap it all up.

Somebody has previously referred to this as a burrito. So it's really all contained.

There is an open end wall where we have the pipe penetrations. We bring in natural gas fired heaters, low emission natural gas fired heaters. And we heat it for several months. So we heat at a low temperature over several months.

And we collect both a prompt liquid, which is just a liquid that drains out the bottom, and also some heavy gases which come out the top. And we -- we collect those as liquids. We condense them back into a liquid. And we also produce some natural gas.

Once we've begun production, we can reuse the natural gas in --in the process. So we've become nearly energy self-sufficient in our -- in our production.

And one other very interesting --interesting facet of our technology is in the first state, we actually steam water off of the shale which we can reuse back in the process to further reduce our water consumption.

So I think it was Rikki that said that the technologies can address the issues. And we're well prepared to -- to meet the demands from both water use from emissions and from reclamation.

So as I mentioned, we did a field pilot study. Those are the products that we produced in that field pilot which I've mentioned, the prompt oil, the condensate.

And as Jerry said, and it's very important, we are producing oil. And this oil is a very high quality product.

The West Texas Intermediate crude, which is kind of the standard for evaluating quality is about a 34 -- 32 to 34 API. And on average that's what Red Leaf's process produces is about a 34 API product.

We believe it's a very advanced technology in terms of being green. I've mentioned these things already: low emissions, rapid reclamation, limited water use.

And because we insert this bentonite amended soil to protect surrounding ecosystems, we also are protecting against ground water impacts.

We have developed a lot of partnerships since our inception. And I won't spend a lot -- a bit of time on that. But basically these are long term companies who have really invested their energy into -- to Red Leaf.

And some of you may know that we have recently closed a joint venture with Total which is the fifth largest oil and gas company in the world, a French-based company. And with them, we're moving forward on our Utah project.

So I'll just conclude with that. Our website is www.Redleafinc.com.

We try to be very transparent in all we do. And I think the website has some great information.

Thank you.

(APPLAUSE)

BOAK: Thanks Laura.

Next up is Michele Thomas of ExxonMobil.

I've worked with Michele since the inception of the Oil Shale Symposia beginning in 2006, or the -- the reviving of the Oil Shale Symposia.

There were 25 of them run between 1964 and 1992. And there were five oil shale conferences run. These were not necessarily done at mines. But those 25 were all done at mines.

But between 1919 and 1924, there were also oil shale symposia. But Michele joined ExxonMobil -- Exxon Production Research Company in 1981 after receiving a PhD degree in Chemical Engineering from the University of Illinois at Urbana-Champaign.

She's held a variety of technical positions in both research and in operations. Her areas of expertise include rock and fluid geochemistry, drilling engineering, and reservoir engineering.

Since 1999, Dr. Thomas has been involved in ExxonMobil's research program -- I mean, Institute Oil Shale Technology. And she is currently the research supervisor of that oil shale project. And as such the person I go to when I'm reporting results from my COSTAR group.

Michele?

THOMAS: (OFF-MIKE).

Good morning, everyone. It's really a pleasure to be here this morning.

What I would like to do today is provide a little bit of an overview of ExxonMobil's Institute Technology, share some of our perspective on how we can develop this resource in a protective and responsible way, and discuss a little bit about future plans and resource access.

This slide shows a graphic description of what we envision for commercial embodiment of the technology. The targeted resource in the Piceance Basin of Colorado for institute development is deep. Probably 2,500 feet deep below the aquifers in that area is the region that we intend to pursue.

And the technology, as shown here, we'll drill down to that oil shale rich formation and then drill a horizontal leg. On the horizontal leg of that heater well we will build a planer heater.

So we looked at a lot of different technologies for how we could most effectively develop oil shale. And -- and came up with -- with this as our leading candidate. And this has been the focus of our research for the last decade.

We fill that planer heater with an electrically conducted material. So we basically -- it's like the burner on your electric stove, like the graphite burner.

It's conductive enough to carry a current. But sufficiently resistive that it turns that electricity into heat. So it's just a giant planer heater. Electricity is conducted from one end to the other to make it a heating element.

Heat is then conducted into the formation. You can perhaps see a little bit of those orange squiggly lines coming away from that red planer heater. Thermal conduction is the process that really converts that kerogen, that solid organic

material that's in the oil shale, into oil and gas.

And then the oil and gas that are generated in the earth are produced by conventional production wells as shown by the couple of green wells in the middle of the graphic there.

We think that this technology, if successful -- we are still in the research phase -- has the potential for more cost effective recovery of oil from oil shale and with less surface disturbance than either mining and surface retorting or competitive in situ process.

We have several years of research and development ahead of us to demonstrate the technical, the environmental, and the economic feasibility of this method.

We're very much committed to a measured pace of our technology development and commitment. In a way that will protect the environment, be sensitive to the socioeconomic aspects of Colorado.

Environmental elements are a very prominent part of our research and development program. We are working hard to have a reduced surface footprint. The graphic here shows on the left, our in situ planer heaters where we drill down to the formation of interest, and then drill along horizontal legs to build that heater.

In contrast to wellbore heaters, vertical wellbore heaters, we have about one twentieth as many heater wells as -- as other technologies might do for in situ development because of this long horizontal leg.

We are working hard to minimize water needs for the project. The -- we've talked a little bit -- Jerry spoke about water earlier. And -- and we think also that we can develop this resource in a way that is sensitive to the other demands for water in the -- in the area in the western states where water is a critical resource.

Industry estimates a few years ago when I presented at one of those oil shale symposia, were in the range of four to six. And we believe that we can, with -- with careful application of technology, bring those numbers down to one to two barrels of water required to produce one barrel of shale oil.

And this is an all in number. This -- this -- you know, this is the water all the way from -- from building the roads, and drilling the wells, to whatever process thing would have to take place before you could put that shale oil in a pipeline.

Some of the ways we can minimize that water are using produced water. We have gas operations in Colorado also. And -- and they produce water that we could use in this process. We'd actually looked at that.

We could recycle that water, the water we produce -- actually when you -- when you generate oil from oil shale, you get some water in the process too. And so we've designed a water treatment plant by which we can recycle the produced water, which minimizes the fresh water demand.

And also we've looked at ARCO power plants which are used in many areas around the world now where water is a scare resource.

So putting all that together, we think we can get water demands down to an acceptable level, with new technologies maybe even further.

ExxonMobil strives to be energy efficient in all of our operations. And this is no exception. What we've looked at here schematically if -- if we develop it is that we would have enough produced gas to be self-sufficient and fuel the process.

So we would envision actually at a commercial scale building, a combined cycle gas power plant, a very efficient process for -- producing the electricity that we need to power the process.

And -- and we've estimated that we -- there's a positive energy return on this investment that we estimate that we would get three barrels of oil equivalent produced and put in the pipeline for every barrel of oil equivalent that goes as fuel to that power plant. So it's very much again, an all in number when we look at that energy balance.

ExxonMobil at this point in time does not have a research lease. We have proposed nomination to the Bureau of Land Management for a research development demonstration lease. And this is a satellite image of the lease in western Colorado that we have proposed.

That pad in the northwest corner shows that there's already oil and gas development in the area. That's actually a gas well seeking the deeper resources underneath the oil shale in Colorado.

This is a schematic of -- of what we would develop. The first stage would be shown with a -- a couple of those orange circles to do appraisal drilling, characterize the resource. Ground water monitoring is shown in the -- the turquoise circles around the -- the leaf.

Ground water monitoring is one of the regulatory requirements. The division of reclamation mining and safety in Colorado requires 15 months of ground water monitoring before starting any projects. So that would be one of the first things that we do.

And then the schematics there, the brown pad on the left, shows where we might put surface facilities in. And we envision a couple of stages of research here.

You know, as we -- as we do things in a research project, we learn things and get better. So the first stage as shown in the smaller planer heaters, the lined on this figure demonstrates the -- the planer heaters. And we envision first a small project with maybe heaters 300 feet long, something like that, something a little bit closer together to reduce the time scale, to learn the results with a lot of monitoring laws around them.

And then -- and then two larger planer heaters, more to commercial scale, which we envision to be probably about 1,000 feet long, that's how we get that reduced surface footprint.

We've talked a little bit about land access already today. This is a schematic that shows what BLM proposed in 2008 in the programmatic environmental impact statement for Colorado. And the -- the current consideration in the 2012 draft programmatic EIS.

In summary, oil shale comprises an important domestic resource to meet U.S. energy -- energy demands and diversify our supply. We believe that our technology has significant potential for technical, environmental, and economic success.

We support very much a measured and protected path to that development. And we believe that oil shale can be developed in an environmentally responsible and socially responsible manner with reduced surface disturbance, reduced water use, and moderate CO2 emissions.

Resource access is required for us to move forward. The RD&D lease that I showed the -- the plan of is in the area of the Piceance Basin where we would envision commercial development. To access to a lease like that where we can test it on acreage close to what we would eventually want to develop commercially is important.

And then commercial scale leases really provide incentive for technology investments. We are investing a lot of -- a lot of money into this project, a lot of staff time, and a lot of money.

So we look forward to commercial access in the future when we're ready to go that far.

With that I will close.

(APPLAUSE)

Thank you.

BOAK: Next up is Dr. Alan Burnham.

And if I'm looking for technical answers about the most obscure pieces of oil shale production, there are two people I would most like to have ready access to in the world.

One of them is Alan Burnham, and the other is Harold Vinegar who developed the shale process.

Dr. Alan Burnham has been the chief technology officer and project manager for American Shale Oil based in Rifle, Colorado since March of 2008. He received his B.S. in chemistry from Iowa State University, and PhD in physical chemistry from the University of Illinois at Champaign-Urbana.

You're beginning to pick up a common theme. We have our Illinois mafia here.

Prior to joining AMSO, he held a variety of research and management positions at Lawrence Livermore National Laboratory where he worked for more than 30 years. He has received five patents and published about 240 journal articles, conference proceedings, and technical reports, and won a Federal Laboratory Consortium Award for excellence in technology transfer.

He's also an adjunct professor at the University of Utah.

Alan?

BURNHAM: Thank you, Jerry.

American Shale Oil LLC is a small company. We have a handful of employees and we do our -- our work through -- consultants and contractors largely.

AMSO is a -- one of the few holders of the original RD&D leases from the BLM. We are a 50 percent joint venture -- 50-50 joint venture of Genie Energy Limited and Total S.A.

Genie Energy is a -- is a new entity which was spun off from IDT Corporation last October. So perhaps if you go through airports you'll see the IDT phone cards. That's -- that's the company that spun off Genie as -- as -- along with our other energy ventures.

Jerry talked a little bit about resources. In the center of the Piceance Basin, we're talking about 2 million to 2.5 million barrels per acre. So a 5,000 plus lease contains around 10 billion barrels of potential resource. And make sure you understand the difference between a resource and a reserve, a resource is something that you may be able to get in the future. But it's not been essentially demonstrated as -- as economically recoverable.

But the point is that here you can talk about roughly ballpark, 50 percent recovery for an in situ retort -- source, so you're -- you're -- you're talking about one square mile -- similar -- similar to the Exxon process. We -- we will use horizontal wells.

You're talking about for one square mile surface disturbance, you could --you could produce 100,000 barrels of oil per day for 125 years. And to put that into perspective, the entire production of the State of Colorado now, with -- with all the natural gas condensate, is about 100,000 barrels per day.

So when people talk about land disturbance, you know, they -- it's completely out of context. The land disturbance per hydrocarbon generated is -- is really quite small for oil shale.

One of the challenges for developing oil shale in -- in the center of the Piceance Basin is that the upper portion of the green reformation is also an aquifer system. And so in order to produce that shale oil, you have to deal with essentially taking the water out of there before you retort, because it costs a lot of energy to boil water. And then you have to clean it up, et cetera.

So being a small company, we -- we thought well, we will instead of trying to deal with the aquifer problem, we are going to go deeper. The bottom third of the -- of the green reformation is -- is actually a clay rich garden gulch number. And the -- the richest member of that part, the R1 formation, has enough to produce about 100,000 barrels per day for 25 years.

And it -- it completely avoids this issue of the water contamination problem as long as we can maintain the integrity of the -- of the cap rock that is the -- the very low permeability saline oil shale above it.

And this is a simple slide. It says (inaudible) oil shale cap. It depends on where you are in the basin as to whether or not a Nahcolite rich or dahsani (ph) rich but the -- the -- it's still a very, very low permeable type rock.

And -- and so this -- this particular process, we -- we have conceived, we believe addresses all the issues that people are -- are concerned about, and rightly so: minimal surface print, footprint, protection of aquifers, low water usage, high energy efficiency, low gas emissions and -- and high value jobs.

And when people talk about the economy today, you know, we're not talking about something that essentially you -- you bring out a massive amount of employees and then a few years later they all go away. We're talking about a sustained employment base that is relatively stable over many decades.

It's -- it's not the same as a boom and bust oil thing where you have, you know, your -- where your field production is -- is a matter of a 10-year production -- something like that. It's a completely different situation.

And so we expect, as I say, about one square mile of surface disturbance over this 25 years for the -- on the square mile lease.

We're in the process of -- of conducting our pilot. We have essentially the -- the -- well geometry is slightly different. This -- this little movie here shows you essentially a rotating view of our -- of our production and heater wells, and our monitoring wells.

See if this were monitoring wells around it, now the top here you can see they're spaced.

A little story about this is when we -- the -- the triangle is really convection loop. And that distinguishes our process from other people. We're trying to use convection as a way of accelerating the heat transfer.

There's different ways you can try to make it. You know, an analogy your -- your common experience.

One is -- is the idea of -- of using some -- sort of like a -- a vegetable steamer. You're not -- we have a boiling liquid at the bottom which is in this case is oil. And it's boiling. And -- and taking this -- this vapor, hot vapor, up into the formation which condenses and then runs back down.

So it's sort of like steaming vegetables instead of boiling vegetables.

Or you could make the analogy it's -- you know, it's the difference between using radiant heat in your -- in your walls versus forced air heat. You know, these -- these are sort of somewhat analogous to the issue we're talking about.

And the heater is really in the bottom part of submerging an oil pool which then distributes the heat. And -- and a part of our R&D is to find out essentially how much more effective this convective heat transfer is than -- than the simple conduction.

It's somewhere between one in 10 and our R&D is trying to find out what -- what that number is.

Modeling capability is not really adequate at these -- this stage to really give you an accurate estimation.

So we -- we're very close to starting our pilot. This is a -- an aerial view of our facilities. The three wells or the three pads on the outline are our hydrological monitoring wells which were mentioned by Michele.

We've been monitoring ground water for now for about 2.5 years.

The center two pads are our production pad. We -- the -- on the right-hand side is where the -- the liquids and vapors are produced. They're piped in over to the -- the left-hand pipe where we have a -- a processing building that essentially separates out the -- the lighter components of the oil which we then send back -- sent back into the -- the retort.

The reason we do that is because in order to have the proper boiling characteristics of this oil pool, we have to have -- we have to do a selection and -- and put the light oil back down.

And then basically it's all ready. We've -- we've had some -- a vendor for our heater has had some manufacturing problems. And it's delayed compared to what we expected.

As soon as those are resolved or we're able to find an alternative vendor we will start our pilot because everything else is -- is ready to go and been tested out.

And -- and so I just mention that we often heard statements by -- by high level officials and politicians about nobody was doing anything on the RD&D leases.

In fact, we -- we've been working very diligently for five years. You don't want to dismiss how long it takes to actually get permits. It takes lots of permits. I don't know exactly how many permits. It's probably 100 or so permits, some major, some minor.

And it takes a long time to do all that.

And as well as doing -- you know, the design and the construction and all that. And 10 years is not a long time when you're essentially trying to demonstrate a new process.

And I think -- you know, the issue with R&D is that you want to have multiple approaches that you're pursuing because it's very difficult in the advanced to predict all the winners and losers in an R&D process. There really is a process of natural selection. You really want, as a -- at a -- a country to be pursuing a variety of things to find out which ones really pan out to be the best.

Thank you.

(APPLAUSE)

BOAK: So that's the formal part. And now it's time for questions and answers.

I have a few that were submitted previously. But in order to get the opportunity for the audience to participate a bunch, I may only ask one or two of these.

And I guess I would ask for each of the developers here, this question was phrased as what are the key barriers. But I'd really like to phrase it as what are the key hurdles along the pathway in both technical and regulatory and whatever?

What are the key hurdles in the path to oil shale development? And with a special emphasis on -- on how the federal

government might be able to help for what they should be doing?

Why don't I start with Rikki and give Alan a rest. We'll go this way.

HRENKO: Sure.

Well, I -- I...

BOAK: OK. Feel free to defer to Harry (ph) if you wish...

HRENKO: And Harry (ph) please step in if -- if there's something that you add -- want to add.

But I would start by saying a key policy hurdle is the misconception that this is something, at least for surface processing from speaking from my project points of view, that this is something unique, different or new.

There are a number of industries in the U.S., in the State of Utah, in the region that are analogous examples of how to permit this kind of a project.

This is a simple mining project. The mining component is nothing unique to oil shale. This is a simple mineral processing project.

There are hundreds of mineral processing projects operating commercially today in the U.S.

The refining industry can be taken as an example as well. It goes into conventional pipelines. This industry is not something that requires a new set of regulations or something that you cannot anticipate or understand how to control.

So from a permitting point of view, I don't see that there is in reality a large barrier. It's just a misconception or an unwillingness to think outside of the box a little and look at the existing analogous industries to draw from as an example.

HARRY (ph): I couldn't agree more with Rikki.

Rikki (inaudible) just generalizing and add to that.

I mean, we are running an industry at home in Estonia. We have projects here in the U.S. and Utah. We have also resource and projects in -- in Jordan. And I must admit that there are more similarities and difference between those governments.

So it's -- it's the unique -- not the unique, but I mean the general problem that -- I mean, the pace of decision making how quick their decisions are made that willingness of developing -- develop a new groundbreaking industry and -- and the -- and readiness of the government and to see the opportunity and sometimes take some risks.

That was a (inaudible) and they are pretty much common to all the governments we have been dealing with.

Thank you.

BOAK: Laura?

NELSON: Well, I -- I -- I agree with everything that Rikki and Harry (ph) said. And I think at the foundation of that, the real issue is public perception. That is really the biggest hurdle.

Because that public perception which is, I think, fired by a lot of old or misinformation on what the economics, what the technological capabilities, what the environmental impacts of oil shale development are, are really misleading. And that filters into a lot of policy and regulatory avenues where we have to work.

And so what you see on the permitting side is that the permitting and regulatory processes take substantially longer than they do for similar processes using similar technologies in other areas that Rikki mentioned.

So I think that that public perception is key. And we as industry, I think, work very hard to talk about the benefits of our processes whether it's generating jobs, or whether it's actually improvements to the environment.

They're not the least of which, I think, delivery of -- of a very valuable resource to -- to the American economy and also globally.

So I think that changing those public perceptions and changing that tide is -- is really a monumental effort and one that we absolutely have to undertake.

(UNKNOWN): Maybe I -- I could take this and say, represents an operation company.

I sit on the management board of Enefit and we are a -- about EUR 900 million (inaudible) company. We mine about 8 million tons of oil shale per annum.

We run oil shale fire powered plants about the size of 2,000 megawatts capacity. And we produce -- and we alone, we produce 5,000 barrels of oil derived out of oil shale rock today.

As economics, I mean, the company in total, so oil and power together, we make a -- a -- a dividend to our shareholder about EUR 60 million per annum, just (inaudible) the average over the last year.

We don't receive any subsidies whatsoever. (Inaudible) barrel of oil that we produce we make a profit that today's oil price which was the (inaudible) today 95. We make about $40 of EBIT, so earnings before interest and tax a barrel of oil.

We are, as Rikki explained, building a -- a new plant, shale oil plant that is going to be on line this year. The breakeven level of this plant is going to be somewhere between $60-$65 per barrel. So those are the rough numbers of our economics.

HRENKO: I would just add that that is all published data as well. You're free to go onto our website, our annual reports are published which has the breakdown by business segments, the power production by oil production, by mining. And there's quite a bit more information that's publicly available.

BOAK: Also, oil and gas (inaudible) published a series of articles on oil shale in -- I believe it was January-February of 2009.

One of those described the economics of oil shale based on InTech's model. InTech was working for the Office of Oil Shale -- what is it-- National Petroleum and Oil Shale Reserves.

Their estimate was for an in situ process of a breakeven -- or on an breakeven cost. But a reasonable rate of return for an in situ process is $38 a barrel for some of the mining processes higher up to, I think, 60 to 65 somewhere in that range.

They -- they mention -- they -- underlying that are some articles in the Society of Petroleum Engineering, I believe in Journal of Petroleum Technology, probably slightly predating that.

And they did an update in one of the oil shale symposia, I think the 2009 Oil Shale Symposia, saying what the effect was of the rapidly rising costs of oil because as price goes up so do costs, reg costs and things like that.

So there is at least one presentation that tries to address that adjustment. Again, they have tended to be below the current oil price which, I believe, is something that's often said that it's always, you know, you always need a slightly

higher price than the current price.

That's no longer true.

QUESTION: (OFF-MIKE).

BOAK: The place I read it is in Journal -- Oil & Gas Journal in early 2009, I believe it is, January-February. I can get it when I get back.

And then underlying it, I think, was more detailed description of that in an SPE article.

(Inaudible).

QUESTION: (OFF-MIKE) I think it was (inaudible).

BOAK: And they did some variation sometimes.

QUESTION: Yes. (OFF-MIKE).

BOAK: Yes?

QUESTION: (OFF-MIKE).

NELSON (?): Do you mind if I -- oh, does Alan want to...

BOAK: We'll let Alan go first.

BURNHAM: So let's go back to 1920 when we had the first look at (OFF-MIKE) and of course then there was these massive discoveries of oil in Texas. And then if you go to the 1970s, there was not a true shortage of oil. There was a politically inspired shortage of oil by the -- by the OPEC.

And the OPEC cartel was broken by essentially production coming on line from the Alaska North Slope and the North Sea, et cetera.

So you asked a good question. What's different this time?

And -- and the -- the answer that I think most industry people would say is that they don't expect to see the oil prices drop substantially. The -- the one thing that is -- is maybe a -- a -- a bit of a new wrinkle over the past year is the question of -- of the shale -- shale hosted oil.

You know, how big will I really be? What will -- what will its effect on prices be?

And so certainly if -- if -- if there's a -- a lot of cheap oil discovered that can be produced for $25 a barrel, shale oil is going to create it again.

And so that's really the question you're asking, what is the probability of that happening?

I think most people pursuing oil shale today do not think that is going to happen.

The -- with the increasing demand from the developing countries, the -- in fact the price of oil will stay high. There was -- I was given a --a sheet from the -- the CEO of Total says that basically they're -- they're planning on the price of oil being at $80 a barrel or more for the -- you know, for -- for the future.

It may dip, you know, momentarily below that. But, you know, you -- you know, companies don't make plans on

noise. They make plans on long term trends.

BOAK: Laura, do you want to comment too?

NELSON: Yes. I don't know that my comments will be significantly different than Alan's. And I certainly agree with everything he -- he said.

That I think that the demand picture today, and we heard that from Mr. Caruso is fundamentally different if there's a lot more global pressure and the need for more liquid fuels.

I also just want to emphasize the fact that we don't -- we aren't subsidized. Red Leaf was founded in 2006, as I mentioned in my presentation. A lot of our time spent has been spent raising private funds.

We are a private company. And we have been able to secure those investments through some significant downturns. If you think back to February of 2009, I think that the price of oil was about $32 a barrel there for a while.

So even through that period, even during a significant downturn, we continue to move forward with our RD&D effort at that time, and to plan for commercialization.

So speaking for Red Leaf, I can say that we fundamentally believe our -- our economics are quite sound under a variety of oil price scenarios. And that in fact development can be competitive with new finds of conventional oil.

So that's -- that was my limited comments.

BOAK: I'll add. I've seen -- I've just seen one headline. It suggests that the U.S. could be 80 percent reliant on renewable energy sources by 2050.

But most projections I've seen are far less optimistic than that. And suggest that we have several generations to go before we can transition away from hydrocarbon based resources. That it's going to be exceedingly challenging to change that.

And the history of -- of energy consumption in this country strongly supports that the only energy resource that's increased it significantly in market share more or less in the U.S. in the past 50 years is nuclear.

It's also the only energy resource that once it began to slow its growth, most energy resources go through a period of -- of exponential growth at some rate. And that rate has actually increased with time, the ability to ramp up a large energy resource is better now than it was 150 years ago when wood was the major resource.

But once they reached that sort of declining slope, once they break from that linear -- from that exponential growth rate, no -- no major energy resource has done more than double, except nuclear, which has more than tripled since it began to slow its growth.

So it's an interesting question, where we're going to get in the near future.

But I'm fond of an Arab proverb that says if you think you'll solve the problem in your lifetime, you haven't taken on a big enough challenge.

The energy transition this nation and the world is going through is not that kind of problem, does not have that problem. It's, I think, going to be -- and I'll be happy if we get close to the point of renewable as being half of our energy supply before I check out.

And I'm hoping that's still a ways off.

QUESTION: (OFF-MIKE). But there's also another trend that may say (inaudible). There's a lot of dynamics here and depending on what side of the equation (inaudible).

BOAK: We'll start on the diesel rich side from the Estonians maybe.

HARRY (ph): The experience we have that -- I'm going to say roughly 80 percent of the liquid that we produce is -- I mean, well suited either for diesel production or (inaudible) gas oil.

I mean that's -- and I mean I think that's roughly the same proportion we have also for (inaudible) project and the same also for Jordan, so our experience mostly these product.

BURNHAM: Yes, I think most people talk about the oil shale having very little resid, very high diesel, jet fuel type content and -- and smaller amounts of gasoline.

So it is -- it has been considered as a -- as something you might even ship to Canada as a diluent for Bitumen. There's lots of different scenarios that are being discussed.

I just mention that the in situ processes tend to cook out a lot of the undesirable components that have been an issue with -- with shale oil refining in the future. Our -- from our laboratory tests, we're -- we're finding around 0.5 percent nitrogen instead of 2 percent nitrogen.

We coproduce hydrogen with our process. there's enough hydrogen theoretically to actually do all the upgrading of the diesel fraction and essentially have a -- a -- a hydrotreater that essentially gives finished products without having to do the steam reforming that is the big water usage.

But gasoline is manufactured in a different story with -- with all the catalytic rearranging you have to do for getting the octane out. So that would be something that we would ship off to a refinery.

But it's conceivable we could actually ship a -- a marketable diesel directly from our -- our offshore retort.

BOAK: Anyone else?

CARUSO: I think -- I think it's important to note that because oil shale was always a bit of a challenge because of the high energy requirements to oil shale companies have always emphasized the importance of trying to -- they're trying to capture as much value as possible from the products so there are a lot of specialty products that are separated from -- especially the Estonian oil that are high value products.

And so the constant search for what can we do with all of these products. The Chinese for example are -- are targeting using all of the mineral residue of this rock -- of the rock material that -- that's left over in a wide variety of engineering processes that lead -- at the simplest end to brick and to cement block and cement feedstocks to a bunch of highly separated materials like silicon and alumina.

So capturing value and -- and -- and minimizing waste products has always been a piece of the oil shale industry.

QUESTION: (OFF-MIKE).

THOMAS: We have submitted comments to interior -- about the 2012 draft proposed for (inaudible) environmental impacts statement.

We believe that with -- because this resource as we've been discussing today has tremendous potential to meet U.S. need for liquids in particular, it's -- it's worth going forward and -- and making this resource available.

So we -- we favor resource availability at the front end. There are many stages to environmental evaluation of the

technology.

As the development goes forward, we've heard about a lot of permits. So I think having resource availability at this point is important. And the environmental aspects of potential commercial development can certainly be evaluated as those development plans actually are matured, formalized, permits are applied for, et cetera.

QUESTION: (OFF-MIKE).

THOMAS: I think what we would be looking for now is a comfort that commercial leasing will be available in this country.

And not taking lands off the table at this point before technologies are fully developed, before all the environmental questions are answered.

BOAK: I would say...

THOMAS: We're not looking for a commercial lease right now. Because we have at least a decade of research to do before we will be ready to make a commerciality decision.

BOAK: It's important to recognize the distinction between the in situ processes which are in a more research oriented phase, at this point in a much more developed surface process. It seems to me it's not unreasonable that a commercial lease should ask that companies specify their technology they're going to use in an area where there is quite a range of different technology potentially applicable.

I think that provides an adequate screening. I believe that BLM has adequate screening simply by asking that question.

It does seem to me that perhaps the questions being asked of oil shale are -- are much deeper than the questions being asked of any other land that is leased. And so you would have to wonder about equity in that regard.

But I think for a technology -- for an area where technology, some of it is not yet fully readily available and some of it is, it may well be reasonable for BLM to say we can't give you a commercial lease until we know what approach you're going to take.

Some would -- would contest that idea. I think it's not unreasonable.

Other questions from the audience?

Tony?

QUESTION: Well, (inaudible) believe the (OFF-MIKE).

(UNKNOWN): (Inaudible).

BURNHAM: So we -- we have done some calculations on that. What we find is without carbon sequestration, we would have CO2 generation around 20 percent higher than conventional fuel oil when you talk about all the way through consumption.

And of course, as I'm sure you're aware, the vast majority of that is in -- in -- in the usage. So the biggest lever arm and -- and also the cheapest lever arm is to increase the efficiency of -- of use of the final fuel.

The other thing -- I didn't mention our energy efficiency. It ranges from four to five, our energy gain, depending on exactly how you calculate it. And there are -- people argue about exactly how you should calculate that.

If you -- if you want to go to carbon sequestration, you actually decrease your energy efficiency because it takes energy to do that. And -- and so that's a tradeoff you have to consider.

And -- and it's my contention that the energy gain is actually really not a number that's relevant. There are two numbers that are relevant.

Number one is what is your return on investment from a financial standpoint, and what is your CO2 mission per final fuel delivered. Those are the two things that are actually important.

The energy gain is -- is sort of a side issue. And -- and -- and I think a lot of people would agree with me on that.

But it is -- it is possible, essentially, to bring it into essentially an equivalence with -- with conventional crude oil with an -- with an investment of a few dollars per barrel, so -- so that's the thing that can be done if society wants that to be done. And is willing to pay that extra price for -- for their gasoline, it could be done.

THOMAS: And I think what -- what Alan perhaps didn't say explicitly but what needs to be considered is that the CO2 emissions from the development of oil shale generally, I mean ours would be from a power plant. So whatever technologies are developed to -- to capture and sequester that would be amenable to the process.

So whatever we decide to do as a nation with respect to carbon capture and sequestration could be applied to these -- these processes as well. It's not a separate and distinct emission.

HARRY (ph): My fundamental attitude towards it has been just on use. If we don't solve the problem of CO2 emissions, oil shale is not going to make a significant contributor to that. It's the traditional hydrocarbon industry.

If we do solve it, that's the same solution will apply to oil shale. So it's not actually specific to the industry although the emissions are somewhat higher.

It's important to note that the work that Adam (ph) and Alan and I did on -- on the issue of CO2 emissions applied to technologies that were relatively well characterized at the time (inaudible) concluded only (inaudible) which uses a fair amount of electrical heat.

There has not been an evaluation (inaudible) of the ExxonMobil in situ approach or of the (inaudible). I think Alan may have done some of that.

But I don't know if he published it.

BURNHAM: It was in a Utah unconventional fuels conference. So those -- those numbers are available. They are, you know, based on early conceptual designs of commercial processes.

But they -- to a ballpark in talking to other people, other industries, they're getting sort of similar sorts of numbers.

(UNKNOWN): (OFF-MIKE).

HRENKO: Yes, I would just add to that, I agree with everything that Michele has said that absolutely it applies to the surface side as well.

But just to add to that, we did publish a third-party analysis and comparison of CO2 emissions from the Estonian oil shale industry as compared to total liquids, and I believe also ethanol and oil sands, from different oil sands technologies and conventional oils.

At the 2010, I believe, Oil Shale Symposium in Golden, Colorado and those were independent third-party calculations done by Jacob Consultancies (ph), so we've been pretty transparent on the issue and where we compare in

terms of the other alternative oil products.

(UNKNOWN): (OFF-MIKE).

HRENKO: It may have been 2011.

NELSON (?): Your (inaudible) comment. And I -- I believe this is on our website as well.

Our process produces about two-thirds less CO2 than historic methods of producing oil from oil shales. So that was absolutely one of the issues that we thought we needed to capture, and when we developed our technology.

And we are about on par with conventional oil production to date. And also our patents do cover again, as I think Michelle mentioned once that becomes a social objective that we want to pursue, our patents do cover carbon capture and sequestration.

QUESTION: (OFF-MIKE).

NELSON (?): Yes.

(LAUGHTER)

But I would add to that that, you know, while you're developing that technology, you're continually learning new things too, so as -- as a technology matures, additional patents would be pursued.

BOAK: (OFF-MIKE). But it's available. And I understand Michele's patent (inaudible) are particularly proud of the fact that while they must disclose the (inaudible) patent (inaudible) they don't have to specify where they (inaudible).

HARRY (ph): Jeremy, I might just add that there's a lot more to running an efficient operation than just patents. There's an awful lot of trade secret and -- and -- and -- so it's -- you know, it's not a matter of just reading some of these patents and say oh yes, I can do that.

It's -- it's not that easy.

BOAK: We can source some of the knowledge on silicon based computers critical (inaudible).

(LAUGHTER)

Any other questions?

Well, I want to thank you all for coming. We appreciate your attention and your questions.

And we hope you'll stay in touch. And if you need any inspiration for any (inaudible) participants, I believe that Emily can -- can be your contact at API.

(APPLAUSE)

END

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