REPRINTED FROM
PROJECT FINANCE
NewsWire
September 2006

New Technologies to Displace Oil: Are They Financeable?

The threats by Iran to build nuclear weapons, the deteriorating security situation in Iraq, the hostilities in Lebanon and the rebel attacks against oil installations in Nigeria are contributing to skyrocketing oil prices. New York Times columnist Tom Friedman predicts that if oil hits $100 a barrel, there will be a rapid demand response in the United States. Many companies are not waiting for $100 oil to act. They are already hard at work on coal gasification and coal-to-liquids plants, new ways to tap tar sands and other technologies that will eventually reduce demand for oil. Are these projects financeable and are they likely to have a major impact?

A panel discussed this topic at a Chadbourne conference in June. The speakers are Steven Greenwald, a managing director with Credit Suisse, Dr. Robert Kelly, a former Enron executive who is now a principal with coal-to-liquids developer DKRW, Merrick Kerr, executive vice president and chief financial officer of Rentech, another coal-to-liquids developer, Tom Shelby, senior vice president for oil and gas at Kiewit, and Yoram Bronicki, chief operating officer of Ormat Technologies. The moderator is Todd Alexander from the Chadbourne New York office.

MR. ALEXANDER: Tom Shelby, there is talk today about long-term shortages of oil. Should we be worried?

MR. SHELBY: There is a smaller margin in oil supply today compared to demand, but is there a long-term shortage of oil? As long as oil prices remain high, the market will respond by looking for alternatives. The alternatives include LNG imports and increased recoveries from oil sands. As long as oil remains at $70 a barrel, people will look hard for alternatives. Even $40 a barrel provides a powerful incentive to find alternatives.

DR. KELLY: Oil demand has finally caught up with supply. There used to be a lot more slack in the system. That slack is gone. From a geological perspective, I think the oil is there. The real instability is in the political arena — in places like Iran, Bolivia and Venezuela. That dynamic is as much to blame for tightening oil supplies as geology. It is making the oil majors think harder about the risk of exploring for new supplies offshore in the Middle East and South America.

Oil Prices

MR. ALEXANDER: Steve Greenwald, it seems fairly well accepted / continued page 2

CHADBOURNE & PARKE LLP

New Technologies

continued from page 1

that we are in for a period of higher oil prices. How does this play out in the deals that cross your desk?

MR. GREENWALD: It is reflected in the mix of deals we see today. We are seeing everything from IGCC plants to coal-to-liquids projects. It plays out in the fact that I am flanked on this panel by two coal-to-liquids developers. However, the real issue is investors are not willing to bet that oil will remain at $70 a barrel or even at $50 a barrel. That is the real challenge for these new technologies. There will not be a lot of private capital to develop new technologies until investors conclude oil prices will remain high in the longer term.

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The banks are assuming oil will fall to the low $20 range per barrel in the downside cases they are running for current loans. One of the more recent price decks we saw for a rating agency assumed $18 a barrel long term. The rating agencies have been remarkably inconsistent. We have seen BB-rated projects at about a $30 break-even point. Then you can ask whether particular projects are economic at $30 a barrel or whether they require an oil price that is higher than that. Banks do not appear willing to bet on projects that require oil prices to remain at $30 a barrel or higher. I am not talking about 2006 or 2007 oil prices, but prices over the next five to 10 years. I am working currently with an oil major on a project in Nigeria, and we are running cases at $30 a barrel flat, and I think we are being aggressive.

MR. ALEXANDER: Merrick Kerr, Steve Greenwald has probably just explained why the oil majors are not all over coal-to-liquids. What oil prices do such projects require to be economic?

MR. KERR: The reason the majors assume that oil prices will fall is that oil costs a lot less per barrel to produce than the price at which it is selling in the current market. Another factor to keep in mind is the world seems to be working fine with oil at $50 a barrel. The economy seems to have absorbed the shock and is still growing. When you have oil supply controlled by a small number of people, there is no reason for them to let the price fall back to $15 or $20 a barrel. That's the counterargument for why oil prices will remain high.

Turning to the coal-to-liquids process, the first phase is gasification. You take the coal, convert it into a synthetic gas. It then runs through the Fischer-Tropsch process, which was developed by the Germans for the war effort when they had no access to oil. It was then further developed and commercialized by SASOL in South Africa during apartheid when they had no access to world oil. Today, SASOL produces about 180,000 barrels a day.

In terms of the economics, the process probably breaks even and makes a small return somewhere around $40 a barrel.

Coal reserves in the United States are huge. If you use just 5% of US coal to make liquid fuel with the Rentech Fischer-Tropsch process, it would be equivalent to doubling US oil reserves. That is a staggering statistic.

MR. ALEXANDER: Bob Kelly, is this the right time for coal-to-liquids given what we have heard about long-term oil prices?

DR. KELLY: Steve Greenwald is exactly right. Oil was $10 a barrel in 1997. Until the view in the market changes about where oil prices are likely to be long term, we will face resistance in the market to financing coal-to-liquids projects. The fact is the majors are finding less and less new oil. The bet that Rentech and we are making is that the market will understand the technology and operating risk. We are where tar sands projects were 10 or 20 years ago. The market got comfortable enough to finance them.

Our view is the market will get comfortable sooner rather than later. That's why we are working steadily on our Medicine Bow project, which has a capacity to produce 11,000 barrels a day of coal liquids. We expect to go to financing next

year. We will have to take care of the oil price risk by hedging. How do you do that? Some people are looking at the US Department of Defense. We are not particularly interested in that. There are all kinds of hedging instruments on Wall Street to hedge financial risks.

Even though the price deck is $25 or $30 a barrel, you can put option hedges on oil for $40, $50 or $60 a barrel. The issue is who is going to profit if oil prices prove different than expected.

Tar Sands

MR. ALEXANDER: Yoram Bronicki, we keep hearing the phrase oil sands or tar sands. You have been focusing on tar sands projects in Canada. How do they fit into the larger energy equation?

MR. BRONICKI: There are two major types of production in the tar sands in Canada. The one that started in the mid-1960s is basically mining a sand oil layer and then separating the oil from the sand. This is labor intensive, equipment intensive and somewhat energy intensive. It is simple separation. And because of the characteristics of the oil and the fact that most refineries cannot digest a big diet of that oil, there is some kind of upgrading that is done on site. Output in Canada is between 400,000 and 500,000 barrels a day.

MR. ALEXANDER: Do you know how many barrels of oil the US consumes a day?

MR. BRONICKI: About 20 million barrels.

The newer tar sands projects use *in situ* combustion, which is done mostly by injecting steam into the reservoir, lowering the viscosity of the oil, and then bringing the oil to the surface. This is energy intensive, but it is not as intensive in terms of equipment and labor. These newer projects produce 250,000 to 300,000 barrels a day. This product must also be upgraded either on site or in the Alberta refineries because it is very difficult to transport otherwise.

MR. ALEXANDER: What oil price do the tar sands producers need in order for their projects to make sense economically?

MR. BRONICKI: Some of the producers have been making money, although the capital recovery was done with the help of grants. If one ignores the sunk capital, I believe they have been making money with oil around $18 a barrel. Other projects can function with $25 oil. Of course, as the oil price increases, all projects do much better.

MR. ALEXANDER: Tom Shelby, what has been your experience with tar sands? I know Kiewit opened an office in Calgary before most people had even heard the term tar sands.

MR. SHELBY: I wouldn't go quite that far. Suncor has been recovering oil from tar sands or oil sands in Canada since 1965 or 1968, something around that time frame. There have been periodic spurts in activity. We opened an office there a few years ago after concluding that the market was likely to see explosive growth. The Calgary office was opened specifically to target oil sands. Before that, we had been working off and on with such projects, but from our other offices.

MR. ALEXANDER: What is the future for tar sands?

MR. SHELBY: We are expecting intense activity for at least the next 10 years. Any forecast is a bet on oil prices. At the moment, prices are through the roof. There is a real labor shortage. We are expecting $10 to $15 billion a year to be invested in oil sands for the next 10 years. The oil is capital intensive to recover, but it is a good market because it is politically stable.

Technology Risk

MR. ALEXANDER: Let me ask you about another area where I know you have experience — gasification. How much potential does Kiewit see for substituting other hydrocarbons for oil using gasification?

MR. SHELBY: We are seeing a lot of interest in gasification not only from the regulated utilities, but also from independent power producers. However, while people are willing to spend some money, they are not necessarily willing to spend the money that it takes to get a job across the finish line.

Everybody is interested in gasification, whether it is IGCC or coal-to-liquids. The Department of Energy is pushing to make jet fuel made from coal. We see a lot of interest, but not yet a clear path to finance such projects to allow them to start construction. Financiers are still asking for a huge risk premium even though the projects involve a known technology that has been in use since World War II. The problem is one of scale. There is risk in scaling up to a plant that is in the $1 to $1.5 billion range, and it is unclear who is going to provide all the guarantees required to get such a large plant to financing.

MR. ALEXANDER: Steve Greenwald, do you have the answer?

MR. GREENWALD: The first thing you learn about project finance is it is an exercise in risk allocation. You allocate risks to the parties who are best suited to take them. If a Kiewit, Fluor or Bechtel cannot get comfortable enough when building these facilities and partnering with a General Electric or Conoco to ensure they work, how are you going to ask a bunch of banks who are looking to earn a 1.5¢ or 2¢ spread */ continued page 4*

New Technologies

continued from page 3

on their money to take the risk that the plant will work? At the end of the day, either the construction contractors and equipment vendors will have to step up to the technology risk or the Department of Energy will have to do it. I think the Department of Energy will end up taking the risk on the first couple plants because I don't know that the Kiewits and Fluors will be comfortable doing it. That is really where the challenge lies.

Banks are assuming that oil prices will fall to the low $20 range per barrel in the downside cases they are running for current loans.

MR. BRONICKI: The OPTI project will be the first gasifier built in Canada. It is actually under construction now. It is a 4,000-ton-a-day gasification unit. The key to gasification is to use the gasifier where you really need it. It will be used for the low grade, low value fuels that otherwise are just being left in the ground. The cost of gasification is reasonable as long as you use it for the right application.

MR. GREENWALD: I think gasification has a shot because banks are more comfortable with coal gasification. The construction contractors seem to be comfortable with it as well. However, going the next step through Fischer-Tropsch to liquids is more problematic. I think IGCC is next to impossible without someone stepping up because there is a history with IGCC and none of it is very good. However, gasification by itself is the one new area where I personally have a little bit of hope.

MR. SHELBY: The gasification on the OPTI-Exxon job was not wrapped. The project was not financed by having a Kiewit say, "We'll guarantee you that we will design it, build it and have it on line by a fixed certain date." Who is bearing that risk?

MR. BRONICKI: The owner. Somebody has to be brave, right?

MR. ALEXANDER: Merrick Kerr, Rentech is planning to build a commercial-scale coal-to-liquids plant and your company has an interesting strategy for getting past the problem that banks are unwilling to finance new technologies. Can you say what that strategy is?

MR. KERR: I wish I had been with the company in time to take credit for what is a very clever strategy, but I am new to Rentech. What we have done is acquire an ammonia fertilizer plant that operates currently with natural gas. We will then add a production line to make gas from coal. This syngas will supply the needs for the fertilizer plant and it will also produce extra gas that can be converted into FT liquids using a Fischer-Tropsch process. We will finance the part that makes the FT liquids using all equity. The first stage – the gasification line to make gas for fertilizer production – will produce 1,800 barrels a day and will be the first commercial-scale facility in the United States. This strategy gets us past the hurdle of having to ask banks to step up to risk associated with the FT technology.

We know the technology works. Our technology is similar enough to the technology that SASOL uses to take comfort from their long history of putting it to actual use. If we want to get this done, we cannot wait for the federal government to step up to project risk.

MR. ALEXANDER: Bob Kelly, DKRW is working on its own coal-to-liquids plant. What is its strategy for dealing with technology risk?

DR. KELLY: We are kind of hitting it straight down the middle of the fairway. We have acquired significant coal reserves to back up our activity. We have partnered with Arch Coal. We have acquired a couple hundred million tons of coal that will belong to the project company and will be a significant source of security. We have General Electric as our partner on gasification. We have Rentech as our partner on the Fischer-Tropsch process. We have a major Rocky Mountain refiner willing to take all the output under a long-term contract. We will do some hedging to fix the price structure on the oil. And you know what? My view is the market works. We have found a number of major engineering firms that are willing to work

with us to understand the technology and put the wraps around it that are required to make the project financeable.

MR. ALEXANDER: Can you give us an idea of the size of the project? How much exposure and what type of liabilities are involved?

DR. KELLY: It is a little bit of apples and oranges because we have acquired the coal. The CTL portion is expected to produce about 11,000 barrels a day and will cost about $1 billion. The coal and related parts of the project cost around $400 million.

Our strategy is plain vanilla project financing. The Energy Policy Act authorized the Department of Energy to guarantee the debt on projects of this kind. The details of the DOE program are expected to be released later this year. We are one of the leading companies that DOE is expecting to apply.

If you look at the opportunities for putting stranded coal to use, I think the engineering companies will step up to the challenge. Even DOE is projecting that somewhere between one and two million barrels a day of oil equivalent can be produced over the next 10 to 20 years.

Government Role

MR. ALEXANDER: Steve Greenwald, how important a role will the US government have to play to get projects of this kind off the ground?

MR. GREENWALD: There is a huge role for the federal government to play if it really gets serious. Having a few companies like Rentech and DKRW build coal-to-liquids plants is not going to solve this country's energy problem.

It will not be solved, in my humble opinion, until the major oil companies have come on board. They will not do so as long as they are projecting long-term oil prices of below $30 a barrel and they see other opportunities to produce oil at lower cost. If the federal government is serious, it will have to say, "You build these things, and we will guarantee you we will buy the product from you at a 10% discount to the market, but in no event will the price we pay drop below" – pick a number – "$35 a barrel."

As a taxpayer — and I believe passionately about this — if the federal government ends up paying Exxon Mobil, for example, billions of dollars a year because the price of oil falls to $28 a barrel, I am fine with that. I think it is a win-win situation for the country. I don't understand why the federal government is not getting more serious about this.

We are working with the Department of Defense on structures like this. That is one way to solve the price or cost-of-production problem. It does not get over the technology risk issues, but frankly, Exxon, Conoco or British Petroleum could build these things without requiring the Kiewits and Fluors of this world to wrap them. The reason they are not building them is they do not want to go into a venture that requires oil prices to remain at $35 a barrel to break even.

MR. ALEXANDER: Tom Shelby, what do you think the government should be doing?

MR. SHELBY: It ought to help the contractor lower the risk profile as it is doing with nuclear power plants. I think the price of oil will settle at a level that makes it economic to pursue oil substitutes, but we have a technology problem. I agree with Steve Greenwald. Eventually Exxon or Shell will get comfortable enough with the technology to take the risk, but they are not comfortable with it today.

MR. GREENWALD: The early DOE loan guarantees will help. Giving a couple loan guarantees to a Rentech or to a DKRW will get people comfortable with technology, but it will not be sufficient to get majors to start building this stuff because they do not believe oil will remain at the $35 or $40 a barrel level required to break even on these projects over the long term.

MR. ALEXANDER: Merrick Kerr, one solution to the oil price conundrum would be to get a long-term offtake contract at a fixed price for the output. Do you see any chance of landing some type of collar or long-term contract for your syndiesel or your jet fuel or maybe even your fertilizer?

MR. KERR: Certainly, it would be the ideal to have. Another way to look at it is there is a 50-cent-gallon tax credit currently that is due to run out, but that were extended, say to 2020, that is equivalent to $21 a barrel in benefit.

If the price of oil falls back to the low $20 range, I am at $41 against a break-even point of $40. I won't make huge returns for the equity at that point, but I am certainly covering all my debt quite comfortably and I am making small returns. It would be nice to have an offtake contract, but with the loan guarantees and if the 50-cent-a-gallon tax credit is extended, then we should be financeable once we have that first plant done and with equity to get over the technology risk.

If somebody wants to give us an index price for the output with a floor and a ceiling, it would probably make a lot of sense. The Department of Defense is the obvious party to do that. The US military consumes hundreds of thousands of barrels a day to operate jets, tanks, ships and other equipment.

MR. ALEXANDER: Yoram Bronicki, what / *continued page 6*

New Technologies

continued from page 5

role do you think the federal government should play in promoting these technologies?

MR. BRONICKI: This is an area where I think taxation could do a lot. US consumption of fuel for transportation is about 14% of the world's oil supply. The average American in the west probably consumes about between two and three times more fuel than a European in a developed European country just because of the choice of vehicle. If the growth in US demand is 200,000 barrels a day of additional growth every year, then it is reasonable to cover it with the private efforts that we have been discussing today. But if the goal is to make a more significant dent in US oil consumption, then a lot more can be done by the government to encourage Americans to be more efficient in their consumption of oil.

The Europeans have decided that they want to use biodiesel and, therefore, the rest of the diesel is taxed, but biodiesel isn't. The government could do more to promote
a change in public consumption patterns while raising money that could be used to subsidize other alternative energy projects.

The opportunities to have an effect are limited in terms of time. When everyone in China drives a big SUV, whatever the US does will no longer matter, but it is important in the meantime for world stability that the US be more engaged.

And just to give an example from the geothermal side of our business that shows where government help can lead, we build geothermal power plants today for maybe a quarter of what they cost when people started building them in the late 1970s or early 1980s. Government subsidies through higher tariffs helped take the industry through the learning curve. If the Kiewits get enough practice, they will build those plants more efficiently the next time. This is how a brave policy could actually change a lot over the next 10 or 15 years.

MR. ALEXANDER: Bob Kelly, I believe you have a comment?

DR. KELLY: I have two comments. First, we are happy the majors are not getting into this right now because even though they have tremendous capital, they are bigger and slower. They will eventually buy what we do and do it on a larger scale. Second, on the price of oil, there are huge external diseconomies in the oil market today because the price of oil does not reflect security spending to ensure that Middle Eastern supplies get to the United States. If you tack all that stuff on, there is a valid reason for the US government to promote coal-to-liquids and other alternative energy projects because it leads to a more sensible resource allocation.

We are spending the equivalent of $30 or $40 a barrel to ensure that guys like the Iranian oil company can send oil over here. That is a real misallocation.

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