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FEATURE: BIOBUTANOL: NEXT GENERATION OF BIOFUELS GETS CLOSER

>> Aside from ethanol and biodiesel, other alternative fuels are emerging to work synergistically with today's biofuels and may well become their successors in moving away from petroleum-derived fuels. One such fuel is biobutanol, which is on its way toward being commercialized by Cobalt Technologies.

Rick Wilson, chief executive officer of Cobalt, recently spoke with *Ethanol & Biofuels News* about butanol's vast potential as a fuel and more, and how this new fuel can help broaden the biofuels arena.

EBN: Tell us a bit about Cobalt and what you folks are working on?

Wilson: What we're doing here is we've developed a technology to make biobutanol from cellulosic materials – think trees, think grasses, think corncobs. The reality is that normal butanol is made today from a fermentation process, but it's made from corn, and that technology is practiced in China and Asia, and the butanol that's made all goes into the chemical business to make coatings and paints and things like that.

So what we have done is we recognized first of all that if you could make normal butanol really, really cheap – and you can't make it really, really cheap from petroleum and you can't make it really, really cheap from corn



Rick Wilson, chief executive officer of Cobalt Technologies. Photo courtesy of Cobalt.

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Cobalt Technologies researchers are moving forward in bringing biobutanol to the fuels market. Photo courtesy of Cobalt.

because crude oil is too expensive and corn is too expensive. But let's say you could do that – it opens up a world of other possibilities for you because normal butanol is a platform molecule. First of all it essentially looks like unleaded gasoline in terms of its properties, it may be an improved biofuel versus ethanol, it can be converted to jet fuel, it can be converted into diesel fuel and it can, with a little bit of magic chemistry, you can turn into a bunch of other chemicals that are made from petroleum today, so what we liked is the concept of okay, if we could make this cheap enough there are all these other things we could do with it [so] the question is how you make it cheap enough, and really all it comes down to is feedstock. You need an inexpensive source of biomass, and so we've mastered the ability to use cellulosic feedstocks, the concept being that we want to use feedstocks that really are other people's waste materials, and that's how we're going to get them for cheap.

EBN: So this whole concept of butanol as a fuel is fairly new then?

Wilson: I think a lot of people have talked about it, but I think we're the first

one – see the question you're going to ask is, well Rick, if you can make butanol, if butanol is such a better fuel, and it is – compared ethanol it has a higher energy density, compared to ethanol it has a lower vapor pressure so you don't need an EPA waiver, it doesn't absorb water so you don't need to segregate it, you can move it pipelines, all these good things about it – well if they do this in China and it's such a good fuel why don't they do it in the United States? And the reason being is that you make [butanol] from corn, number one, and number two, the fermentation is really, really slow, so you really can't do it economically – the way you do it economically is you can't make it from corn, corn is too expensive, you have to make it from something cheaper, and we've reengineered the entire process, so we've dramatically accelerated the fermentation.

So those are really the two things we've done from a technology perspective. Now that we've developed and piloted the technology, our business model is to co-locate with other businesses that are already in a biomass-related business. We see ourselves partnering with pulp mills, corn ethanol

plants where we would use corncobs, as well as partnering with sawmills where we would use the treetops and limbs that aren't used to make boards as feedstock. You may have read that we have the ability, that we've demonstrated, to convert pine beetle killed pine trees, and there's a lot of them, into butanol. We're trying to enter a market with feedstocks that don't have other sources of use, so we want to avoid the “food vs. fuel” debate.

EBN: So what's new or exciting or forthcoming at Cobalt?

Wilson: Well I think you're going to find that the details haven't been announced, but we're building a demonstration facility – this is a small commercial facility and it may well be the first profitable cellulosic biorefinery in the world, and I say profitable is the key word. And another really distinctive part of Cobalt I think that sets us apart is that my view of the world is that when you try to do cellulose ethanol, the problem with ethanol is that it's very cheap. It's hard to make money in the ethanol business, so we're not going

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to start our business in the fuels business. We're going to start our business in the chemicals business, and the reason being is that you can sell normal butanol into the chemical market for \$6 or \$7 a gallon compared with ethanol at \$1.50 or \$2 a gallon.

So what that means is that when we build a plant, the investors, we depend on greed, we depend on fear here, so the greed will drive people to build these facilities very quickly once they see our demonstration facility work and what happens then is once you start, our technology is very capital efficient already, but as you build plants, you build more and more of them, you learn things, right? After you build one, the first thing you don't have to pay for is all engineering work, you've already done it once, so the cost comes down for that and you learn things, you figure how to make it cheaper and as you propagate these things through the economy the investors are excited to do it very quickly because they make a huge amount of money because they start out selling to the chemical market. And then after you've built a number of these things, now you're able to build these things for half the cost of the first one and now you're in a position to compete in the fuels market.

So the really neat thing for us is we don't have anywhere in our business model any dependence on subsidies to make us profitable. We really think it's our responsibility to develop the technology that can compete without subsidies, but that said we don't see ourselves in competition with ethanol, we see ourselves synergistic with ethanol. So I mentioned that one of the feedstocks we could potentially use is corncobs and so we see ourselves co-locating with a big corn ethanol business and that butanol can in the beginning be sold into chemicals and later on [into fuels]. One of the perfect fuel blends out there would be butanol and ethanol, because butanol only has an octane number of 87, which is unleaded regular, so wouldn't it be nice if

we could have a little bit more octane, will you can get that from ethanol. And the issue you have with ethanol is high vapor pressure, which contributes to ozone pollution, but our butanol is so low in vapor pressure that you fixed that problem with ethanol and the good thing for the United States is now you actually could probably take a butanol-ethanol blend well beyond the blend wall and even grow both businesses to the benefit of the economy.

EBN: So there's the potential for butanol to make a pretty big contribution to those renewable fuel mandates then?

Wilson: Absolutely, and I think the synergy with ethanol, it wouldn't be just butanol, it could be ethanol also, it could be a mixture that actually allows you to put much higher blends into automobiles without having problems. If you put a high concentration of ethanol in the car you'd need to do a flex fuel retrofit, because ethanol is corrosive and it damages the seals – with butanol you don't have that problem.

The other thing you should know you can do with butanol is if you do a little chemistry on it you can even send it to a refinery and a refinery can use that resulting molecule to make gasoline, so you can make true unoxxygenated gasoline from butanol through putting it into one of the refinery processes, namely a sulfuric acid alkylation unit that makes standard indistinguishable gasoline. So again it's a platform molecule, there's a lot that you have to do and we're trying, we're focused on making it as cheaply as possible and that's all about using waste feedstock.

EBN: Are you working along any time lines?

Wilson: Well we want to have a demonstration unit up and running by – which is over 1 million gallons a year – by the end of next year.

Once you build the first one, so hopefully in 2012, once everybody sees the first one work, then the question is how many can I build now, how

many larger facilities can I build, and I think with the team I have today, probably three or four. But would I like to do 30 or 40, I would, but that's about resourcing my own company ... and hopefully I can get the resources to do this dramatically.

EBN: Will we see butanol at the same scale or greater that we are seeing ethanol and biodiesel today?

Wilson: I think you could see it – well obviously the potential for butanol is much larger than ethanol. Remember I can take butanol and send it to an oil refinery and turn it into gasoline that's indistinguishable from the gasoline that people use today – so if anyone ever has any issues with it once it gets to be [in a] 30% or 40% [blend with gasoline], I can say, okay fine, you don't like the oxygenate and I can rip the oxygen out of the butanol molecule and turn it into octane and put it directly into a car. So I think its ultimate potential is much greater and I think that what's really neat about it is that unlike, as I mentioned corncobs and ag wastes, that's one potential feedstock for us, but the forests are also potential feedstocks for us – if you look at any logging operation for instance, half of the wood, half of the biomass in a forest that gets chopped down just sits there as waste.

I think the biorefinery boom with ethanol has really been focused on the Corn Belt. This next biorefinery boom could have a much broader base than you see with corn ethanol. So I think it's really exciting and the great thing about [butanol] is it's a 90% improvement in greenhouse gas reduction [over gasoline]. I think you'll see the facilities will probably be the size of ethanol plants, so you'll see a lot of these things all over the place and that's good for employment, right? So there's another real good benefit and maybe we can get out of drilling for oil off the Gulf of Mexico. ■

Louise Poirier