Text Version for Biomass Program Manager Paul Bryan's Tour of the Biochemical Conversion Section of the Biomass 2011 Interactive Exhibit Hall

[The video shows Biomass Program Manager Paul Bryan interviewing Seth Snyder of Argonne National Laboratory.]

[Seth shows Paul the Biochemical conversion display.]

Seth Snyder: What we have here set up, is some of NREL's technology and a little bit of Argonne's. We do pretreatment, we do conversion. So, we actually have a small fermenter here, we have a yeast stream, and we are producing ethanol from cellulosic sugars. This is some purified ethanol produced from NREL, so this is stuff that came out of Golden. We have here some hydrolysate streams, we take biomass, and I believe this is from corn stover, we treat it with some chemicals, we treat it with acids, we produce hydrolysate, which is the first step in decomposing biomass. Similar work at NREL, and I believe they've licensed this technology. They have some reactors for screening for new enzymes, so these are little reactors, you can do multiple experiments together, and this is to identify enzymes for saccharification.

[Seth hands Paul small bottles with samples of ethanol and hydrolysate.]

[Seth shows Paul a high throughput screening system.]

Paul Bryan: The Secretary talked about a high throughput screening system in his talk this morning, was that the same one?

Seth Snyder: Yes, it was.

Paul Bryan: Yeah, so that… he is very impressed by that, it certainly allows us to advance by looking at a wider variety of ideas more quickly in the lab.

Seth Snyder: Yes, a lot of science has been advanced by doing things in high throughput resins.

Paul Bryan: Yeah, in catalysis… in my old work in the petroleum business in the area of catalysis, high throughput experimentation is becoming a big deal.

Seth Snyder: Yes, and a generation ago it wasn't.

And the final thing we have is this technology that came from my group at Argonne, this is a technology we call a resin wafer electrodeionization, this is a separation system, we've recently licensed this technology, to Nalco who is building prototypes for commercial use. In this technology we [inaudible]… this is a Plexiglas one, in the actual system we have steel plates that, we have an electrode that…

[Seth shows Paul the laboratory-scale separation system.]

Paul Bryan: So it is a plate frame system?

Seth Snyder: Yes, it is a plate frame system… and with multiple… it is a parallel system… what we do is we flow a process solution through, and in the case of the biomass work, it is typically just a pretreatment stream, we separate out the acids, we… the pretreatment is done with sulfuric acid, we separate the sulfuric, and then we can separate the acetic acid…

Paul Bryan: Is it a straight separation, or are you doing salt-splitting?

Seth Snyder: It is actually… it does, it has a little bit of salt-splitting, the ionic… this is the material that we have patented, it's made of ionic… commercial ion exchange resins, and it provides a template for the salt splitting, so that makes it much lower energy than a traditional solution for electrodialysis…

Paul Bryan: Absolutely. Right.

Seth Snyder: So we have a series of patents on use, fabrication, and process design on stacks like this… this is actually a laboratory scale stack, so this is what we are working on in our lab. A pilot-scale stack is 18 by 24 inches, and we can process about 2,000 gallons a day. We've actually demonstrated… we've recently published a paper… using materials, corn stover from NREL, showing that we can separate both the… first the sulfuric and then the acetic acid to give you a concentrated cleaner sugar stream.

Paul Bryan: Great.

Seth Snyder: So this is a little part of what's going on at ANL in biochemical conversion.

Paul Bryan: Now the acetic removal particularly applies to fermentation inhibition?

Seth Snyder: Yes.

Paul Bryan: Whereas the sulfuric is more of an economic… acid recovery issue?

Seth Snyder: Exactly, yes. For sulfuric, the goal would be to recycle and reuse it… [inaudible] the conventional process right now is through calcium … one of the considerations is using ammonia. The problem with ammonia is it is a challenging waste stream. We are trying to avoid either one. It may be that the route to take is ammonia and recover ammonium sulfate, you could do that. We don't know what the commercial winner is yet, but we'll have to…

Paul Bryan: So it makes the process as a whole greener?

Seth Snyder: Yes, greener, more energy efficient, and cleaner waste streams.

We also see some commercial markets for what you feel can replace the whole barrel? We're partnering with ADM, producing bio-based organic acids, and we use this as a critical recovery

technology. And we actually won an R&D 100—in 2006, with ADM as a partner, using this technology.

Paul Bryan: Do you think plate frame is the right geometry for the long run?

Seth Snyder: This is definitely the right geometry in this case. People have tried spiral wound, simple plate frame, with a single membrane would have a lot of capital cost. This is a parallel step, I show about a half-dozen cell pairs. On a lab scale, we typically work up to about 10 cell pairs, on pilot scale goes about 20, commercial system would have hundreds of cell pairs, so we are avoiding basically the capital cost of plate frame. As we go larger, that is… we're scaling toward a more efficient process.

Paul Bryan: Yeah, well I mean there are commercial systems that are plate frame and are going to remain that way, but a lot of times you go to the higher specific surface area geometries.

Seth Snyder: And it doesn't… the cost of the plate frame reduces as we go to larger scale. We have one commercial skid in our system, and it was about this big, and so the two inputs are small and [inaudible].

[Seth indicates the size of the skid as comparable to that of the table.]

Paul Bryan: Great, well thank you very much Seth, I appreciate it.

Seth Snyder: Thank you.