Bounding Maine: Top 10 companies targeting Maine's forest resource for higher-value apps

September 11, 2017 | Jim Lane

Maine is the Pine Tree state and yet in recent years the industries surrounding the noble pine have been in all kinds of distress, as readers have fled newspapers and magazines for digital reading.

Now, Maine's hardwoods have been in demand. The market for maple, yellow birch, and white ash hardwoods has been strong. The tissue market is good, packaging is growing, and the sawlog market continues to shine. But pulp and paper markets have taken big hits. Headlines have centered around damaged balance sheets that make it difficult to modernize or expand, mothballed plants, bankruptcies, job losses that have struck hard at northern Maine's forest-based economy.

As **BioBased Maine**'s chief Charlotte Mace told The Digest, "There are mills struggling, and continuing to shut down paper machines as necesary. There are others going full tilt — the tissue markets track population growth and are always a good market, and Sappi is a success story, too. They're putting $200M into mill and $20M into woodyard, of which $65M to upgrade paper to packaging grade.

"But all pulp & paper mills could evolve, and we have sawmills in Maine with tons of residual chips and sawdust. Our job — and my job — is to find a new home for all our wood."

An indeed, a renaissance has been in the making, focused on apps that unlock wood sugars for higher-value materials and chemicals — displacing petroleum. Trade groups, individual companies making strategic investments, venture groups, and state resources have been at work preparing the way for a new generation of companies.

For one, think conversion of wood into cellulosic sugar intermediates, and into higher-value chemicals.

Sappi's strategic moves

Sappi is a case in point. The company is proactively seeking biotechnology for its Westbrook Paper Mill. The strategic intent is to identify and deploy economically feasible technology in support of Sappi's Biotech Business across the Group, which includes Maine. In April, Sappi issued an RFP with the help of Biobased Maine to seek proposals for biobased technologies that could be co-located with its Westbrook paper mill.

They're serious, Sappi announced that it will bolster its biorefining expertise through the acquisition of the Xylex and Versalac technologies owned by Plaxica Limited. The transaction will result in Sappi acquiring the sugar clean up technologies which includes the patents, knowhow, equipment and key technical staff of Plaxica. The size of the transaction does not require regulatory disclosure.

The technology acquisition follows Sappi's successful commissioning of a demonstration extraction unit at its Ngodwana Mill in South Africa during April 2017 to extract a sugar rich prehydrolysate stream from the PHK pulping process. The next step towards the production of clean sugars involves the clean-up of the PHK liquor or hydrolysate to separate the xylose-rich sugars from the lignin.

Strong state backing

Financing? Maine Technology Institute (MTI) is managing a $45M R&D bond to help with commercialization of new biobased products – these will be grants, not loans. There could be quick turnaround times, starting this fall. 1:1 match.

And that Maine Department of Economic and Community Development is very active in pursuing biobased technology companies, including biofuel companies, in an effort to leverage existing industrial assets. There are state loan guarantee programs and other incentives available to help with project financing.

In March, we reported that Maine's eagerness has not spilled over into foolosihness. Indeed, the Governor Paul LePage wants a tighter leash on the two companies receiving $13.4 million in biomass subsidies over the next two years to ensure that they achieve the job creation goals and wood purchases promised in order to secure the funds. The newly created program specifically to promote these two major statewide projects that should create 87 jobs and consume more than a million tons of wood annually are meant to have annual reviews to ensure goals are being met but the governor has submitted a request to the state's public utilities commission to have the promises reviewed more often than once per year.

Forest Bioproducts Research Institute

It's not a company, but FBRI has been on the move. Last September, we reported that the Defense Logistics Agency will invest $3.3 million to advance wood to jet fuel technology at the Technology Research Center of the Forest Bioproducts Research Institute at the University of Maine. The technology is based on FBRI's patented thermal deoxygenation process, which was shown to yield jet fuel test samples that have met key specification. In order to improve process economics, FBRI will investigate co-production of advanced materials, such as nanocelluose composites, as well as some high-value chemicals from woody biomass and liquid hydrocarbon fuels.

This project will explore conversion of cellulose and lignin to liquid hydrocarbon fuels, and use of hemicellose extract and cellulose fiber slip streams for developing high-value co-products. UMaine's research approach, based on potential sustainable supply of woody biomass, will provide new opportunities for high-value use as an alternative to direct combustion in biomass power plants, where energy efficiency is often very low.

FBRI recently received funding from the USDA Agricultural Research Station project – for a project on fiber-board (particle board, density board, sheetrock replacements, smaller particle size) bonded with nanocellulose, all using low-value, low-grade wood source for a higher value product. The University of Maine has a nanocellulose pilot plant which can produce 1 T per day of nanocellulose.

The Top 10

Who's targeting Maine and its massive wood basket — and residues like MSW? From projects to process for new fuels, chemicals, materials and wealth creation – here are the Top 12 companies and R&D consortia whose destinies are intertwined with the Pine Tree State.

Biofine

In May, we reported that Biofine is seeking investors to help it scale up the wood-based biofuel technology developed by the Forest Bioproducts Research Institute. The company invested $200,000 in an old small-scale biofuel plant that was converted to run on the technology and demonstrate its viability. It's now ready to scale up at the Old Mill facility where it is being tested or at other mill sites across the state that have shut down in recent years due to a decline in the pulp and paper industry.

> **Biofine seeking investors to scale up wood-based biofuel technology in Maine**
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Ensyn

In February, we reported that Ensyn is looking to source enough customers in the state to justify investment in a commercial scale biofuel facility similar to the 10.5 million gallon per year $78 million plant it is building in Quebec and the 20 million gallon facility planned for Georgia based on technology the company developed and tested in Ontario. The company has a $70 million loan guarantee from the US Department of Agriculture for the Georgia plant. Ensyn says it would need offtake agreements for about 7 million gallons in Maine to justify the investment.

Fiberight

It's not all about woods. In the case of Fiberight, it's all about MSW. In July we reported that Fiberight told a Maine community nonprofit group concerned about trash disposal that the current under-construction plant in Hampden should start taking in trash as planned in April 2018. However, the trash may be shipped to a landfill temporarily and biofuels may not be produced from the trash right away as the biofuel processor isn't scheduled for completion until June and a completely functional plant won't be ready until March 2019.

The pressure is now on for Fiberight as a new master waste supply agreement says if Fiberight isn't ready to at least accept trash by April 2018, then it will be responsible for liquidated damages. Fiberight's plant will convert organic waste into biofuels like biomethane and separate recyclables to be sent off to recycling facilities.

Maine's Born Global Challenge

At ABLC 2017, Maine's Born Global Challenge named DMC, NuFuels, Visolis, Phytonix, Renmatix and Sweetwater Energy among the first set of prequalified companies — a second round of companies will be announced after the Statements of Concept and Cooperation have been executed. D4 Energy Group, Ark Power Dynamics, Core Biofuels, Concord Blue were also named among the first prequalified set.

CRI

IH2 technology is a continuous catalytic thermo-chemical process which converts a broad range of forestry/agricultural residues and municipal wastes directly into renewable hydrocarbon transportation fuels and/or blend stocks.

The IH2 technology is an efficient conversion route for lignocellulosic biomass. Production economics have been estimated to provide hydrocarbon fuels at fully profited manufacturing costs of $2.50/gallon at 2000 tonne dry feed/day scale on a USGC basis using a full stand-alone design.

The hydrocarbons currently meet the ASTM specifications for their respective road transport fuels, positioned for the US market as an E10 gasoline fully renewable product or as a 100% fully renewable on-road diesel. Ongoing research indicates a high probability to achieve EN specification fuels or high-quality blend stocks. High-quality jet-range hydrocarbon blend stocks are also produced.

The IH2 process was developed by Gas Technology Institute (GTI) of Des Plaines, Illinois—a research, development, and training organization serving energy markets.

DMC

DMC's technology enables reproducibility and robustness to scale; Production of a diversity of targets using a single bioprocess; HTS approaches that translate to full scale performance — and the company says, "50X improvement in speed and cost of product development." The business model? Specialty chemicals, nutrition products, and pharmaceuticals, with a focus on partner agreements to quickly generate revenue and validate the technology; eventually, commercialization through strategic partnerships and existing supply chains.

Ultra-Low Cost Product Development: The Digest's 2016 8-Slide Guide to DMC

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NuFuels

NuFuels, LLC is a developer of renewable transportation fuels using environmentally responsible, cost-effective technologies. Our company locates these facilities near the feedstock source using a standardized component design that is completely scalable and flexible to accommodate different feedstocks and produce a variety of energy products.

The company projects that "By late 2018, NuFuels will break ground on its first of many fully-financed facilities in the United States. Each system will produce 1,000 barrels (42,000 gallons) of renewable JetA or 1,150 barrels of ultra-clean renewable diesel fuel per day. As a byproduct, NuFuels' facilities will also produce 35,000 tons annually of A+ quality BioChar, that is universally recognized as a critically necessary product in agriculture while providing unprecedented levels of carbon sequestration."

Phytonix

Phytonix Corporation purchased the worldwide license to a class of bacteria modified to produce biobutanol and biopentanol as drop-in replacements for gasoline. Phytonix, which expects that its bacteria could produce upwards of 20,000 gallons per acre, has patents pending globally for the process technologies that will create the unique bacteria and that will prevent the bacteria from surviving if they get into the natural environment. The company said that its bacteria will act as tiny microrefineries for a direct solar, carbon-based, liquid transportation fuel, that utilizes carbon dioxide, solar energy and water to photosynthetically produce biofuels.

Phytonix says its solar fuels microorganism may produce 20K gallons per acre of biobutanol

In North Carolina, Phytonix Corporation purchased the worldwide license to a class of bacteria modified to produce biobutanol and biopentanol as drop-in replacements for gasoline. The company said that its bacteria will act as tiny microrefineries in what Phytonix CEO Bruce Dannenberg described as a direct solar, carbon-based, liquid transportation fuel, that utilizes carbon dioxide, … Continue reading

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We reported in 2014 that Phytonix was awarded a US patent for its biobutanol production technology entitled “Designer Organisms for Photobiological Butanol Production from Carbon Dioxide and Water. In addition, Phytonix’s IP portfolio includes biosafety guarded technology, which uses a number of redundant mechanisms to prevent the proliferation of our organisms outside of a chemicals & biofuels production environment.

Renmatix

We reported last September that Bill Gates was leading the latest investment round into the pioneering cellulosic sugars producer Renmatix as energy giant Total joins in with second investment and a 1 million ton per year license.

Gates is the chairman of the Breakthrough Energy Coalition— along with Zuckerberg, Branson, Bezos, Steyer, Khosla, Doerr, and 20 others who said at the COP 21 meetings last year in Paris that:

“Current governmental funding levels for clean energy are simply insufficient to meet the challenges before us. We must also add the skills and resources of leading investors with experience in driving innovation from the lab to the marketplace. The private sector knows how to build companies, evaluate the potential for success, and take the risks that lead to taking innovative ideas and bringing them to the world.

The Renmatix transaction can be fairly seen as a first tangible investment into the low-carbon transport sector by members of this group, since the Paris announcements. For those who have followed the Renmatix story for a long-time, John Doerr and KCPB were among the foundational investors in this company and Amyris — which in turn has a foundational investment partner in Total. The Gates Foundation got Amyris’ foundational technology rolling, as another case in point.

Gates Backs Renmatix; Total takes 1 million ton/year cellulosic sugar license

In Pennsylvania, Bill Gates is leading the latest investment round into the pioneering cellulosic sugars producer Renmatix as energy giant Total joins in with second investment and a 1 million ton per year license. Gates is the chairman of the Breakthrough Energy Coalition— along with Zuckerberg, Branson, Bezos, Steyer, Khosla, Doerr, and 20 others who … Continue reading

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Sweetwater Energy

We reported in August that Sweetwater Energy finalized a licensing and joint technology development agreement with the Finnish company **MetGen** for MetGen's LIGNO technology platform which facilitates the enzymatic break down of Sweetwater's ultra-clean lignin into its fundamental component parts. This will allow the development of a full range of high value lignin-based products.

LIGNO's secret? It's MetGen's enzyme set — in this case, bred for kraft pulp applications and thereby these alkaliphilic enzymes can effectively function at a pH up to 11, where lignin becomes fully soluble, with an added benefit of outstanding thermo-tolerance — think up to 80- degrees.

Sweetwater and MetGen will carry out the commercialization of both technology platforms at Sweetwater's small commercial facility in Rochester NY and will roll the technology out to facilities world-wide.

Lignin? It's the meanest, toughest hombre of a material that ever came out of the ground, it's the Yosemite Sam of the advanced bioeconomy — unreliable, inconsistent, grumpy, fiery, strident, incapable of improvement, impossible to do anything with, and impossible to ignore. But trapped deep inside lignin are some aromatic molecules that are easily worth $1500-$2000 per tonne — more than fuels, more than most bulk chemicals. More than some people we know.

MetGen, Sweetwater unlocking lignin – the roughest, toughest, ornieri'st material that ever bushwhack'd a pioneer in the Valley of Death

MetGen, Sweetwater Energy say "there's gold in them thar side-streams" For all of your questions about the advanced bioeconomy there's just the one answer and that is "lignin". Why don't we see more biobased chemical plants built these days? Lignin. Why do people shy away from hardwoods as a raw material even though it's sustainable, … Continue reading

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Visolis

The Visolis process enables production of bio-based elastomers, unsaturated polyester resins, super adsorbent polymers, and other products using a variety of feedstocks like agri-residues, dextrose, glycerol and syn-gas. As we come down the cost curve, the same technology can be adapted to produce high energy density jet fuels.

In March 2016, we reported that the Bioenergy Technologies Office allocated $1.9 million for the U.S. Department of Energy's (DOE) Small Business Vouchers (SBV) Pilot.

The SBV initiative seeks to help small businesses bring next-generation clean energy technologies to market faster by providing access to expertise and specialized equipment at DOE's national laboratories. BETO will award vouchers to projects focused on developing and transforming our renewable biomass resources into commercially viable, high-performance biofuels, bioproducts, and biopower.

During Round 1 (September 2015–January 2016), BETO awarded a voucher to Visolis, who will work with NREL and PNNL to demonstrate the scale-up potential of their high-efficiency process technology that converts lignocellulosic-derived sugars into intermediates that can be used to produce bio-based commodity products and fuels.

Visolis, Lygos pick up support via DOE's Small Business Vouchers Pilot Program, as DOE opens funding Round 2

In Washington, the Bioenergy Technologies Office has allocated $1.9 million for the U.S. Department of Energy's (DOE) Small Business Vouchers (SBV) Pilot. Meanwhile, DOE has opened Round 2 of the Small Business Vouchers Pilot Program. Request for Assistance will be accepted at the SBV website until Sunday, April 10, 2016 at 11:59pm Eastern Daylight Time. … Continue reading

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