

# As Long as it Burns, it's Gold

Will the move to bio-fuels bolster Canada's pulp and paper industry or contribute to other global concerns?

By DAVID LEIDL



Our world has long run on crude oil, natural gas, coal and all the derivatives wrung from them. That world is changing. Economic pressures, increasing scarcity struggling with increased use and environmental concerns are ramping up the pressure on the world's finite – and dwindling – fossil fuel reserves. The world is now desperately seeking a savior technology. Enter bio-fuels and bio-chemicals; replacement and/or substitution products derived from natural, renewable biomass, living stuff grown from the earth. Forests, for example.

For the Canadian pulp and paper industry desperate for new directions and new revenue streams, the lure of bio-fuel refining – and concerns about the proverbial pitfalls – are growing too. So are the opinions. Wait and see? Or jump in now?

*Pulp & Paper Canada* talked to four experts; people who know the industry but are far enough to the side that they can clearly see the forest for the trees. Here are their thoughts:

## Enthusiastic but Cautious

Dr. Paul Stuart is head of the NSERC Environmental Design Engineering Chair in Process Integration in the Pulp and Paper Industry and professor with the Chemical Engineering Department of École Polytechnique in Montreal. Unabashedly enthused about bio-refining, Stuart also warns the industry should look first before it makes any leaps. "Don't throw everything into the wind, put everything at stake, simply because this [bio-refining] may be a good idea."

streams, Stuart says industry executives should instead first get a realistic grip on the most promising and lucrative bio-products the particular mill can produce, examine potential risks and rivals and how to best mitigate them, identify the potential markets and what strategy will achieve maximum profits for minimum outlay and effort . . . and only then think about retrofits and risking hard-won capital.

The brave new world of bio-fuels has three 'grades' of risk. First, the technology risk: How to make the process work? That should be the bailiwick of research engineers and scientists in technology development companies, not pulp and paper companies. Stand back and let the dedicated small and medium-size R&D companies take the risk, find the capital needed to demonstrate and scale up the concepts.

Second, techno-economic risk: What will be the return on investment from installing each stage of the bio-refinery? For those answers, you'll likely need a knowledgeable partner.

Third, commercial risk: Demand and supply will drive the future price of the particular "feedstock" or biomass needed to drive the selected bio-refining process. As well, the products produced will go through periods of price volatility. For example, commercial ethanol plants designed around, and dependent upon, cheap wheat, corn and similar foodstuff have been knocked for a loop courtesy of the global leap in grain prices.

Stuart notes that the market price of ethanol and bio-diesel is highly volatile and unpredictable; the margins likely "skinny" at best. Also, in terms of competition and value-added products, these fuels represent the lowest rung of what can be wrung from biomass and it's an increasingly crowded lowest rung at that. If the mill plans to burn homegrown fuels to augment or replace costly fossil fuels, fine. If not, then good luck. The big oil companies might buy what Stuart calls these "low value, low margin" bio-fuels from you . . . but at their own price and convenience.

### **Mitigate Risks – Take It In Phases**

Firstly and as always, strive for maximum efficiency at the lowest cost. If the nascent bio-refinery doesn't work on paper, rethink it until it does. Second, ensure the derivative product(s) are high added value, have a strong market and truly represent a significant and secure increase in overall revenues that will help buoy up the whole operation.

As Stuart notes, pulp and paper mills are very capital intensive; when the mill isn't continually producing products of value, the cost of depreciation is eroding the already skinny margins. To stay afloat, struggling mills are often forced to discount their prices vis-à-vis competing mills in what then becomes a race to the bottom.

Third and most crucial: know the targeted marketplaces – cold. Stuart calls it "knowledge-based manufacturing" that never, ever, assumes. It stays abreast of the market, forecasts potential clients and competition and balances these with the bio-facility's built-in flexibility to adjust to changing markets' needs.



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woody biomass, pulp and paper products, energy products and bio-refinery products to dance with the shifting markets and thus maximize those margins. The mill becomes proactive, rather than reactive. "It's a completely different way of thinking," says Stuart. "It's the way pharmaceuticals and [oil] refinery companies think."

It's this third stage where the company's transformation kicks in. Forestry companies will move away from being "manufacturing centric" and will operate to maximize profit margins. The temporary idling of paper machines may become commonplace as supply and demand are better maintained in balance, even as sales of cellulose-based chemicals are increased.

It's a heady vision but, warns Stuart, don't get your head stuck in the clouds and think you can go it alone. Phases two and three require the sort of product and technology innovation and timely market smarts that the pulp and paper market now sorely lacks. "We [the pulp and paper industry] don't have much of a product development culture anymore," says Stuart. "We fired everybody. We don't have many company research centres and we don't remember how to bring new products to market."

What the industry does have, however, is strong internal efficiencies, secure access to quality, renewable biomass and

tested supply chains on the commodity side of the ledger. But to play in the brave new world of bio-refining and high-value niche markets, Stuart says it's best to shrug off the aura of rugged individualism and get realistic. Stick out your hand and find a trusted partner or ally in the chemicals arena and work out a mutually beneficial agreement.

But first get the long-term business strategy in place. Getting excited about various high-tech bioprocess developments and committing to a course of action – without knowing where it will ultimately lead – is simply dangerous.

"Make sure the technology strategy serves the business strategy," says Stuart. "There's a big difference between "process" design and "product" design. Process design is: *What could I make?* Product design is: *What should I make?* In other words, where can I make some money if I made it?"

"So get the business strategy right. Decide what products you're going to make, find your right partner and then you start. That's the message. That's what pulp and paper executives should be looking at right now, before anything else."

### Who Will Jump Aboard?

Dr. Tom Browne, program manager mechanical pulping and

## Bill C-33 to Boosts Bio-fuels?

In Canada, there are plans afoot to wean ethanol production away from grain and into alternative biomass. With the goal of having all gasoline sold in Canada contain five percent ethanol by 2010, Ottawa is readying Bill C-33 and what will be a \$2.2-billion purse to develop bio-fuels. The bulk will go to grain-based ethanol, including the \$500-million NextGen Biofuels Fund, earmarked for transitional 'second generation' cellulosic-based ethanol.

But if the industry is to make brave new bio-products, it must learn to step away from the traditional mindset. For the cash-poor Canadian pulp and paper industry, this also means finding new pools of capital and expertise. Which in turn means enlisting outside help and funding, be it public or private.

The outside interest seems to be there. For example, earlier this year Weyerhaeuser and Chevron formed joint-venture U.S.-based bio-refiner Catchlight Energy to focus on cellulosic-ethanol. In Saskatchewan, Ottawa-based Iogen and partners Petro-Canada, Goldman Sachs and Royal Dutch Shell plan to spin literal straw into gold and open Canada's first commercial-size cellulosic ethanol plant. GreenField Ethanol and Quebec-based partner Eneerkem are perfecting high-temperature "gasification" technology to convert organic waste into fuel. In BC, Lignol Energy Corporation will open its \$15-million demonstration plant this summer; the technology strips away lignin from sawdust and wood chips and uses bio enzymes to convert the

For the rest of the industry looking in, the urge to do a deal is growing. But as one unnamed expert told P&PC, do read the fine print before you stick out your hand and make any leap.

In any business relationship, those with the money usually have the clout. Until the pulp and paper industry improves its performance, banks real profits and manages to widen its share of the value chain of products made from pulp, this expert fears that some members of the industry are vulnerable to the siren call of self-serving potential partners. The clout could turn into a cudgel.

"The problem is that they [the wealthy partners] would be foolish if they didn't take advantage of the situation. If they're going to put a lot of money into it and they see a weak industry, they're going to take everything they can, it's just the way things work." A long pause. "But there could be enough [profit] there for you to make it work."

Green gold is where someone finds it. Watch your head, stake your claim . . . but know your partners and do it carefully.

Over the years the Canadian forestry industry has grown fearful about its overseas rivals and has long worried about its own long-term economic prospects. It's still early days for cellulose-based bio-fuels and bio-chemicals to take hold in the industry but the intention – and the inventative mindset – is growing strong. Sure, people can't eat trees . . . but utilized correctly, those

sustainability for FPInnovations (formerly Paprican) recently attended the World Congress on Industrial Biotechnology & Bioprocessing in Chicago: "There's something of a gold-rush mentality here; there's an awful lot of money floating around and an awful lot of people jockeying for position."

Bio-fuels won't be "the savior" of the Canadian pulp and paper industry, muses Browne, but they could easily be an important source of revenue . . . if done carefully and is tailored to the individual mill.

First step: identify the "waste- or under-utilized streams" in an existing mill. Next, find market-savvy partners or allies in the oil or chemical industries that truly know the most economically viable existing or potential products and processes. Craft a mutually beneficial business arrangement; outside capital and smarts in exchange for secured sources of cellulose.

For the chronically cash-strapped Canadian industry, Browne says finding the right outside partners is vital. "I think that's a key piece the partners will bring to the table. Not just cash but an understanding of what it is they can sell [to the markets]."

However, be careful you don't get sold out. (see sidebar II)

Don't fixate on ethanol. Sure, the market is "bottomless" but in terms of value-add, ethanol is but one step up from burning the biomass for heat and power. Crude oil is chemically and thermally fractured into different products, from high-value aviation fuel to plebian road asphalt. Ditto for forest biomass, says Browne. "Every fraction has a value and you maximize the value of as many of these fractions as you can."

For example, Tembec's showcase integrated sulfite mill in Temiscaming, QC, transmutes wood chips and bark into a raft of specialty bio-products: alpha cellulose pulp, lignosulphonates, ethanol, resins, cellulose derivatives and other high-value products.

Two years ago Browne was "a lot less optimistic" about the latent forestry, biotech industry. That view has changed. Petroleum prices, ongoing economics and "some technical successes in the lab have convinced people there are some opportunities here." Browne says the initial efforts will be "small scale uses of a side-stream" but will grow as the technical and economic aspects are worked out. "The industry is beginning to move and I think it is going to start moving pretty quickly in the next little while."

He also says a number of pulp and paper mills are quietly preparing to enter the bio-refining arena.

"I can't name them right now because of confidentiality issues but I think you'll see some interesting projects coming up in the

**There's also a growing public perception that all bio-fuels might be part of the problem, not a solution. This was underlined by a United Nations official who called bio-fuels a "crime against humanity." The belief is that, later or sooner, hungry countries in Asia and throughout the world will face a stark choice: grow crops for food, or fuel?**

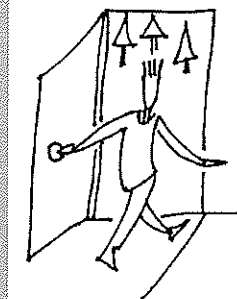
### Uncertainty Calls for Patience

Industry consultant Dr. Andrew Garner says the pulp and paper industry should pause and collectively figure out the lay of the land. There are many different biomass conversion technologies, many different tech players

jockeying for many different positions and products.

"It's a time of great uncertainty," says Garner. "It's not clear where the gold is yet. You can't go out, put your money down and have a guaranteed plan that's going to make you money. It's not as simple as that."

Garner also believes the forest products industry needs to keep pressing forward to raise public awareness about the positive aspects of bio-fuels and bio-chemicals derived from forest waste especially vis-à-vis bio-fuels from agricultural feedstock. In the public's view, Canada's farmers and the agricultural industry have certain honest nobility, whereas tree-cutting loggers and forestry companies don't quite cut it when it comes to public support. However, Garner believes that FPAC has "made a



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## Bio-fuels and Global Food Shortages

Necessity and fear are the mothers of invention. As crude oil prices climb, the western world seems to be now getting serious about alternatives – such as bio-fuels – to fill the gap. This seriousness is only sharpened by fears about the environment, geo-politics, the depreciation of the U.S. dollar and the wish to offset the west’s “addiction” to foreign oil with secure, domestic sources.

With bio-refining, most of the effort is on high-volume, low-cost production of ethanol and other automotive bio-fuels created by fermenting starch- and sugar-rich food crops such as wheat, rice, soy, sugar cane and corn.

This “green” focus has created unforeseen problems. Not all biomass is created equal. Food crops are easily fermented, quick to grow but come with a steep price; diverting finite cropland into bio-fuel feedstock is now partially blamed for ongoing food shortages in much of the world. (Climate change, chronic drought in Australasia, transportation costs, increasingly expensive petroleum-based fertilizers and sheer greed-driven price rises are the other cited factors.)

Here in Canada, the federal and provincial governments have thrown a lot of weight (and almost \$3 billion in taxpayers’ money) behind the bio-production of ethanol and biodiesel. By 2010, gasoline and diesel/heating oil will contain a legislated five percent and two percent ethanol. To meet this goal, national ethanol/biodiesel production must jump from the current one billion litres to three billion litres per annum. To do that, bio-fuel companies such as Terra Grain Fuels, GreenField Ethanol, Husky Oil and others look to Canada’s grain fields – wheat and corn especially – as the prime feedstock to feed the ethanol process. This will consume million of tons of grain a year.

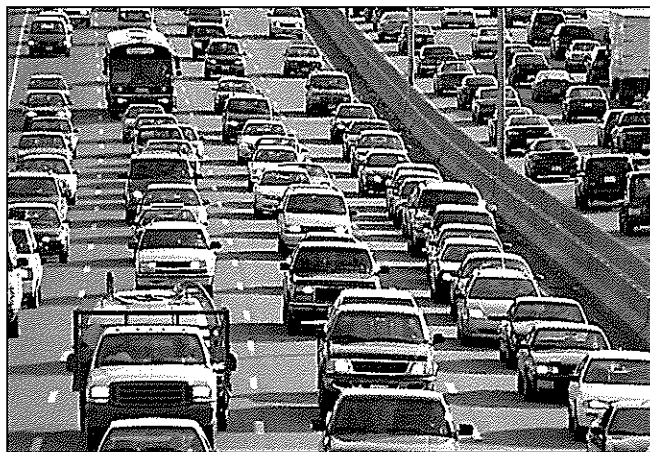
Meanwhile, grain prices are rising. Bloomberg Food and Agricultural Organization notes that on a year-to-year basis (March 07/ March 08) wheat prices jumped 130 %, corn 31 % rice 74% and soy 87 %. Within the ranks of ethanol producers, the (soy) bean counters are worried.

Catch-22. For example, Terra Grain’s \$130-million facility in Saskatchewan is lauded as the largest wheat-fed ethanol plant in North America. The problem: finding enough wheat to feed the production maw. As wheat prices rise and shortages grow, the economic viability of grain-dependent production

eight million hectares. Not only does it add to deforestation -- Brazil has cut 570,000 square kilometers of Amazon rainforest to date – but soy fields absorb less heat than does forest or pastures, adding to the region’s increasingly dry/drought conditions. Meanwhile the governor of one of Brazil’s larger agricultural states says the country should “take down” even more of the rainforest to grow more soy. Between August and December 2007, about 7,000 square kilometres of rainforest was illegally harvested; it is the first increase in deforestation after three years of declines and is in step with the rise in world food prices.

In nearby sugar-cane rich Cuba however, Fidel Castro has long warned of the dangers of crop-based bio fuels. In March 2007, for instance, he accused the United States government and the U.S. auto industry of propagating the “sinister idea” of bio fuels to push up global food prices and thus risk a global famine. Instead of food-based bio fuel, Castro has long pointed to recycling, low-energy appliances and a societal shift from rampant western-style consumerism as solutions to the world energy needs.

There’s also a growing public perception that all bio-fuels might be part of the problem, not a solution. This was underlined by a United Nations official who called bio-fuels a “crime against humanity.” The belief is that, later or sooner, hungry countries in Asia and throughout the world will face



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a stark choice: grow crops for food, or fuel?

But sustainable forest-based bio-fuels and bio-chemicals are different. The biomass used – chemically amorphous hemicelluloses, crystalline cellulose and the “glue” that holds the tree together, lignum – is harvested from renewable trees grown on marginal land unfit for food-crop product. Managed responsibly and in a sustainable manner, this truly green feedstock can be part of the solution. Educating the public as to the difference between grain and wood bio-fuels is important.

In the global bio-refining arena, one of Canada’s chronic disadvantages – its plethora of small, aging mills – could be an advantage. Rather than bankroll a brand-new huge centralized bio-facility, some experts believe it would be far easier, and more financially and politically palatable, to retrofit small pulp mills, especially those nearing the end of their lives – and retain innumerable small-town jobs. Dotted around the country,

good start" addressing the PR challenge and turning it around.

For farming and forestry, the real carbon footprints are starkly different. Modern mechanized farming is fossil-fuel intensive, ploughing, chemically fertilizing, "clear cut" harvesting, constantly moving on and off the land; farming's carbon footprint is continual, broad and deep.

Forestry is different, says Garner. "The carbon footprint of forestry is very light." Go in once, harvest the tree, replant, come back in a few decades, harvest, repeat. The harvest might not look pretty but in terms of biomass yield versus fossil fuel burnt, forestry is very efficient and, arguably, more earth-friendly than food-crop farming.

Yet it's the agriculture bio-industry that attracts the bulk of government attention and funding. Like many, Garner feels the industry must continue to speak with a common voice, to skillfully press its case to get more respect and public support.

Approached properly, the inherent potential (and profits) of cellulose-based bio-refining and high-value bio products offer much to Canada's economy in general and the forestry industry in particular. Bio-refining likely won't be the panacea but it could be a solid help for a domestic industry seemingly beset by cheap-labour, cheap-fibre overseas rivals. As Garner notes: "Outside pressures force inventiveness."

An entrepreneurial inventiveness backed by huge forest reserves. As Garner notes, and "despite what some in the NGO community want you to believe" Canada's forest industry has always planted more trees than it has harvested and is a world leader in forest conservation.

Dr. Richard Kerekes, professor emeritus with the University of British Columbia Pulp and Paper Centre in Vancouver, BC believes the oil crisis won't go away, not this time. Before, it was a largely a matter of cartel-driven politics by OPEC. Now it is demand-driven by growing prosperity, largely in Asia.

"If you look at [the entire situation] the consumer prefers to get fuels from a renewable resource. Look to the forestry industry, an industry that hasn't done well in a long time; a part of the biomass is better used as a source of fuel."

For centuries, the forest has supplied fuel and cellulose-based chemicals, resins, rayon, oils and profits. Prior to the late 1970s, for example, most Canadian universities had specific departments of forest science.

For many years the forest has supplied fuel and cellulose-based chemicals, resins, oil and profits. "Forest-based chemicals were supplanted by petro-based chemicals but this may now change back to the way things were," says Kerekes. Bio-refining won't be "the saviour" of Canada's forestry industry but "it will play a significant role in the health of the future industry."

The Canadian pulp and paper industry has small, aging mills in comparison to the large modern mega-mills drawing fibre in from plantation forests. However, when it comes to converting some capacity to bio-refining, certain advantages may go to smaller mills. Such mills may be tailored to create profitable

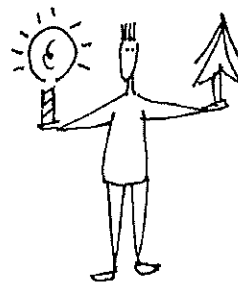
outside itself to make meaningful, really significant moves – alignments with oil companies is a good one." Oil companies have access to capital, have the market knowledge with the necessary distribution networks already in place. The oil industry is also under public and political pressure to seek new green renewable alternatives and long-term solutions.

Kerekes doesn't have any easy solutions but notes that farmers have long known the value of diversifying their crops and spreading the risks. For some mills the "ideal thing" would be a "swing situation" where the mill produces and shifts production from pulp and bio-products as the market situations warrant.

### In Conclusion

Organic garbage, agricultural waste (straw, corncobs etc.), switch grass; wood cellulose – this country is awash with bio-potential, enthuses Stuart: "Canada is an energy superpower and this [bio-refining] just fits the portfolio perfectly to help offset all of that heavy-oil exploitation that is going on in terms of carbon credits."

Canada also has among the best forestry practices in the world, solidly certifiable, firmly renewable resources. Tree diseases and forest fires notwithstanding, there are as many commercial trees in Canada now as there were in the 1900s. Stuart concludes: "The forest is just dying to be exploited, responsibly." **PPC**



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**Nalco Brings Home Jasper Mardon Memorial Prize**

Naperville, IL – A Paper presented by Nalco at the 2008 Appita Annual Conference & Exhibition was awarded the Jasper Mardon Memorial Prize.

The award went to Przem Pruszynski, Jogeir Munkeby and Paul John Puiatti of Nalco, for their work entitled “The Use of White Water Closed Loop Consistency Control to Provide Chemical Savings and More Stable Wet End Chemistry Conditions of a Newsprint Machine.” The paper was co-authored by Ingo Von Medvey.

The work focused on technology best practices and control methodology to drive stability, productivity and end-product quality on a fast newsprint machine. The paper was voted the top work from among 15 candidates in the conference program.

**Aid Package For B.C.**

Vancouver, BC – Premier Gordon Campbell has confirmed his government’s plans to devote part of the \$1 billion national community development fund on forestry workers and forestry-dependent towns. According to a recent report by *The Vancouver Sun*, BC will receive \$129 million from Ottawa over a three year span in the form of an aid package designed to help towns that depend on industries facing downturns.

“We’re working with forest companies, labour and communities to ensure that B.C.’s forest sector receives effective,

timely assistance to deal with the impact of market volatility and cyclical change,” the *Sun* reported Campbell as saying in a statement. The pledge came during the same week that Price-WaterhouseCoopers labeled 2008 as the worst year to date for British Columbia’s forestry sector. The *Vancouver Sun* further reported that more than 11,000 people have been laid off, both permanently and indefinitely from the forestry industry since January 2007.

**Bill C-33 Raises Concern**

Toronto, ON – A recent editorial in the Toronto Star captured the concern many are expressing around Stephen Harper’s push for the implementation of Bill C-33.

The bill will allow the government to legislate the quantities of biofuel that must be blended with gasoline at 5%.

“The concerns over global warming have prompted the move to biofuels, such as ethanol and biodiesel, which burn more cleanly than oil-based gasoline,” the Star reported. “That’s why the Harper government is committing \$2.2 billion to their development and why Liberal Leader Stéphane Dion has pushed for doubling the government’s target to 10%. But in their rush to biofuels, the politicians have overlooked the drawbacks of turning food into fuel.

“Although biofuels do emit less greenhouse gas than regular gasoline, environmentalists point out that this comparison does not take into account the emissions coming from the farm machinery and fertilizer required to “grow” these new fuels and the trucks for transporting them. When these emissions are added in, critics say, the environmental benefits of biofuels may be negligible. And while biofuels may be doing little for the environment, they are doing the world a great deal of harm by diverting food from hungry people to the feeding of automobiles. Various international agencies have fingered growing demand for biofuels as a principal reason for the skyrocketing food prices.

“Parliament should heed NDP Leader Jack Layton, who has lost his own enthusiasm for biofuels, and take more time to consider the implications of Bill C-33 before passing it,” the Star editorial noted.

**Tembec Indefinitely Shuts Ontario Mill**

Mattawa, ON – Tembec is indefinitely shutting down its hardwood Mattawa plant, in northern Ontario.

The facility, which employs 52 people, will close on June 30 for a minimum period of ten weeks. According to a report by The Canadian Press, spokesman Richard Fahey confirmed the company will revisit the situation in August in order to evaluate a potential restart in the fall.

The Canadian Press further reported that higher fossil fuel prices are driving transportation, chemicals and direct energy purchases upwards.

“You could see the writing on the wall for a long time,” The North Bay Nugget reported Fahey as saying.

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