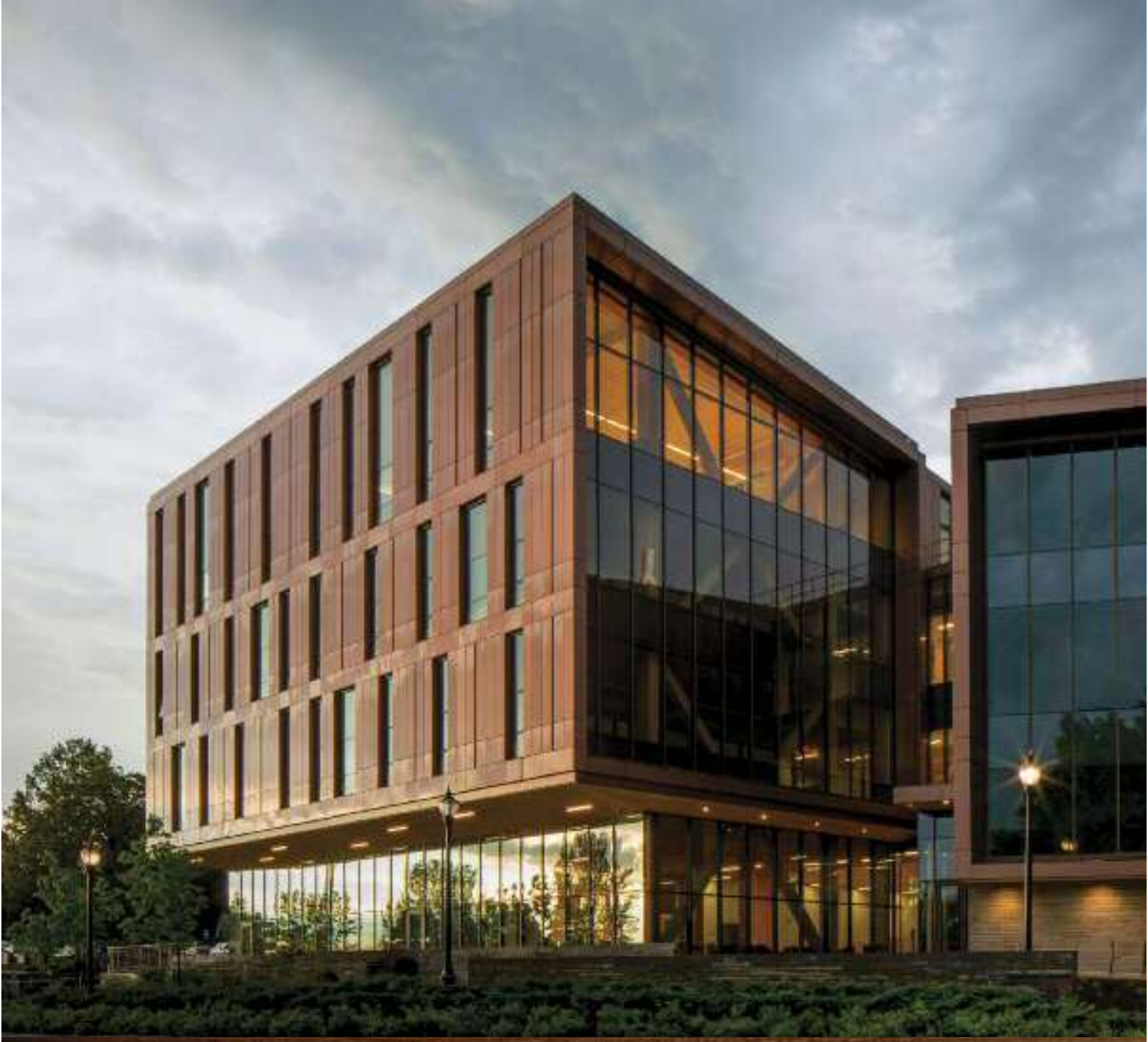
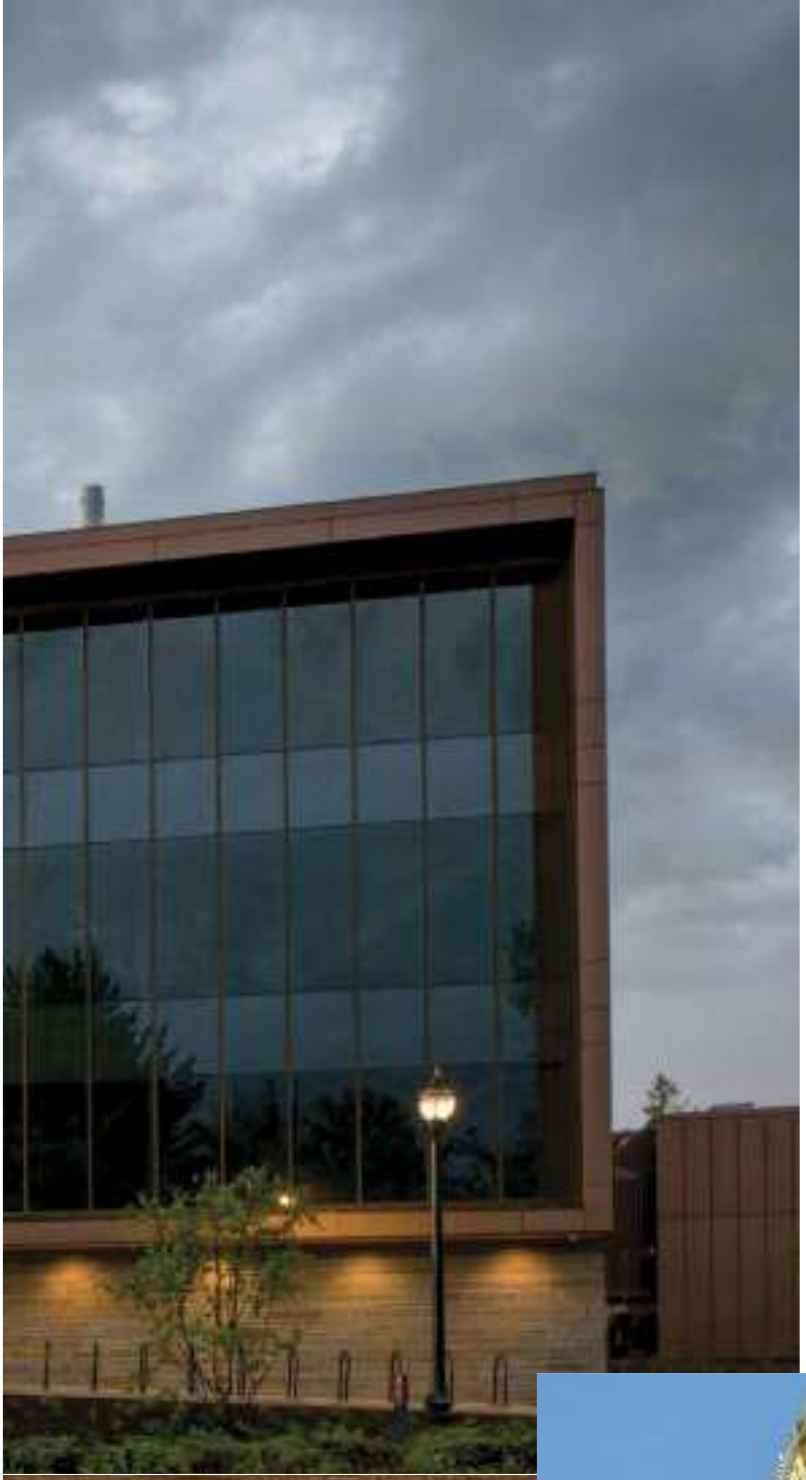


What's Next for Wood?

Opportunities and Challenges Abound for Low- and High-Grade Products

— By Eric Kingsley —

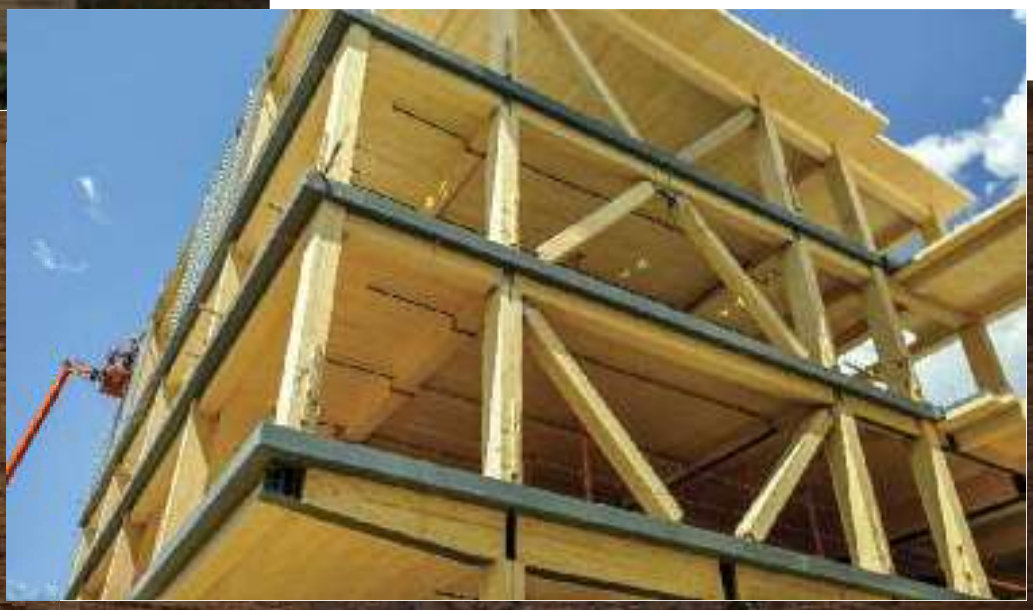


The forest industry is always changing.

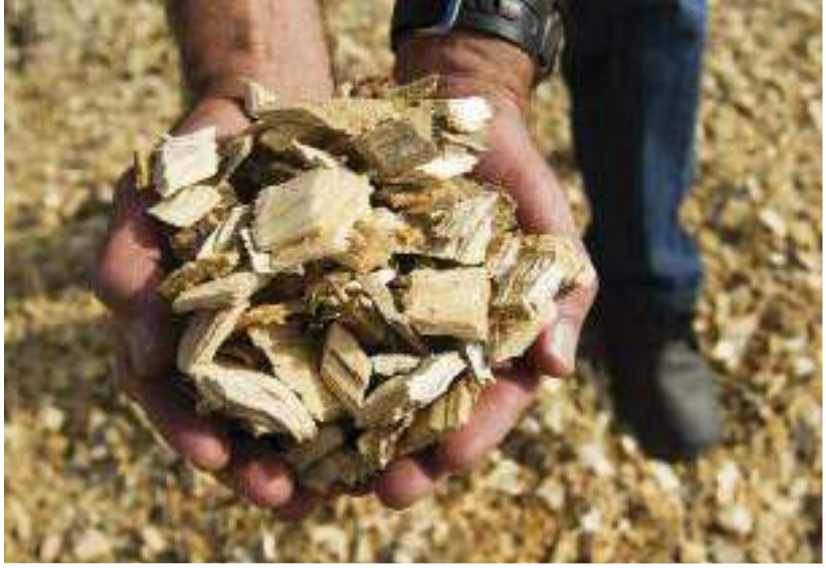
When this century began, New Hampshire's two surviving pulp mills in Berlin and Groveton were still operating. Today, those pulp mills are idle, closing its doors in 2006 and 2007, respectively. In Maine, long a state known for its critical market of wood, five pulp mills have closed since 2014, leaving only four operating mills in New England, all of which are in Maine. Biomass electricity plants, high-volume users of low-grade wood, also face economic headwinds that threaten their viability. Northern New England has thirteen operating biomass plants, seven of which are in New Hampshire. New England has lost many markets for wood in recent years, but these losses have created opportunities for new products and new applications to emerge. The issue is attracting much discussion given the recent political debate about the future of low-grade markets in the state.

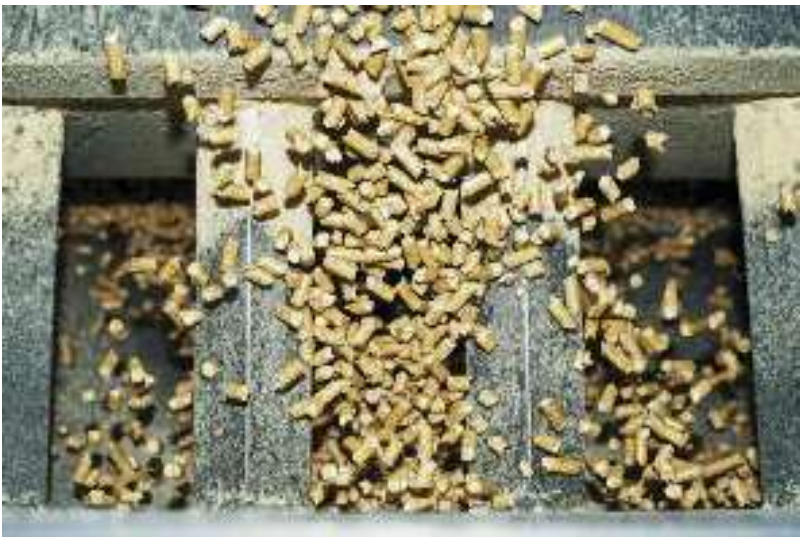
As a consultant in the forest industry, I have the opportunity to review emerging technologies hatched in university and federal research labs, meet with developers claiming they have identified the next big thing for wood, and visit pilot projects where prototypes face rigorous testing environments. What I have learned, time after time, is that it is easier to talk about a technology than it is to bring it to market.

A professor friend often tells me that anything you can make from oil can be made from wood. At some level that only a chemist can appreciate, I am sure he is correct. After all, oil is just organic matter processed with heat, pressure, oxygen, and—something researchers don't have a lot of—time.



Completed in January 2017, the John W. Olver Design Building at UMass Amherst, the largest and most technologically advanced academic contemporary wood structure in the U.S., was made with innovative materials, including cross-laminated timber.





(Clockwise from top left) A biomass facility in Oregon turns raw material (pictured) into energy; woody biomass chips; cross-laminated timber samples; wood pellets fall into a conveyor at a mill in Oregon.

Entrepreneurs and scientists are looking into ways to speed up the time it takes to turn wood into a liquid fuel or otherwise find new uses for wood. Here are a few of the technologies researchers are exploring:

Wood Fuels

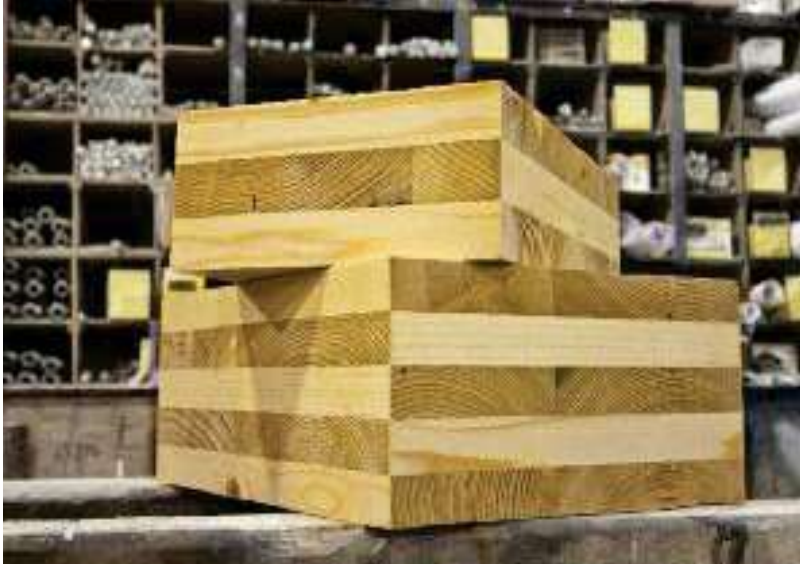
Biofuels made from wood is a market with lots of potential. It has been well established that woody biomass can be turned into ethanol, butanol, or other liquid fuels using several processes, including fermentation, gasification, and pyrolysis. What researchers haven't been able to establish is how to make commercial-scale biomass fuel while simultaneously making money. Despite the challenges researchers face, there have been some recent promising developments. In 2016, a jet using a blend of 20 percent wood-based fuel flew from Seattle, Wash., to Washington, D.C., proving that the fuel can be used by modern technology. In 2014, North Conway's Memorial Hospital began heating its facilities with a bio-oil made from wood in a Canadian plant. Given the significant market for home heating across the Northeast, liquid fuels that can replace traditional home heating oil provide a great opportunity for the region. Though there might be some bumps along the way, it appears that the technology may be nearing a point where it can be deployed at a commercial scale as long as it can clear the economic hurdles. Of course, a wood fuel doesn't have to fit into our existing fossil fuel infrastructure to make an impact. New Hampshire plants have manufactured wood pellets for more than two decades, providing a locally made alternative to heating with fossil fuels. In addition to pellet stoves, which provide great supplemental heat, modern boilers combined with bulk storage provide opportunities to heat entire homes, offices, or schools using local wood. The big driver of growth for wood heat is the price of competing fuels. If oil prices rise again, expect a spike in this market.

Bioproducts

In addition to wood-based fuels, there are emerging opportunities in the bio-based product market (i.e., products traditionally made from fossil fuels that are now made from wood). In the past year, there have been credible efforts to site manufacturing facilities in New England that would

- produce a range of organic chemicals from low-grade wood, which could be used to make plastics, pharmaceuticals, and other products;
- manufacture a low-density fiberboard for use as an insulating material in construction;
- create blown-in cellulosic insulation that competes with fiberglass insulation;
- combine wood chips and recycled plastic to form the material for highway signs (currently made of aluminum);
- create a high-protein pellet to replace soy-based animal feed and nutrition in aquaculture operations.

Having followed similar proposals for a few decades, I can say with certainty that most of these won't go anywhere; a few may succeed. That is the nature of emerging industries, and it's nothing unique to the forest products industry; bringing new technologies to market is hard work. What can provide us with some real optimism is that the recent loss of markets in the region has attracted entrepreneurs and developers looking for



(PRECEDING PAGE) COURTESY OF ALEX SCHREYER/UMASS (X2); (THIS PAGE) COURTESY OF OREGON FOREST RESOURCES INSTITUTE (X4)

the next generation of how to use the region's forests. Elected officials and economic development agents are also eager to make sure the forest products industry continues as an important contributor to northern New England's economy.

Mass Timber

In addition to low-grade wood markets (the material that would normally go to pulp mills or biomass) there are emerging opportunities to use wood in ways previously thought technically impossible or uneconomical. These new construction technologies are changing the way wood is being incorporated as a building material.

The most prominent of these technologies is cross-laminated timber (CLT). The technology is remarkably simple: take lumber, layer it, and glue it together. CLT panels, which are often as large as ten by sixty feet, can be pre-cut with openings for doorways, windows, plumbing, and cables. Under current building codes, CLT can be used in buildings up to six stories high. Efforts are currently underway to increase the permissible usage to 18 stories, which would cover all of the construction in New England with the exception of skyscrapers.

CLT isn't a pipe dream; it's an accepted building material around the globe. In London, an eight-story CLT building was completed in 2009. In Vienna, Austria, a 24-story building is currently under construction. Here in the U.S. a 12-story project in Portland, Ore., and a 10-story project in New York City are being built.

CLT is catching on because it has significant benefits for consumers, builders, and the environment. For consumers, wood has a warmth and ambiance unlike other building materials; namely, steel and cement. For builders, assembling pre-manufactured CLT panels on site reduces construction time and labor, yielding more projects and thus more profit. And for the environment, a CLT building stores lots of carbon in the wood as long as the building is standing. On the flip side, steel or cement construction is carbon-intensive due to the significant energy inputs used to manufacture these materials.

Most CLT panels are made from structural lumber tree species, including Northeast spruce-fir, Pacific Northwest Douglas Fir, and southern yellow pine. These species are also used to make two-by-four lumber that can be purchased across the country. It is great to have expanded markets, but it's important to note that CLT promises to be an expanded market for a species group that has historically had strong sawlog markets. Recognizing this, there is research underway to include hemlock, hardwoods, and oriented-strand lumber as part of CLT manufacturing, thus expanding markets for underutilized species.

Currently, CLT is manufactured in Europe, Quebec, and the western United States. However, as the technology is poised to grow, two firms, SmartLam and Ligna Terra, have announced plans for manufacturing facilities in Maine, and other companies have evaluated sites across New England.

When?

New products made from New Hampshire's woods are coming, but a fair (and hard) question to answer is When? It can take years to site, permit, and build manufacturing facilities. Add the risk of bringing a new technology to commercial scale on top of that timeline, and even a project announced today could wait five or more years before it is turning out a product.

I like to quote a paper industry executive who thought a lot about new forest product development. Speaking in New York, John Hinman, president of International Paper, said:

"[O]nce wood is reduced to a pure and stable chemical it provides the base on which the chemist can build a hundred different products….It is conceivable that the forests of the United States and Canada within the next half-century will supply us not only paper for many varied purposes…but also quantities of foodstuffs, alcohol, and chemical raw materials from parts of the wood which we are only beginning to use today."

The year was 1948. In the more than half-century since, we have made progress, but we are probably far from what Hinman was imagining in his speech.

Today, universities, entrepreneurs, and industries are researching ways to produce products that meet consumer needs in a sustainable manner. In New Hampshire and across New England, we have the forest resource, the forest industries, and the proximity to market that will allow the next generation of forest products to emerge and take hold. While we all want to see the new industries established today, that probably isn't going to happen. We can take comfort in knowing that while new forest products are developed and brought to market, the forests of New Hampshire can continue to grow and will be ready when new opportunities emerge.

Eric Kingsley is a partner at Innovative Natural Resource Solutions LLC, a New Hampshire-based forest industry–consulting firm.