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TAPPI Journal Editorial Board

The innovation engine and the forest products industry value chain

The forest products industry (FPI – pulp, paper, paperboard, building products, allied products, and byproducts) has been continuously innovating as it manufactures and delivers value-added products to consumers worldwide. Integrated pulp and paper mills produce pulp, paper, paperboard, and byproducts like turpentine, tall oil, methanol, lignin, and other chemicals. As Peter Hart points out in his paper, “Pulp and paper mills: The original biorefineries – past performance and limitations to future opportunities,” that is published in this issue (p. 619), pulp and paper mills have been optimizing their processes and producing a variety of byproducts for almost 100 years. Process and product innovation is also integral to the building products industry, with ongoing improvements in the quality and utility of building products, ranging from pressure treated lumber to mass timber.

Kraft process fuels value

In transforming wood to value-added products, the kraft process produces black liquor (containing spent chemicals and organics from the cooking of wood) that is combusted in a recovery boiler to both regenerate and reuse most of the cooking chemicals and generate enough energy to meet a vast majority of the manufacturing facility’s onsite energy needs and produce electricity that is sold to the grid. Additionally, wood residues generated during the manufacture of forest products are burned in biomass boilers, providing an additional source of energy for the manufacturing facility. The FPI is a leader in the use of combined heat and power (CHP – sometimes referred to as cogeneration), an energy efficient mode of steam and electricity generation from the same fuel source. In the United States, the forest products industry produced 32% of all the CHP power generated by manufacturing industries in 2018 [1]. The U.S. pulp and paper sector avoids over 12 million metric tons CO₂e annually by using CHP compared to the separate generation of steam and electricity [2]. The industry has also made significant strides in reducing its environmental and non-biogenic

carbon footprint, sourcing sustainably grown fiber, and focusing on environmental social and governance (ESG) topics while integrating sustainability metrics into operations and business decision-making.

Robust innovation engine drives opportunity

The FPI industry has a robust innovation engine, spanning the entire value chain from managed forests to products, that is now powering more technological advances. This ecosystem includes research institutes, foundations, industry-funded consortia, forestry and paper engineering departments, and R&D/product development groups within the leading manufacturing companies and their supply chain partners. The ecosystem is poised to be the enabler as the FPI enters new frontiers and scales new heights in process and product development, byproduct development, and the scale-up of novel integrated biorefineries that capture more value while also achieving higher levels of decarbonization.

A quick review of literature and industry-focused peer-reviewed journals reveals the scale and scope of research underway, ranging from eutectic solvent pulping processes and novel processing additives to nanocelluloses, biopolymers, and second-generation biofuels. Leading forest products companies are also scaling up integrated bioproducts mills and validating the viability of these technologies to coexist and meaningfully scale-up [3]. On the decarbonization front, the industry is leveraging its track record with closed loop regeneration, chemical recovery/reuse, and CHP to now evaluate technologies like bioenergy with carbon capture and storage (BECCS) and calcium looping. Such technologies further reduce the carbon footprint and potentially achieve carbon negative emissions status. Other topics, such as carbon storage in managed forests and the life cycle of forest products, are also getting more attention as companies develop decarbonization strategies.

Significant opportunities exist at the intersection of process, products/bioproducts, decarbonization, carbon storage, and environmental footprint reduction

for the forest products industry. The role of a robust innovation pipeline has therefore never been more consequential, given the need to advance along multiple and aligned pathways to develop commercially viable technologies and operating practices. **TJ**

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for scientific research and technical information required to address the environmental and sustainability needs of the forest products industry in North America. NCASI conducts in-house technical studies on broad-based topics related to environmental impact measurements and assessments; conducts surveys that help benchmark industry performance; and sponsors scientific research by universities and others to document the environmental performance of industry facility operations and forest management and to gain insight into opportunities for further improvement in meeting sustainability goals. NCASI is celebrating its 80th anniversary and has approximately 80 U.S. member companies and 33 Canadian member companies. Email Varma at vvarma@ncasi.org

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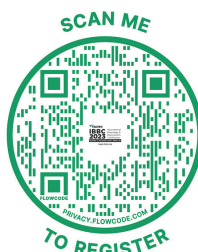
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