

## The Forest Products Sector: Circular By Design?

DECEMBER 2018

### Introduction

The Circular Economy is “a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops” (Ellen MacArthur Foundation 2015). The principles of the Circular Economy are intrinsic to the forest products industry: all parts of the tree, a renewable resource, can be used efficiently to manufacture products of high quality; products are recyclable; and residuals can be used for energy production or other purposes. In this fact sheet, we explore this circularity of the forest products sector and discuss some opportunities for improvement and associated challenges.

### Reliance on Renewable Resources

One of the core principles of the Circular Economy is the use of renewable resources wherever possible. The basic raw material for producing forest products, wood, is renewable and derived from managed forests in North America. A large proportion of these forests are managed under Sustainable Forest Management Certification programs. According to the American Forest and Paper Association (AF&PA 2018), 99% of the wood fiber used by its members is procured from certified sourcing programs and all members of the Forest Product Association of Canada (FPAC) must be certified under an SFM Certification standard (CSA, FSC or SFI).

A large fraction of the forest products industry’s energy need is met using renewable fuels, mostly residuals from harvesting, wood products manufacturing, and pulp and papermaking. In 2016, more than two-thirds of the onsite energy used by North American forest products facilities was from renewables (AF&PA and NCASI 2018). Pulp and paper facilities also self-generate more than half of their electricity needs, more than 90% of this being through the efficient use of combined heat and power (CHP). CHP makes the most of energy resources, by generating electricity and utilizing the heat that would otherwise be wasted to provide useful thermal energy for manufacturing operations.

Examples of challenges to increasing the use of renewable fuels and production of electricity include economic considerations, uncertainty about the

regulatory status of emissions from biomass fuels, availability of biomass residues and competition for other uses.

### Efficient Use of Resources

Another core principle of the Circular Economy is the optimization of resource yields by “circulating” materials and products to their highest value. Recycling is a common practice in the forest products industry.

**Water** - The forest products sector has strong connections to water resources. The maintenance and management of forestlands serve not only to maintain access to fiber, but also to sustain key environmental attributes of the land, including important components of the water cycle. While pulp and paper manufacturing requires a lot of water, 90% of it is returned to the environment in a manner that conforms with water quality criteria in North America. Water is used efficiently within mills with each gallon of water being used more than 10 times before being returned to the receiving environment (NCASI). Water use by AF&PA members was reduced by more than 50% since 1975 (NCASI 2009). Challenges to further reducing water use include process constraints (e.g., build-up of substances that can damage process equipment) and lack of economic incentives.

**Chemicals** - The kraft chemical recovery process is a good example of the circular use of resources by the forest products sector. Over 98% of pulping chemicals are recovered and reused in the kraft recovery process. An NCASI study showed that by recovering

its pulping chemicals and generating energy from recovered organic material, the U.S. kraft pulp industry saves more GHG emissions than are released from onsite processes and purchased electricity of the entire U.S. forest products sector (Gaudreault et al. 2012).

**Manufacturing Residuals** - Forest products facilities generate a variety of manufacturing residuals including boiler ash, wastewater treatment plant residuals, secondary fiber rejects and causticizing residuals. These residuals have properties that make them useful for many purposes such as land application or geotechnical uses. However, there are significant opportunities to increase the fraction of these residuals that are beneficially used rather than landfilled. For instance, in 2016, 56% of residuals generated by North American pulp and paper facilities were still disposed of (NCASI 2018). Barriers to reducing disposal of residuals and increase their beneficial reuse include lack of proximity to markets and regulatory barriers.

**Products** - To achieve the principles of the Circular Economy, wood should be used through some sort of cascading system. Little information is available on the recovery and recycling of wood products in North America, but prior to 2014, Bratkovich et al. (2014) estimated that in the U.S., 35% of the wood in the municipal solid waste stream was being recovered for products (e.g., energy, fiber, or chemical-based), an additional 16%, combusted for energy, and that 32% was yet available for recovery, the remainder not being usable for recovery. For construction and demolition wood, 52% was recovered, combusted for energy, or not usable. With regards to paper and paperboard products, their recovery rate has significantly increased in North America over the years. For instance, in the U.S., it increased from 33.5% in 1990 to 65.8% in 2017 (Paper Recycles 2018), a rate approaching the maximum that can be practically achieved (WBCSD 2015). Achieving increased recycling can be complicated by many factors including single-stream collection of recyclables and a lack of markets.

## Conclusions

The forest products industry has unique aspects that are consistent with principles of the Circular Economy. The industry is based on renewable resources and its products are recyclable. Reuse and recycling are integral to manufacturing processes. That said, there remain opportunities to enhance this circularity, including seeking ways to increase the beneficial use

of residuals along with enhancing cascading and recycling of forest products.

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