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# PULP & PAPER PRODUCTS

## Research Brief

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# PULP & PAPER PRODUCTS

## Research Brief

SASB's Industry Brief provides evidence for the disclosure topics in the Pulp & Paper Products industry. The brief opens with a summary of the industry, including relevant legislative and regulatory trends and sustainability risks and opportunities. Following this, evidence for each disclosure topic (in the categories of Environment, Social Capital, Human Capital, Business Model and Innovation, and Leadership and Governance) is presented. SASB's Industry Brief can be used to understand the data underlying SASB Sustainability Accounting Standards. For accounting metrics and disclosure guidance, please see SASB's Sustainability Accounting Standards. For information about the legal basis for SASB and SASB's standards development process, please see the Conceptual Framework.

SASB identifies the minimum set of disclosure topics likely to constitute material information for companies within a given industry. However, the final determination of materiality is the onus of the company.

### Related Documents

- [Pulp & Paper Products Sustainability Accounting Standards](#)
- [Industry Working Group Participants](#)
- [SASB Conceptual Framework](#)

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## SUSTAINABILITY DISCLOSURE TOPICS

### ENVIRONMENT

- Greenhouse Gas Emissions
- Air Quality
- Energy Management
- Water Management

### LEADERSHIP AND GOVERNANCE

- Fiber Sourcing & Recovery

### WATCH LIST

- Bio-based Products Innovation

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## INTRODUCTION

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The Pulp & Paper Products industry is a mainstay of industrial economies; the industry manufactures staple consumer goods including paper-packaging materials, printing paper, sanitary paper, and industrial raw materials like wood pulp. Paper products are ubiquitous in modern households and offices, and paper packaging is commonly used in the food and beverage, transportation, and retail sectors. Despite changing patterns of paper use and competition from synthetic materials such as plastics, the industry is growing. The use of renewable wood fiber as a raw material is an attribute that will likely continue to be a positive factor in the industry's long-term development.

However, emerging sustainability challenges such as climate change and resource depletion are spawning increasingly stringent regulations. Pulp and paper products manufacturing is resource intensive, requiring significant quantities of energy, water, and wood fiber. Onsite energy production and consumption generates air emissions, while water use in locally water-stressed regions can impact both the environment

and local communities. Furthermore, forestry and logging activities in the industry's supply chain can adversely impact biodiversity and forest-dependent communities.

Management (or mismanagement) of certain sustainability issues, therefore, has the potential to affect company valuation through impacts on profits, assets, liabilities, and cost of capital.

Investors would obtain a more holistic and comparable view of performance if pulp and paper products companies reported in their regulatory filings metrics on the material sustainability risks and opportunities that could affect value in the near and long term. These metrics would include both positive and negative externalities and the non-financial forms of capital that the industry relies on for value creation.

Specifically, performance on the following sustainability issues will drive competitiveness within the Pulp & Paper Products industry:

- Reducing greenhouse gas emissions (GHG), particularly carbon dioxide emissions;
- Reducing non-GHG air pollution, which can create hazards for public health and the environment and require mitigation;
- Managing energy use to reduce the cost of production and indirect GHG emissions;
- Preventing water contamination and securing water supplies without exacerbating local water stress; and
- Ensuring that wood and wood fiber suppliers adhere to environmental and social best practices.

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## INDUSTRY SUMMARY

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The Pulp & Paper Products industry comprises companies that produce industrial wood pulp as well as companies that produce a range of paper products including newsprint, containerboard, paperboard, printing and sanitary paper, construction paper, and paper bags.<sup>1</sup> Some pulp and paper companies are vertically integrated, producing both pulp and paper. The majority of U.S. pulp production occurs at integrated mills.<sup>1</sup>

During the 1990s and early 2000s, many vertically integrated pulp and paper companies divested their substantial timberland holdings in an effort in part to consolidate their operations and monetize their non-strategic assets.<sup>2</sup> Today, many divested timberlands are owned and managed by entities called Timber Investment Management Organizations and Real Estate Investment Trusts, some of which are publicly traded companies.<sup>11,3</sup>

During virgin pulp production, logs or wood chips are transported to mills, chipped, screened, and fed into pulp digesters. The pulping process, which can be either mechanical or chemical, separates cellulose fibers from lignin, the substance that holds cellulose together. Chemical pulping, the most common method, requires high temperatures, pressure, water, and chemicals. This process generates cellulose fibers (pulp) and a by-product called black liquor that is composed of inorganic pulping chemicals and organic hemicellulose and lignin. Black liquor is commonly processed to recover pulping chemicals, and the resulting residue is used as a source of energy. Pulp is often bleached with the elemental chlorine-free process to increase its brightness.

Pulp is then further refined in the papermaking process.<sup>4</sup>

Paper production involves the conversion of pulp into paper sheets. Typically, pulp (virgin or recovered) is blended with water and additives to create a slurry, which is then fed into a paper machine that screens and presses the pulp to create paper sheets. The sheets are then dried thermally and mechanically and rolled into reels for ease of transportation and storage.<sup>5</sup>

The industry's principal customers are manufacturing and wholesale businesses. Unintegrated pulp producers sell market pulp to paper product manufacturers and paper converters.<sup>6</sup> Integrated pulp and paper products companies typically sell to paper converting companies (containers and packaging manufacturers), publishing and printing firms, and office supply companies, among others.<sup>7</sup>

The Pulp & Paper Products industry is mature, with total global revenues of approximately \$143 billion. The paper segment accounts for the majority of reported revenue, partly a reflection of the fact that revenues from integrated pulp and paper operations may not be reported by individual segment, and that the sale value of paper products is generally higher.<sup>8</sup> Demand for pulp and paper products typically correlates with overall economic activity. The most important demand drivers are manufacturing activity and consumer spending. Due to strong international trade in paper products and production in countries outside the U.S., currency fluctuations can affect financial results. Broader societal trends also influence demand. Per capita paper consumption in the U.S. has fallen steadily for the

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<sup>1</sup> Industry composition is based on the mapping of the Sustainable Industry Classification System (SICS™) to the Bloomberg Industry Classification System (BICS). A list of representative companies appears in Appendix I.

<sup>11</sup> Companies engaged in timberland management are classified under SASB's Forestry & Logging industry (RR0201)

past two decades, due in part to the increase in electronic communication and publishing.<sup>9</sup>

Both pulp and paper production tend to be capital intensive, characterized by high natural resource requirements and the use of industrial machinery.<sup>10,11</sup> Integrated pulp and paper mills may use industrial boilers, presses, digesters, paper machines, and other equipment. The most common energy sources are biomass (residual wood-based materials), natural gas, coal, fuel oil, and electricity. Efficient cogeneration of steam and electricity allows many manufacturers to recover process heat energy and to generate a significant share of electricity onsite.<sup>12</sup>

Raw materials comprise the greatest cost of goods sold, and are typically between 50 and 60 percent as a share of revenues.<sup>13, 14</sup> According to the U.S. Department of Energy (DOE), virgin wood provides approximately 72 percent of the fiber used in paper production in the U.S.; the rest comes from recycled paper and paperboard.<sup>15</sup> Many factors can affect the supply and price of wood fiber, including weather conditions that affect timber harvests, fiber transportation costs, and currency fluctuations. Other notable costs include wages, depreciation, and rent and utilities, which vary depending on production techniques and product mix. Because of the nature of equipment involved and other factors, depreciation expenses for a company that primarily produces pulp may be higher than for a company that primarily makes paper products.<sup>16,17</sup> As of December 2015, the median gross margin of companies in the Pulp & Paper Products industry was 19.6 percent, while the median net income margin was approximately 3.2 percent.<sup>18</sup>

Due to consolidation in the late 1990s and early 2000s, production in the U.S. is dominated by a group of large firms.<sup>19</sup> IBISWorld estimates that the top four American paper companies account

for more than 25 percent of U.S. production. In North America, consolidation is expected to continue as companies face competition from emerging markets and seek to reduce costs.<sup>20,21</sup>

Because pulp and many types of paper are commoditized, companies compete largely on price and quality.<sup>22,23</sup> Additionally, the certification of pulp and paper products to third-party standards is an important factor for product differentiation. Standards typically address environmental and social externalities in the wood and fiber supply chain.<sup>24</sup>

The industry's top U.S. exchange-listed companies operate in and are domiciled primarily in the U.S. and Canada. Other major unlisted companies also operate and are domiciled in Brazil, Sweden, China, and Finland, among other countries.<sup>25, 26</sup> Demand from developing economies is expected to drive industry growth over the medium-term. This demand will also result in net exports of paper products from North America. While the export market for semi-finished or finished paper products is strong, market pulp is commonly imported from Canada into the U.S. because some types of pulp are not produced in sufficient quantities in the U.S. Canada's large forestry sector and its proximity to the U.S. make pulp imports economical.<sup>27</sup> Due to the cost of transporting timber supplies, pulp and paper manufacturing facilities are generally located in proximity to major sources of timber. Most American pulp production takes place in the Southwest, while major paper products manufacturing regions include the Southwest, Northwest, Northeast, and North-central U.S.<sup>28,29</sup> Canadian pulp and paper operations are concentrated in the southwest and southeast regions.<sup>30</sup>

Financial analysts covering pulp and paper products companies will typically examine factors

including but not limited to: raw materials, energy and freight costs, liquidity, debt expenses, weather conditions that could affect the supply of wood fiber, and foreign exchange risk.<sup>31</sup>

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## LEGISLATIVE AND REGULATORY TRENDS IN THE PULP & PAPER PRODUCTS INDUSTRY

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Regulations in the U.S. and abroad represent the formal boundaries of companies' operations, and are often designed to address the social and environmental externalities that businesses can create. Beyond formal regulation, industry practices and self-regulatory efforts act as quasi-regulation and also form part of the social contract between business and society. In this section, SASB provides a brief summary of key regulations and legislative efforts related to this industry, focusing on social and environmental factors. SASB also describes self-regulatory efforts on the part of the industry, which could serve to pre-empt further regulation.<sup>32</sup>

The Pulp & Paper Products industry is subject to regulation by various agencies at the federal, state, and local levels. Generally, regulations address the industry's environmental externalities.

At the federal level, the U.S. Environmental Protection Agency (EPA) regulates air and water pollution in the industry. Air emissions are regulated under the Clean Air Act (CAA) of 1970. The National Emission Standards for Hazardous Air Pollutants (NESHAP), issued under the CAA, established specific hazardous air emissions thresholds for industrial facilities, including pulp and paper factories. The on-site combustion of biomass and fossil fuels results in emissions of a range of substances that include Criteria Air

Pollutants (CAPS), Hazardous Air Pollutants (HAPS), and Volatile Organic Compounds (VOCs). Companies that emit pollutants above the threshold levels must apply for state permits, and may be required to install Maximum Achievable Control Technology (MACT) to maintain emissions below mandated thresholds.<sup>32</sup>

In 1997, the EPA issued cluster rules for pulp, paper, and paperboard mills that set more stringent baseline standards for air emissions and water effluents. The cluster rule was designed to have companies implement systems to capture and treat air emissions during the pulp cooking, washing, and bleaching stages, and reduce discharges of certain compounds found in water effluents. Air pollutants targeted by the rule include sulfur, VOCs, and PM, while water pollutants include dioxins, chloroform, and furans.<sup>33</sup>

The combustion of fossil fuels like natural gas and coal generates GHG emissions. Under the EPA's Greenhouse Gas Reporting Program (GHGRP), facilities emitting greater than 25,000 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) emissions must report total GHG emissions. The data informs policy decisions, particularly regarding programs to reduce emissions.<sup>34</sup> Although the industry is not currently subject to federal carbon emissions reduction regulations, certain states and regions have implemented carbon cap-and-trade programs.<sup>35</sup>

The most prominent example is California's GHG reduction law, known as AB 32, which took effect in 2012. The program introduced an emissions cap for industrial and other major emitters, which will be reduced by approximately three percent annually. Alternatively, facilities can offset emissions by obtaining emissions credits.<sup>36</sup>

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<sup>31</sup> This section does not purport to contain a comprehensive review of all regulations related to this industry, but is intended to

highlight some ways in which regulatory trends are impacting the industry.

Regulation in major manufacturing centers outside of the U.S. may also affect the industry. In Canada, Quebec Province maintains a cap-and-trade program for industrial entities that emit 25,000 metric tons or more of CO<sub>2</sub>e annually. Quebec's program is linked with California's, creating the largest carbon trading market in North America.<sup>37</sup> In 2015, Ontario announced that it would join Quebec's program.<sup>38</sup> Additionally, the European Union (E.U.) cap-and-trade program, the Emissions Trading Scheme (ETS), sets emissions allowances for industrial facilities including pulp and paper plants.<sup>39</sup>

The industry's use of wood biomass for energy production allows companies to divert manufacturing residuals into highly efficient energy cogeneration (heat and electricity). However, biomass combustion generates GHG emissions, also called biogenic emissions, and it is unclear how these emissions will be classified under existing or future GHG emissions legislation. Biogenic emissions are mostly CO<sub>2</sub>, but also include other gases. The EPA does not currently regulate biogenic emissions from the pulp and paper industry, but facilities still must report them to the GHGRP.<sup>40</sup> Because they are not offset by carbon sequestration during biomass growth, non-CO<sub>2</sub> biogenic emissions do fall under the scope of GHG regulations.<sup>41</sup>

The EPA has researched biogenic emissions as a result of an effort to further the agency's understanding of the role that biomass can play in reducing GHG emissions. In November 2014, the EPA released the Revised Framework for Assessing Biogenic CO<sub>2</sub> Emissions from Stationary Sources. The agency is currently reviewing its technical understanding of biogenic emissions through targeted peer review with the agency's Science Advisory Board and public comments. In the Revised Framework, the agency contends that biogenic emissions from biomass sourced from

sustainably managed lands likely contribute minimal or zero net carbon emissions, as the carbon released during biomass combustion is largely offset by carbon initially sequestered by trees.<sup>42</sup> It appears likely, though not certain, that the agency will maintain its policy on the carbon neutrality of biomass if it is sourced from sustainably managed forests. The agency will also likely determine whether emissions from biomass sourced from lands that are not sustainably managed should be considered carbon neutral.

The E.U.'s ETS currently treats biogenic emissions as having a zero emission factor.<sup>43</sup> As part its 2030 Climate and Energy Framework, The European Commission is expected to propose new biomass emissions sustainability criteria in 2016 or 2017.<sup>44</sup> In 2010, the E.U. Commission decided not to introduce binding criteria for sustainability requirements for biomass used in electricity, heating, and cooling applications, but instead made recommendations to member states that had introduced or planned to introduce national biomass sustainability requirements. The recommendations include sustainability criteria like land use change and impacts on the forest ecosystem. When it does issue a ruling, the E.U. will likely take an approach similar to the U.S., and maintain the carbon neutrality of biogenic emissions, provided that biomass is produced in a sustainable manner.<sup>45</sup> The E.U.'s treatment of biogenic emissions is relevant for companies that have operations in or that source biomass from the E.U. bloc.

The Clean Water Act (CWA) of 1972 established water discharge quality standards for industrial point sources, including pulp and paper mills. Water effluents from pulp and paper manufacturing can contain organic materials, salts, metals, or other substances that can affect water quality and pH.<sup>46</sup> The EPA has the authority to levy fines against entities that do not comply



with the CWA, and the agency may also require violators to make adjustments to processes or equipment in order to achieve compliance.<sup>47</sup>

Pulp and paper manufacturers source significant quantities of wood and wood fiber from forestry companies. In the 1990s, several independent organizations developed forestry management and wood supply chain sourcing certification standards to improve the industry's impact on environmental and social factors such as biodiversity and rights of indigenous peoples. Forestland can be certified when a third-party auditor determines that a forest manager meets the criteria set by a certification standard.<sup>48</sup> Certification can help pulp and paper manufacturers mitigate potential supply chain disruption or reputational impacts from poor supplier performance. Rising customer demand for certified paper products likewise drives certification. The Programme for the Endorsement of Forest Certification (PEFC) is the world's largest timber certification organization in terms of total certified forest area.<sup>49</sup> Other major standard-setting organizations include the Forest Stewardship Council (FSC)<sup>50</sup> and the Sustainable Forestry Initiative (FSI).<sup>51</sup>

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## SUSTAINABILITY-RELATED RISKS AND OPPORTUNITIES

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Industry drivers and recent regulations suggest that traditional value drivers will continue to impact financial performance. However, intangible assets such as social, human, and environmental capitals, company leadership and governance, and the company's ability to innovate to address these issues are likely to increasingly contribute to financial and business value.

Broad industry trends and characteristics are driving the importance of sustainability

performance in the Pulp & Paper Products industry:

- **Resource intensity:** Pulp and paper products companies use large quantities of natural capital inputs including energy, biomass, and water. Increasing resource constraints and more stringent environmental regulation could lead to higher operating costs or an unstable supply of key resources, especially in developing markets.
- **Environmental externalities:** Externalities of pulp and paper production operations include GHG and other air emissions and water effluents. Increasingly stringent environmental regulation may result in future pollution abatement operating costs and capital expenditures.

As described above, the regulatory and legislative environment surrounding the Pulp & Paper Products industry emphasizes the importance of sustainability management and performance. Specifically, trends suggest a regulatory emphasis on environmental protection and resource efficiency, which will serve to align the interests of society with those of investors.

The following section provides a brief description of each sustainability issue that is likely to have material financial implications for companies in the Pulp & Paper Products industry. This includes an explanation of how the issue could impact valuation and evidence of actual financial impact. Further information on the nature of the value impact, based on SASB's research and analysis, is provided in Appendix IIA and IIB.

Appendix IIA also provides a summary of the evidence of investor interest in the issues. This is based on a systematic analysis of companies' 10-K

and 20-F filings, shareholder resolutions, and other public documents, which highlights the frequency with which each topic is discussed in these documents. The evidence of interest is also based on the results of consultation with experts participating in an industry working group (IWG) convened by SASB. The IWG results represent the perspective of a balanced group of stakeholders, including corporations, investors or market participants, and public interest intermediaries.

The industry-specific sustainability disclosure topics and metrics identified in this brief are the result of a year-long standards development process, which takes into account the aforementioned evidence of interest, evidence of financial impact discussed in detail in this brief, inputs from a 90-day public comment period, and additional inputs from conversations with industry or issue experts.

A summary of the recommended disclosure framework and accounting metrics appears in Appendix III. The complete SASB standards for the industry, including technical protocols, can be downloaded from [www.sasb.org](http://www.sasb.org). Finally, Appendix IV provides an analysis of the quality of current disclosure on these issues in SEC filings by the leading companies in the industry.

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## ENVIRONMENT

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The environmental dimension of sustainability includes corporate impacts on the environment. This could be through the use of natural resources as inputs to the factors of production (e.g., water, minerals, ecosystems, and biodiversity) or environmental externalities and harmful releases in the environment, such as air and water pollution, waste disposal, and GHG emissions.

Pulp and paper production requires significant amounts of energy and water, and can generate

externalities including air emissions and water effluents. Fossil fuel combustion contributes to GHG and other air emissions that can result in increased pollution abatement operating costs, capital expenditures or monetary penalties. While pulp and paper companies use significant amounts of renewable biomass energy, companies also use other resources that can have detrimental environmental impacts. Effective management of on-site and purchased energy and the use of renewable energy can lower operating costs, while potentially reducing GHG and other air emissions. Furthermore, water use and discharge create regulatory risks and may increase vulnerability to operational disruption.

## Greenhouse Gas Emissions

Pulp and paper products manufacturing generates GHG emissions, creating regulatory compliance costs and risks for companies due to climate change mitigation policies. Direct greenhouse gas emissions stem primarily from fossil fuel and biomass combustion in boilers and other processing equipment. Companies also produce some emissions from non-energy related emissions such as lime kiln chemical reactions and methane emissions from wastewater treatment.<sup>52</sup> The vast majority of emissions from the industry are in the form of CO<sub>2</sub>.<sup>53</sup>

The relative magnitude of GHG emissions from the Pulp & Paper Products industry exposes it to potential financial impacts from operating and capital expenditures for GHG emissions abatement, requirements to purchase carbon credits or pay carbon taxes, emissions monitoring, and regulatory penalties for violations of emissions standards.

Companies commonly use onsite combined heat and power (CHP), or cogeneration, systems fueled by biomass and fossil fuels to satisfy a large share

of their energy requirements.<sup>54</sup> The industry's use of renewable biomass fuels, including wood chips, bark, and pulping co-products, is a unique aspect of its GHG and energy profile.

Companies in this industry typically meet a significant share of their energy requirements with biomass. Because they are believed to be negated by carbon sequestration during the growth of biomass, biogenic emissions are considered carbon neutral by most major regulatory regimes around the world. The use of biomass can therefore mitigate the risks posed by current GHG emissions rules. The use of biomass can also help reduce the considerable costs associated with purchasing fossil fuels, as many biomass fuels are residuals or other by-products from manufacturing. Companies could also earn renewable energy credits in some regions through the use of biomass fuel.

However, there is uncertainty about the regulatory treatment of biogenic emissions and the scope of future GHG regulations. Regulatory authorities including the U.S. EPA and the European Commission are currently assessing biogenic emissions from stationary sources (see Legislative and Regulatory Trends section). The relative size of the Pulp & Paper Products industry's biogenic emissions suggests that companies must manage this issue carefully. Emissions of GHGs other than CO<sub>2</sub> and other air pollutants also create regulatory risk under existing environmental regulations.

A principal way for the industry to reduce direct GHG emissions is to manage direct energy consumption. Because fossil fuel purchases are a large share of the cost of materials in this industry,<sup>55</sup> energy consumption is also directly related to operating costs. Emissions reduction through improved energy efficiency, use of cleaner-burning fuels, or process advances can

provide significant financial benefits. These include lower operating costs and reduced regulatory risk and emissions offset or abatement expenditures. Companies can also use other renewable energy sources that have lower associated GHG emissions (like biomass), or implement emissions capture technologies.

Company performance in this area can be analyzed in a cost-beneficial way through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Gross global Scope 1 emissions; and
- Description of long-term and short-term strategy or plan to manage Scope 1 emissions, emission-reduction targets, and an analysis of performance against those targets.

## Evidence

A company's energy profile is a key determinant of the magnitude of its direct and indirect GHG emissions. In general, direct GHG emissions are positively correlated with fossil fuel consumption, while indirect emissions are linked with purchased electricity consumption. Financial impacts and risks from the consumption of purchased electricity are discussed in the Energy Management disclosure topic.

Pulp and paper manufacturing processes are energy intensive and typically require high operating temperatures and pressure and operate at relatively low thermal efficiency.<sup>56</sup> The industry meets a large proportion of its energy needs through highly efficient on-site cogeneration of steam and electricity, primarily by burning pulping by-products, woody biomass, natural gas, coal, and smaller amounts of distillate fuel oil. According to the American Forest and Paper Association, biomass fuels supply nearly two-thirds of the industry's energy.<sup>57</sup> Individual

companies report even greater use of biomass; in 2014, Domtar met 77 percent of its energy needs from biomass, 13 percent from natural gas, six percent from coal, and the remaining four percent from purchased electricity and steam.<sup>58</sup>

Data from the 2013 GHGRP shows that Scope 1 GHG emissions (excluding biogenic emissions) from the 230 reporting facilities in the Pulp & Paper Products industry totaled approximately 44 million metric tons CO<sub>2</sub>e, accounting for nearly 1.5 percent of the total emissions reported to the GHGRP. By comparison, the industry's biogenic emissions totaled nearly 119 million metric tons CO<sub>2</sub>e,<sup>59</sup> or approximately 170 percent of non-biogenic emissions.<sup>60</sup> Biogenic emissions are therefore an important regulatory consideration for the industry. Biomass combustion also produces smaller volumes of non-CO<sub>2</sub> emissions, including methane and nitrous oxide, both potent GHGs. Over a 100 year period, methane and nitrous oxide are approximately 32 and 298 times as potent as CO<sub>2</sub>.<sup>61</sup> Some companies also operate landfills for the disposal of process waste, which produce methane emissions. By weight, the industry's methane and nitrous oxide emissions were approximately 13 and 1.4 percent of total reported GHG emissions, respectively.<sup>62</sup>

The industry's significant direct GHG emissions are a result of its relatively high fossil fuel consumption compared to other industries, despite the fact that fossil fuels account for a small share of its overall fuel consumption. As reported in the 2010 Energy Information Administration's Manufacturing Energy Consumption Survey (MECS), SASB's Pulp & Paper Products industry—which includes the North American Industry Classification Code (NAICS) Pulp Mills (NAICS 322110), Paper Mills (NAICS 322121), Newsprint Mills (NAICS 322122), and Paperboard Mills (NAICS 322130)—consumed approximately 579 trillion British thermal units

(Btu) of fossil fuels. The fuels in the survey included residual fuel oil, distillate fuel oil, natural gas, liquefied petroleum gases and natural gas liquids, coal, and coke breeze. The industry accounted for nearly nine percent of total fossil fuel consumption for all industries surveyed in the MECS.<sup>63</sup>

Purchased fossil fuels are a significant cost to companies. According to data from the U.S. Census Bureau's Annual Survey of Manufacturers (ASM), the Pulp & Paper Products industry spent nearly \$3.4 billion on purchased fuels in 2013; approximately 8.9 percent of the cost of materials and 7.8 percent of value added for the industry. By comparison, across all industries included in the survey, the average costs of purchased fuels as a share of the cost of materials and value added were 1.1 percent and 1.6 percent, respectively. This disparity illustrates the industry's relative energy intensity and the potential for cost savings from energy efficiency measures.<sup>64</sup>

Besides the potential for cost savings, companies have an incentive to reduce their emissions due to emerging and existing GHG regulations. Major pulp and paper products companies address the risks related to GHG emissions regulations in SEC disclosure forms. For example, Domtar stated in its FY 2014 Form 10-K that "Passage of GHG legislation by Congress or individual states, or the adoption of regulations by the EPA or analogous state agencies, that restrict emissions of GHGs in areas in which the Company conducts business could have a variety of impacts upon the Company, including requiring it to implement GHG reduction programs or to pay taxes or other fees with respect to its GHG emissions. This, in turn, will increase the Company's operating costs and capital spending."<sup>65</sup> Most large companies in this industry have similar disclosure in their SEC filings, underscoring the impact regulations can have on financial performance.

Implementing energy efficiency measures is among the most cost-effective means for companies to reduce their GHG emissions. Steam is the largest end use of energy in the industry, including energy produced onsite and offsite. Electricity is the second largest end use. Therefore, improvements to the efficiency of steam and electricity-driven equipment and processes can help companies achieve energy cost savings and lower GHG emissions associated with steam and electricity production.<sup>66</sup>

In 2013, the World Resources Institute (WRI) conducted a study on energy use and GHG emissions in Midwestern pulp and paper mills and found that in the near term, energy efficiency measures could reduce carbon emissions more than switching to less carbon-intensive fuels. In the study, WRI estimated total possible emissions reductions for two possible scenarios: In one, coal and fuel oil were switched to natural gas; in the other, facilities achieved U.S. DOE Energy Star benchmark efficiency. The fuel-switching scenario reduced emissions by 19 percent, while the DOE scenario reduced emissions by 34 percent.<sup>67</sup>

In the long term, an increase in the use of biomass or other renewable energy may also be necessary to lower the industry's regulatory risks related to direct GHG emissions. Alternative energy sources could also support cost reductions from displacing the purchase of fossil fuels, which can have volatile prices. However, according to the WRI, the cost-benefit of increased biomass use could depend on how biogenic emissions are ultimately accounted for under regulatory emissions programs.<sup>68</sup> Additionally, using more biomass fuel might also increase emissions of non-CO<sub>2</sub> GHGs and other air emissions. Greater emissions could lead to more regulatory risk or pollution abatement obligations under existing environmental regulations. Companies must

consider environmental and regulatory risk tradeoffs associated with biomass fuels.

In light of these concerns, major companies are undertaking energy efficiency and GHG reduction measures. For example, in its FY2014 Form 10-K, Weyerhaeuser wrote, "To address concerns about greenhouse gases as a pollutant, we adopted in 2006, as part of the Company's sustainability program, a goal of reducing greenhouse gas emissions by 40 percent by 2020 compared with our emissions in 2000, assuming a comparable portfolio and regulations; determined to achieve this goal by increasing energy efficiency and using more greenhouse gas-neutral, biomass fuels instead of fossil fuels ..."<sup>69</sup>

While reducing GHG emissions can mitigate regulatory risk, companies can also benefit from GHG regulations through the sale of renewable energy credits generated from the use of renewable fuels. For example, in the first three quarters of FY2015, P.H. Glatfelter sold \$2.9 million worth of credits earned through its use of renewable biomass energy.<sup>70</sup>

## Value Impact

Managing GHG emissions can directly affect a company's cost structure. Regulation could require companies to reduce or offset GHG emissions, resulting in higher operating costs or emissions abatement capital expenditures. These costs could lower operational efficiency, and reduce profit margins.

Conversely, the potential to reduce emissions can provide a revenue opportunity through the sale of carbon-offset credits. Reducing emissions through improved energy efficiency, the use of renewable energy, or other process improvements can also increase operational efficiency and generate significant cost savings. Managing GHG emissions therefore requires careful consideration from a

company's management in order to optimize benefits from the many trade-offs involved.

Firms that currently derive most of their energy from biogenic sources benefit from the lower risks associated with energy independence: and exemption from GHG regulations addressing CO<sub>2</sub> emissions. Lowered risk in this area can favorably affect their cost of capital. On the other hand, if the regulatory environment were to require the monitoring or reduction of CO<sub>2</sub> emissions from specific types of biomass, companies may be financially impacted, particularly given the magnitude of their biogenic emissions. Increased use of biomass energy could also potentially create regulatory risks related to non-CO<sub>2</sub> GHG emissions and air quality.

The probability and magnitude of the impact of GHG emissions on the industry are likely to increase in the near to medium term, as the trend toward broader regulation of GHG emissions continues.

Disclosure of Scope 1 GHG emissions enables financial analysis of the current and future effects of GHG mitigation policies and pressures on profitability and cash flow. The metric also allows for comparative analysis of competitor performance and their respective exposure to GHG risks, allowing for investment preference and, ultimately, capital allocation. The percentage of emissions covered under regulatory programs can indicate which companies are at risk of significant financial impacts due to GHG emissions.

Discussion of a company's strategy to manage Scope 1 emissions gives analysts a view into the company's ability to address the operational and financial impacts associated with GHG emissions, and how well the company is positioned for more stringent GHG emissions regulations or incentives for lower emissions.

## Air Quality

In addition to GHGs, pulp and paper mills emit significant quantities of air emissions that can impact the environment and human health. These emissions include Hazardous Air Pollutants (HAPS) and volatile organic compounds (VOCs) like SO<sub>x</sub>, NO<sub>x</sub>, carbon monoxide, particulate matter (PM), formaldehyde, and methanol. Exposure to these substances has been linked to human health problems including cancer and pulmonary disease.<sup>71</sup> Emissions can also contribute to acidification of soils and bodies of water, harming wildlife and plants. The sources of emissions from paper and pulp manufacturing include cogeneration fuel boilers, pulp and paper pressure chambers, wood chip pulping, pulping chemical recovery, and process engines, among others. Biomass and fossil fuels are the primary sources of emissions; an increase in the use of renewable biomass to mitigate GHG emissions could lead to greater non-GHG emissions. Thus, greater biomass use may have regulatory implications.

Emissions of air pollutants from the industry have declined considerably over the past few decades.<sup>72</sup> Nonetheless, the industry's air emissions are substantial and result in regulatory risk. Non-compliance with emissions standards could require the installation of emissions-reduction equipment, potentially creating unplanned capital expenditures. Additionally, the industry may face future risks from currently unregulated air emissions or emissions below current regulatory thresholds, as public and regulatory concern over air quality drive more stringent air quality regulations.

Companies in the industry work to maintain air emissions below regulatory thresholds in order to anticipate and reduce costs associated with pollution abatement, permitting, and regulatory penalties. Active management of facility emissions

through the implementation of industry best practices across operations can also lower costs, and potentially enhance operational efficiency.

Company performance in this area can be analyzed in a cost-beneficial way through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Air emissions for the following pollutants: NO<sub>x</sub> (excluding N<sub>2</sub>O), SO<sub>x</sub>, volatile organic compounds (VOCs), particulate matter (PM), and hazardous air pollutants (HAPs).

## Evidence

SASB's analysis of air pollution data for all industrial processes from the EPA's 2014 National Emissions Inventory of data shows that the Pulp & Paper Products industry has relatively significant air emissions. The industry released as much as 31 percent of all acetaldehyde and 13 percent of all VOC emissions from industrial processes. The industry's share of nitrogen oxides from all industrial processes was approximately 5.2 percent, while its share of PM<sub>10</sub> was about 7.4 percent. The industry was consistently among the top three emitters of the pollutants examined in the report.<sup>73</sup>

In the U.S., the EPA inventories emissions and sets limits for emissions sources. Manufacturers are required to estimate their emissions in order to pay periodical permitting costs. Companies may also be required to invest in emissions-reduction technologies to comply with regulations or stricter permit requirements.<sup>74</sup> The EPA has the authority to levy monetary penalties against violators. In Canada, the Canadian Ambient Air Quality Standards currently regulate emissions of PM and ozone. The standards are eventually expected to include emissions of SO<sub>x</sub> and NO<sub>x</sub>.<sup>75</sup> Proposed federal multi-sector air pollutant regulations will

establish Base Level Industrial Emission Requirements for pulp and paper facilities, including numeric emission limits or qualitative requirements. Some provincial governments have issued their own air emissions standards.<sup>76</sup>

Companies have to contend with increasingly stringent air emissions regulations, which could threaten profitability or create business risk, particularly in the absence of company strategies for continuous emissions reductions. In December 2012, the EPA issued a new standard for emissions from industrial and commercial power boilers, machines that pulp and paper facilities commonly use.<sup>77</sup> The new rule, labeled the Boiler MACT, aims to reduce HAP emissions and impacts all industrial manufacturers. The rule is expected to increase air pollution abatement capital expenses for pulp and paper producers.<sup>78</sup> The AF&PA estimates that the regulations may cause the industry to incur capital costs of up to \$14 billion over the next three to ten years.<sup>79</sup>

Individual companies report spending considerable sums to reach compliance, and also note the potential for future costs associated with regulatory developments. In its 2015 second quarter report, P.H. Glatfelter stated that the rules "will require process modifications and/or installation of air pollution controls on boilers at two of our facilities ... [t]he total cost of these projects is estimated at \$85 million to \$90 million of which \$17.9 million has been spent to date ... [t]he amount of capital spending ultimately incurred may differ, and the difference could be material. Enactment of new environmental laws or regulations or changes in existing laws or regulations could significantly change our estimates." Some of the modifications include converting or replacing coal-fired boilers with natural gas power.<sup>80</sup> To reach compliance with the MACT, Domtar expects to spend an additional

\$18 to \$25 million, in addition to the \$10 million spent in 2014 on equipment upgrades.<sup>81</sup>

Data from the EPA's 2005 Pollution Abatement and Capital Expenditures (PACE) survey shows that the Pulp & Paper Products industry spent approximately \$360 million on air pollution abatement capital expenditures, approximately nine percent of the manufacturing sector's total spending in this area.<sup>82</sup> In addition to capital expenditures, companies also incur substantial air pollution abatement operating expenses. In 2005, the Pulp & Paper Products industry spent approximately \$489 million on air emissions abatement operating costs, approximately 5.6 percent of the manufacturing sector's total air emissions abatement operating costs.<sup>83</sup> These figures, although dated, suggest that the industry spends considerable amounts of money to comply with air emissions regulations. More stringent regulations in the future could result in additional, potentially unplanned costs.

Air emissions from the Pulp & Paper Products industry have fallen significantly as a result of technological innovation and process improvements, which were driven in part by more stringent environmental regulation. Data obtained by the AF&PA show that member, emissions of NO<sub>x</sub> and SO<sub>x</sub> per ton of production fell 47 percent and 80 percent between 1975 and 2010. Emissions of these substances fell an additional 23 percent and 42 percent between 2000 and 2010, respectively.<sup>84</sup> Individual company efforts are the driving force behind these improvements. For example, Kapstone Paper aimed to reduce "critical air emissions" per ton of production by 25 percent between 2010 and 2020. By the end of 2013, the company had achieved a 54 percent reduction. The implementation of MACT for boilers was partly responsible for this decline. The power boiler at the company's Charleston facility

was one of the top 12 performing boilers for low mercury and hydrochloric acid emissions.<sup>85</sup>

Violations of emissions standards can result in significant fines and mediation expenses. In 2007, the EPA fined a Northern California pulp mill \$900,000 for allegedly exceeding allowable HAP emission levels by 230 percent and violating monitoring, reporting, recordkeeping, and air pollution control equipment maintenance requirements over a period of several years. The company was also ordered to spend \$4 million to install a pollution control device designed to capture particulate emissions from a lime kiln.<sup>86</sup>

### Value Impact

Air emissions management can have an ongoing impact on the operational efficiency and cost structure of companies. Companies could face planned or unplanned capital expenditures for emissions abatement and regulatory fines due to violations of emissions standards.

Furthermore, companies could face difficulties obtaining the air emissions permits required for the production or expansion of facilities, affecting revenue generation. Production may be also be affected by the down time that is required for upgrades to air pollution mitigation equipment.

The financial impacts from air pollution will vary depending on the specific location of company operations and the prevailing air emissions regulations, which may be less developed in some regions and countries.

Regulations addressing air quality are likely to become more stringent over time. As a result, the probability and magnitude of the impact of air emissions management on financial results is likely to increase in the near to medium-term.

Emissions of specific air pollutants can provide an indication of the likelihood that a company will be



impacted by abatement costs. Comparing the emissions intensity of production among companies can help analysts gauge relative emissions-related risk.

## Energy Management

Pulp and paper products manufacturing requires substantial quantities of electricity, typically produced from the direct combustion of biomass and fossil fuels and purchased from the electrical grid.<sup>87</sup> The regulatory risks and operational efficiency implications associated with fossil fuel and biomass consumption are discussed in the Greenhouse Gas Emissions disclosure topic. In addition to a large amount of direct fuel use, the industry also purchases a significant amount of electricity relative to others. Purchased electricity accounts for a significant share of the cost of materials across the industry. Reliance on purchased electricity creates indirect regulatory and operating risks through higher grid electricity costs or potential grid disruption.

The long-term prospects of increased demand for energy and climate change regulation suggest mounting upward pressure on the price of conventional sources of electricity. Disruptions to the electrical grid due to climate change or other factors also create operational risk for companies reliant on purchased electricity. Thus, the tradeoff between on-site versus grid-sourced electricity and the use of alternative energy can be an important factor in influencing the cost and reliability of energy supply, as well as the extent of GHG and other air emissions.

Energy efficiency improvements and the use of distributed renewable electricity—including biomass-based electricity—can reduce a company's dependence on the grid, its overall need for power generation, and, therefore, its energy costs. The use of CHP systems greatly

improves the overall energy efficiency of pulp and paper manufacturing.<sup>88</sup> While the use of biomass can help mitigate risks associated with both fossil fuel and purchased electricity consumption, companies must also consider the regulatory treatment of biogenic GHG emissions and other air emissions, as discussed in the previous disclosure topics.

Company performance in this area can be analyzed in a cost-beneficial way through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Total energy consumed, percentage grid electricity, percentage from biomass, and percentage from other renewables.

## Evidence

Energy is crucial for value creation in this industry, and purchased power costs can be a significant expense. Improvements in energy efficiency or the use of renewable energy sources can increase operating margins and mitigate impacts from possible electricity price increases or supply disruptions.

According to 2013 ASM data, the Pulp & Paper Products industry purchased approximately 47 billion kilowatt hours (kWh) of electricity in 2012. This quantity constituted 6 percent of the total purchased electricity in the U.S. manufacturing sector. In 2012, the industry spent nearly \$2.6 billion on purchased electricity, which amounts to approximately 6.6 percent of the total cost of materials, or 5.9 percent of value added. By comparison, purchased electricity accounts for 1.5 percent of the total cost of materials of all U.S. manufacturing industries included in the survey.<sup>89</sup> These figures indicate the industry's above average exposure to rising electricity costs and grid disturbances. Individual energy use characteristics vary by company, but generally

reflect industry averages. For example, energy consumption in Domtar's pulp and paper segment accounted for approximately six percent of its cost of sales.<sup>90</sup>

While real prices of electricity have remained relatively stable in recent years, the U.S. Energy Information Administration's long-term projections show that average end-use prices for electricity across sectors will increase by around 4.5 percent between 2013 and 2020, in 2013 cents per kWh, and by 12.5 percent between 2013 and 2035. In fact, compared to 2013 prices, real electricity prices are expected to increase across various scenarios, including low and high economic growth and low and high oil prices.<sup>91</sup>

In addition to price increases, grid service interruptions can cause operational downtime. Grid disruptions can occur due to increasing extreme weather events associated with climate change in both developed and developing countries. In the U.S., significant weather-related grid disturbances have been steadily increasing, from just over 20 incidents in 2003 to almost 140 incidents in 2011.<sup>92</sup>

Companies may be unable to pass on increased energy prices to customers since the industry competes largely on price. SEC disclosure addresses some of the financial risks from energy prices and accessibility. In its FY2014 Form 10-K, Resolute Forest states, "Any sustained increase in other raw materials or energy prices without any corresponding increase in product pricing would reduce the Company's operating margins and may have a material adverse effect on its business and results of operations."<sup>93</sup>

While the industry purchases a significant amount of electricity, it is also the largest self-generator of electricity in the U.S. manufacturing sector. According to the 2010 MECS, the industry generated an estimated 44.7 billion kWh of

electricity onsite, approximately 33 percent of the U.S. total generated onsite.<sup>94</sup> The AF&PA reports that its members generated 59 percent of their electricity requirement in 2014, largely through biomass-fueled cogeneration. Companies can therefore achieve cost savings through onsite electricity generation using manufacturing residuals and biomass, and mitigate the impact of possible grid supply disruptions. Furthermore, approximately 23 percent of AF&PA members sold energy back to the grid, suggesting that some companies can earn revenue from energy sales.<sup>95</sup>

Electricity produced from renewable biomass fuel is eligible for renewable energy incentives in some U.S. states and areas of Canada and Europe, allowing some companies to generate additional revenue. For example, in 2014, Mercer International generated \$88.8 million—nearly 7.5 percent of the company's total revenue—from sales of surplus renewable electricity from its facilities.<sup>96</sup> In its FY2014 Form 10-K, Mercer International states, "As part of the pulp production process our mills generate 'green' energy using carbon-neutral bio-fuels such as black liquor and wood waste...and allow us to produce surplus electricity which we sell to third party utilities. As a result, we have benefited from "green" energy legislation, incentives and commercialization that have developed over the last few years in Europe and Canada."<sup>97</sup>

However, self-generation of electricity using biomass or fossil fuels must be understood in the context of regulatory treatment of biogenic GHG emissions and other air emissions.

Companies can implement energy-efficient technologies in order to reduce purchased electricity costs. Approximately 80 percent of electricity is used to power machine-driven systems such as pumps, conveyors, compressors, fans, grinders, mixers, and other processing

equipment. Heating, ventilation, cooling, and refrigeration equipment consume the remainder.<sup>98</sup> In 2002, the DOE estimated that electrical motor-driven efficiency improvements at some facilities in the industry could result in an overall reduction in electricity use of 14 percent.<sup>99</sup> Considering the industry's total cost of purchased electricity, a 14 percent reduction in use could amount to hundreds of millions of dollars in savings.

## Value Impact

Effective energy management can mitigate the impacts of electricity price increases as well as operational disruptions or inefficiencies that might result from grid interruptions. Pulp and paper companies can improve their operational efficiency and lower their cost structure in the medium to long term by implementing process or technological innovation to improve energy efficiency, producing electricity on-site through CHP, or using renewable sources of energy. Additionally, companies could earn additional revenues as well through the sale of renewable energy or carbon offset credits through the use of renewable biomass. Companies that generate surplus energy onsite can also earn revenues from energy sales.

The probability and magnitude of these impacts could increase in the future as emerging governmental regulations on environmental externalities from energy generation affect energy prices and incentives.

A company's energy consumption can give analysts an indication of its relative energy efficiency and vulnerability to rising prices. The percentage of a company's energy coming from the grid indicates its exposure to electricity price increases, as utilities internalize the costs of carbon emissions (for example, through new GHG mitigation regulations). It can also indicate a company's exposure to possible grid supply

disruptions due to climate change or other factors. Disclosure on the percentage of renewable energy used indicates how well a company is positioned to capture possible cost savings and ensure stable energy prices.

A company's share of energy from biomass sources can indicate reduced exposure to increasing grid electricity prices, volatile fossil fuel prices, and potential grid energy disruptions. The share from biomass sources and a company's approach to the use of such sources would also provide additional context to analysts on any regulatory risks associated with biogenic GHG emissions and air pollutants (discussed in earlier disclosure topics).

## Water Management

The Pulp & Paper Products industry is among the most water intensive industries, and generates significant water discharges. Water is used during raw materials preparation, pulping, bleaching, pulp transportation, creation of paper slurry, process cooling, and steam generation at on-site cogeneration plants. The water intensity of an individual mill is dependent upon the processes, technologies, and materials in use, such as recycled versus virgin wood fiber. Process applications account for approximately 90 percent of water use in a typical mill, while boiler and cooling functions account for the remainder.<sup>100</sup> Water is commonly returned to the environment after use. The AF&PA estimates that water can be recycled as many as ten times in the paper making process.<sup>101</sup>

The majority of the forest products industry's water needs are met by surface water withdrawals; only about 14 percent is derived from groundwater supplies. As a result, many facilities require stable surface water sources such as lakes and rivers. Water consumption is

relatively low, however; the National Council for Air and Stream Improvement estimates that 88 percent of water withdrawals in the industry are returned to the environment as treated effluent or untreated coolant effluent. Water loss occurs primarily through evaporative cooling.<sup>102</sup>

In addition, the Pulp & Paper Products industry generates large volumes of wastewater. Process water is often rich in total suspended solids (TSS) from pulp cooking, screening, bleaching, chemical recovery processes, and dissolved organic compounds, and may also contain resin acids and tannins released from wood and bark. Releasing inadequately treated water effluent to the environment can result in oxygen depletion of receiving waters, aquatic pH fluctuations, accumulation of persistent organic chemicals in the ecosystem, eutrophication from nutrient loading, and heavy metals.<sup>103</sup> Therefore, water treatment typically involves neutralization, screening, and sedimentation to remove solids, as well as further biological treatment to remove organic materials and reduce toxicity. Water treatment produces sludges that are sometimes used in energy generation or are disposed of as solid waste.<sup>104</sup> Although regulatory bodies have issued infrequent water regulation fines to companies in the industry over the past decade, violation of water effluent standards can result in penalties.

The industry's reliance on water for value creation adds additional risk. Water is becoming a scarce resource in many regions due to increasing consumption from population growth and rapid urbanization, and more stressed supplies due to climate change. Furthermore, water pollution can make available water supplies unusable or expensive to treat. Based on recent trends, important river basins in the U.S., Mexico, Western Europe, China, and elsewhere will face severe water shortages by 2025 as demand

overtakes renewable supplies. Many important river basins can already be considered "stressed."<sup>105</sup> Additionally, if companies withdraw water from sensitive areas for manufacturing purposes, or contaminate water supplies, they could create tensions with local communities, particularly if those communities are deprived of drinking water as a result.<sup>106</sup>

Companies can adopt various strategies to address water supply and treatment issues and related business risks. For example, they can work to improve closed-loop recycling of process water, implement production techniques to lower water intensity or wastewater volumes, and manage water effluent treatment.<sup>107</sup> Water efficiency and wastewater reductions could also help lower water sourcing and treatment costs, mitigate water constraints, and reduce the energy requirements of water treatment. Companies could also seek to secure alternative water supplies or storage facilities in the face of increasing water stress, but these could necessitate substantial capital expenditures.

Company performance in this area can be analyzed in a cost-beneficial way through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Total water withdrawn and total water consumed, percentage of each in regions with High or Extremely High Baseline Water Stress; and
- Discussion of water management risks and description of management strategies and practices to mitigate those risks.

## Evidence

Pulp and paper producers are highly reliant on water for value creation. A 2013 MSCI ranking of 130 Global Industry Classification System sub-industries by water value-added placed the Paper

Products industry fifth overall.<sup>108</sup> According to the EPA, the pulp and paper industry is the largest industrial process water user in the U.S.<sup>109</sup>

Reduced water availability due to climate change and other trends is a growing risk for the industry, despite the fact that the majority of operations are in regions with historically ample water supplies, including the U.S. Great Lakes region, the U.S. Southeast<sup>110,111</sup> and Southwest, and Southeast Canada.<sup>112</sup> For example, Glatfelter, a paper producer with manufacturing locations in Pennsylvania, Ohio, and Quebec, among others,<sup>113</sup> disclosed in its FY 2013 Form 10-K that “At various times and for differing periods, each of our mills has had to modify operations due to water shortages, water clarity, or low flow conditions in its principal water supplies. Any interruption or curtailment of operations at any of our paper mills due to drought or low flow conditions at the principal water source or another cause could materially and adversely affect our operating results and financial condition.”<sup>114</sup>

Two recent examples from South America illustrate the potential operational impacts manufacturers face from reduced water availability, and how companies have responded to water supply risks. In 2011, Arauco, a large Chilean pulp producer, halted production at its mill in Southern Chile due to low flow in the river that supplies the plant’s water. The mill reopened after ten days, but the shutdown reduced production by an estimated 15,000 tons, nearly 2.7 percent of the mill’s annual production capacity.<sup>115</sup>

Fibria Cellulose has taken measures to mitigate operating risks from water supply constraints, as well as to avoid wastewater contamination of nearby areas. The company has built a 35 million cubic meter reservoir at one of its mill sites, which

the company estimates could supply the mill for 5 months during a severe drought. The company also operates emergency lagoons and tanks that can capture untreated effluents in the event of a malfunction of its water treatment plants.<sup>116</sup>

In addition to potential financial impacts from reduced water availability, the treatment of process water and effluents results in ongoing pollution abatement expenses. While most companies in the industry have not experienced significant fines or remediation expenses related to water effluents in recent years,<sup>117</sup> water quality standards present an ongoing regulatory risk for companies generating substantial amounts of wastewater. Manufacturing facilities can generate wastewater of 10 to 250 cubic meters per metric ton of product, depending on the pulping and paper process used in a facility.

Treatment of water effluents in on- or off-site facilities results in operating costs and capital expenditures. According to data from the 2005 PACE survey, the industry faced water pollution abatement operating costs of approximately \$700 million, while capital expenditures totaled \$142 million. These amounts represent nearly ten percent of the U.S. manufacturing sector’s total water pollution abatement operating costs and capital expenditures.<sup>118</sup> This data suggests that the industry regularly spends considerable sums to comply with water quality regulations. More stringent water quality regulations in the future could result in additional costs.

Production methods that can reduce water consumption and contamination include: dry debarking processes, reduced use of bleaching chemicals in the extended pulp delignification process, chlorine-free bleaching systems, and controlling spills of black liquor in chemical pulp manufacturing. Reduced water use has the added benefit of a corresponding reduction in energy

use, and can potentially result in savings of millions of dollars per year per mill site.<sup>119</sup>

As a result of improved water efficiency and recycling and treatment technologies, the industry has achieved notable improvements in the quality of discharged water over the past few decades. As of 2010, AF&PA members had reduced treated effluent discharges by 55 percent since 1975, and 15 percent since 2000. Releases of biochemical oxygen demand substances—dissolved organic materials that contribute to water oxygen depletion—have fallen by 88 percent since 1975, and 11 percent since 2000. Similarly, discharges of TSS fell by 80 percent from 1975 levels. However, water treatment and discharge continue to present a cost and risk for pulp and paper manufacturers.<sup>120</sup>

### **Value Impact**

Significant water consumption and wastewater can influence companies' operational risks, with potentially acute impacts on value from disruptions to production. Large water withdrawals, inefficient water use, and contamination of water sources create operational risks related to price and availability, potentially disrupting production or leading to additional permitting requirements and affecting companies' ability to meet demand. Water constraints could have an impact on long-term growth prospects and market share, as well as a company's risk profile and cost of capital.

The treatment of process water can also affect ongoing operating costs and impact cash flows through increased capital expenditures or one-time regulatory penalties. On the other hand, more efficient use of water over time could generate cost savings and lower operating expenses.

As regulations become more stringent over time, and the effects of climate change become more acute, the probability and magnitude of financial impacts due to water effluents and withdrawals are likely to increase.

Withdrawals of water in water-stressed regions indicate a company's exposure to the risk of water supply constraints or higher costs. Discussion of a company's approach to managing water risks can indicate how well it is meeting long-term water needs and managing financial impacts related to water treatment and discharge compared to its peers.

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## **LEADERSHIP AND GOVERNANCE**

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As applied to sustainability, governance involves the management of issues that are inherent to the business model or common practice in the industry and are in potential conflict with the interest of broader stakeholder groups (government, community, customers, and employees). They therefore create a potential liability, or worse, a limitation or removal of license to operate. This includes regulatory compliance, lobbying, and political contributions. It also includes risk management, safety management, supply chain and resource management, conflict of interest, anti-competitive behavior, and corruption and bribery.

The Pulp & Paper Products industry sources large quantities of virgin and recovered wood and wood fiber from a variety of suppliers, including private landowners and forestry companies. Forest management and fiber recovery can lead to potential adverse environmental and social impacts that can affect the fiber supply and create reputational risk. If forests are not managed in a sustainable manner, there may be adverse outcomes such as biodiversity loss, impacts on endangered species, deforestation, erosion, soil

depletion, and runoff. Additionally, forestry operations could impact forest-dependent communities and indigenous peoples. Because of increased emphasis on the recognition of the value of ecosystems and human rights, the industry's customers as well as government and public stakeholders continue to value strong sustainability performance in forestry and logging operations. Pulp and paper products companies can show leadership by encouraging the use of more sustainable forestry practices among suppliers. Third-party certifications of such practices allow companies to meet rising demand for certified paper products. Furthermore, the use of recycled fiber in paper production can mitigate some of the risks associated with virgin fiber and wood sourcing. However, challenges associated with using recycled fiber warrant a careful lifecycle analysis of potential net sustainability and financial benefits.

## Fiber Sourcing & Recovery

Pulp and paper manufacturers source large quantities of wood and fiber from forestry and logging companies, private landowners, paper fiber recyclers, and forests that companies manage themselves. The potential for adverse environmental and social externalities in forestry and logging operations can create reputational risk and operational impacts for pulp and paper companies. To mitigate supply chain risk and satisfy growing customer demand for sustainably sourced fiber and paper products, pulp and paper manufacturers use forest and fiber certification and chain-of-custody standards, which verify that virgin and recycled fiber originate from sustainably managed forests. Pulp and paper companies can benefit financially from robust fiber-sourcing guidelines and by encouraging or assisting their suppliers to engage in sustainable forestry practices, particularly by supporting group certification of smaller timber producers.

In addition to issues that arise from sourcing virgin fiber, pulp and paper manufacturers face trade-offs when they use recycled fiber. Just like certified products, those with recycled content are increasingly in demand. Using recycled fiber can minimize the need for virgin fiber, potentially reducing adverse externalities from timber production, as well as divert paper waste streams, thereby lowering landfill GHG emissions. Companies could also benefit from anticipating regulations designed to extend the product end-of-life responsibility to manufacturers. Conversely, manufacturing products with greater recycled content can increase waste generation and energy consumption, and because of demand-supply gaps, recycled fiber can also be more costly to purchase. Therefore, companies could benefit from a lifecycle approach that includes optimizing recycled fiber use to balance its environmental and economic impacts.

In an effort to mitigate supply chain risk and meet market demand, many pulp and paper companies source fiber from forests certified by organizations including the FSC, SFI, and PEFC. Forestry companies can achieve certification of their lands by following guidelines outlined by forest management certification standards that typically protect and promote biodiversity and ecosystems, workers' and indigenous peoples' rights, local employment, and legal logging practices.<sup>121</sup> Pulp and paper companies in turn obtain Chain-of-Custody (COC) certifications that trace fiber from a certified forest to the mill. COC certifications are used to establish that the sourced fiber—either virgin or recycled—originates from well-managed forests, controlled sources, reclaimed materials, or a blend of these.<sup>122</sup>

While obtaining certification can require investment of time and resources, companies can achieve net benefits from risk mitigation and enhanced market opportunities. Pulp and paper

products companies can benefit financially from strategic decision-making about supplier and raw material selection and ensuring that suppliers adhere to industry best practices. Company performance in this area can be analyzed in a cost-beneficial way through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Percentage of wood fiber sourced from third-party certified forestlands and percentage to each standard, and percentage meeting other fiber sourcing standards and percentage to each standard; and
- Amount of recycled and recovered fiber procured.

## Evidence

Nearly 30 percent of the world's forests are used to supply the production of wood-based products, including pulp and paper. Statistics from the United Nations Food and Agriculture Organization (FAO) indicate that in 2013, the volume of virgin and recycled wood fiber used in the manufacture of paper and paperboard produced globally was nearly 400 million tons, or approximately 23 percent of total industrial roundwood<sup>IV</sup> production. Approximately 36 percent of global pulp and paper production took place in the Asia-Pacific region, 29 percent in North America, 26 percent in Europe, and eight percent in Latin American.<sup>123</sup>

Commoditized wood and fiber can be difficult to trace through the supply chain. Companies source fiber from forestry companies through contract agreements, or through a combination of purchases from other fiber producers or private landowners. While most of the fiber sourced by

U.S. exchange-listed companies in the Pulp & Paper Products industry is grown in North America, some companies source fiber from higher-risk areas such as Brazil,<sup>124</sup> where an estimated 47 percent of primary forest logged areas are illegally logged. Chatham House estimates that illegal logging accounts for between 20 and 40 percent of global timber production, and occurs mostly in regions with weaker legal and regulatory environments, such as parts of South America, Southeast Asia, and Eastern Europe. In the U.S., only an estimated three percent of the timber market is illegally logged.<sup>125</sup>

Despite the fact that many forestry and logging companies and private landowners follow stringent SFM guidelines, potential environmental externalities in forestry create supply chain risks for pulp and paper producers. For example, logging infrastructure and activities including vehicles, roads, skid trails, and clear-cutting can foster erosion and soil depletion, restricting trees' access to water and nutrients, and diminishing their growth rates. Externalities could extend beyond the forest; for example, erosion caused by logging operations can result in sedimentation of streams, harming the aquatic environment and increasing the risk of downstream flooding.<sup>126</sup> Such unintended externalities can not only affect forest health, but also have reputational impacts resulting from concerns of nearby communities and the broader public. This could reduce demand for a company's products, as well as increase the likelihood of regulatory attention to these issues.

Industrial-style timber cultivation is projected to grow significantly as the world's timber needs and competition for land resources rise. Today, plantations constitute a small share of total

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<sup>IV</sup> Industrial roundwood includes harvested logs used for non-energy applications, including the production of wood building materials and pulp and paper products.



commercial forest acreage. Plantations generally utilize monoculture methods, where one fast-growing species, such as eucalyptus or some species of pine, is planted across thousands of contiguous acres. Although plantations can result in higher yields, there are potential externalities to this type of silviculture if it is not properly managed, including soil degradation, pesticide runoff, and biodiversity changes.<sup>127</sup> These impacts could ultimately harm forest productivity, leading to reputational impacts to pulp and paper companies due to stakeholder concern over potential externalities.

In addition to environmental concerns, the forestry sector must consider its relationship with forest-dependent communities worldwide. The Programme for Endorsement of Forest Certification (PEFC), one of the largest forest management certification programs in the world, estimates that forests contribute to the livelihoods of about 1.6 billion people worldwide; meanwhile, 60 million indigenous peoples are fully dependent upon forests, and a further 350 million people depend on forests for income and food.<sup>128</sup> Forestry and logging operations can therefore affect the lives of millions of people, underscoring the importance of community inclusion and social issues in all aspects of operations.

Tension with local or indigenous populations could put companies' access to timber assets at risk, directly jeopardizing companies' finances and revenue streams. For example, since December 2, 2002, members of Grassy Narrows, a First Nations group in Canada consisting of about 1,500 people, have staged a continuous logging blockade on its approximately 5,000 square miles of treaty land in Ontario, Canada. The blockade has led several companies, including large, publicly-traded forestry firms, to either cease

clear-cut logging operations in the territory or refuse to accept wood harvested therein.<sup>129</sup>

Companies could have their third-party certifications suspended or revoked if social criteria are not met, possibly impacting access to markets for certified products. For example, in December 2013, the FSC suspended three forest management certificates for forests in Quebec and Northwestern Ontario held by Resolute Forest.<sup>130</sup> The suspensions occurred because FSC's auditor found that the company did not conform to FSC standards that address possible impacts to First Nation's forest resource interests and economy, as well as certain environmental impacts.<sup>131</sup> The suspensions affected 8 million hectares of timberland.<sup>132</sup>

Top Forestry & Logging companies have implemented procedures and programs to strengthen relations with local populations and indigenous peoples in areas where they operate. In 2012, Resolute Forest published an Aboriginal Peoples Policy that details the company's approach to respecting aboriginal people's rights and cultures. It encourages the hiring of indigenous people by both the company and its contractors, helps develop skills within the community, and provides a framework to consult communities on possible impacts of logging operations.<sup>133</sup> The company has entered into financial partnerships with First Nations in order to strengthen ties with the local population. For example, the company employs 205 First Nations people between its Thunder Bay and Opitciwan sawmills.<sup>134</sup> Companies can benefit from such partnerships through access to local laborers and the mitigation of downside risk from poor relations with local communities.

Top companies recognize the potential impact on access to timberlands from indigenous peoples' land claims in SEC disclosure. In its 2014 Q3 Form

10-Q, Weyerhaeuser discusses the impacts of a 2014 Supreme Court of Canada ruling that the Tsilhqot'in First Nation has aboriginal title over approximately 430,000 acres of forest in British Columbia. The company states, "This decision confirms that aboriginal title claims can result in the transfer of public lands and resources to aboriginal ownership and control. We are not directly affected by the Tsilhqot'in ruling, but could be affected in the future if First Nations in our Princeton, BC, operating area are able to establish title."<sup>135</sup>

In 2013, an estimated 28.3 percent of global roundwood production originated from certified forests, while an estimated 10.3 percent of the world's forests are certified to sustainable management standards. This disparity suggests that a relatively small share of the world's forests contribute an outsized volume of certified timber to global markets.<sup>136</sup> The share of certified lands has grown steadily since the 1990s, when several certification systems were introduced.<sup>137</sup>

In addition to the use of fiber sourcing certifications and environmental and social impact guidelines, companies can reduce supply chain impacts and differentiate their products through the use of recovered<sup>v</sup> fiber. Increasing recovered fiber use reduces both the demand for virgin fiber and the disposal of paper goods in landfills. The production of virgin wood can have environmental and social externalities including biodiversity loss and impacts on forest-dependent communities and indigenous peoples. Virgin pulp and paper production typically releases higher amounts of air pollution, water effluent, and GHGs, and uses large quantities of water, energy, and chemical inputs. Additionally, paper products

can release methane, a potent GHG, as they decompose in landfills.<sup>138</sup>

However, there is growing recognition that increasing recovered fiber use rates carries environmental tradeoffs. Recovered fiber processing can generate greater amounts of waste than production from virgin wood. Recovered fiber use may also require greater amounts of non-renewable energy than virgin fiber manufacturing because less renewable biomass is available. There could be indirect impacts as well. For example, while reducing sourcing of virgin fiber from forestlands can allow forests to regenerate and store carbon more easily, lower demand could also cause private landowners to convert forestland into more profitable uses, including development or agriculture.<sup>139</sup>

The conclusions about the use of recovered versus virgin fiber described above are general. It is more difficult to compare the environmental attributes of a specific product. Lifecycle assessments are a tool that can provide valuable insights into the environmental benefits of using recycled fiber in a given product. However, as assumptions must be made about complex interactions in the recovery and production stages, different lifecycle analyses can produce widely varying determinations of environmental benefits.<sup>140</sup>

There are practical limits to the amount of fiber that can be recovered for reuse; some studies estimate it to be 80-85 percent. Recovery rates have been near 70 percent in the U.S. and the E.U. Because of processing losses in fiber quality, rising global fiber demand, and limitations on fiber recycling, the industry still requires the production of virgin fiber.<sup>141</sup>

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<sup>v</sup> Recovered fiber includes post-consumer fiber and manufacturing by-products. Recovered fiber includes post-consumer recycled fiber.

Furthermore, price and quality considerations factor into a company's use of recovered fiber. In the 1990s, virgin fiber was largely more expensive than recovered fiber. This gap has since narrowed, and at certain points recovered fiber has been more expensive, due in large part to a doubling of recovered fiber demand between 1995 and 2010.<sup>142</sup> The use of recovered fiber may therefore not be in the economic interest of a company, even if it carries environmental benefits.

According to an estimate from research firm RISI, the use of recovered fiber is expected to grow by approximately three percent annually for the next 15 years, driven by demand from customers who prefer recycled fiber products and by greater demand from developing markets. Rising production of virgin fiber is also expected due to demand for high-quality fibers, and fiber in general.<sup>143</sup>

In response to customer demand and in an effort to support more sustainable forestry, the industry is continuing to increase the use of certified fiber. The AF&PA reports that its members procured approximately 95 percent of their fiber through certified fiber sourcing programs in 2012, up from approximately 87 percent in 2005.<sup>144</sup> Major customers of the Pulp & Paper Products industry have implemented purchasing guidelines regarding the use of third-party certified or sustainably-sourced fiber, driving demand. Recovered fiber is also preferred. Kimberly-Clark, one of the world's largest buyers of market pulp, preferentially purchases certified virgin fiber and recycled fiber. Since 2012, the company has successfully met its commitment to source 100 percent of its virgin fiber certified to FSC, SFI, PEFC, or similar standards. The company also designates fiber as "Environmentally Preferred" if it is virgin fiber certified under the FSC Mix or FSC Controlled Wood standards, or if it is recycled fiber. Kimberly-Clark aims to reduce its impact

and dependence on natural forests through the environmentally preferred sourcing guidelines. Approximately 28 percent of Kimberly-Clark's fiber use is recycled fiber.<sup>145</sup> Unilever, a major consumer products company, aims to source 100 percent of its paper and paperboard from third-party certified suppliers by 2020. The company achieved 87 percent of its goal in 2014, up from 62 percent in 2013.<sup>146</sup>

SEC disclosure supports the contention that the use of certified fiber and the certification of products can affect financial performance. In its FY 2014 Form 10-K, Mercer International stated that "During the past few years, certain customers have endeavored to purchase pulp that is produced using fiber that meets certain recognized wood certification requirements from forest certification agencies like FSC, PEFC, SFI-CSA. If the fiber we purchase does not meet certain wood certifications required by customers, it may make it more difficult or prevent us from selling our pulp to such customers."<sup>147</sup> There are also opportunities from producing certified products: in its FY2014 Form 10-K, Domtar reports, "We also seek product differentiation through the certification of our pulp mills to the FSC chain-of-custody standard and the procurement of FSC-certified virgin fiber."<sup>148</sup> Companies with stringent supply chain sourcing guidelines, increased transparency of supplier performance, and that use certified pulp could benefit from increased revenue and market share.

## Value Impact

The wood fiber supply chain creates potential reputational risks and market opportunities for product differentiation. The environmental and social performance of wood and fiber suppliers is an important consideration for downstream customers of the Pulp & Paper Products industry. Companies associated with wood suppliers that do not adhere to sustainable forestry

management practices could experience lower demand for their products, reducing profitability. Unsustainable forestry practices could also affect the health and productivity of supplier forests over the medium to long-term, resulting in less robust fiber suppliers.

Conversely, companies that implement responsible sourcing guidelines may be better insulated from illegal, contentious, or unethical activities that result in reputational harm to the company. Customers may seek product and chain-of-custody certifications to assess the performance of their suppliers. This consumer preference could result in product differentiation, leading to greater revenues and increased market share.

The use of recovered fiber in manufacturing carries environmental and financial tradeoffs. Using recovered fiber could mitigate potential supply chain risks associated with virgin fiber production, including supply constraints and reputational impacts. Companies that produce products with recycled fiber content could experience higher demand; however, they must consider the relative costs of recovered and virgin fiber.

The percentage of wood fiber purchased from certified forestlands or meeting other sourcing standards indicates the degree of reputational or operating risk associated with environmental or social impacts in the company's supply chain. Discussion of due diligence practices used when sourcing fiber from non-certified forestlands provides insight into potential reputational or operating risks. The amount of recycled and recovered fiber procured indicates a company's reliance on virgin fiber and its associated reputational risks, as well as the potential cost impacts from purchasing each type of fiber, and

the company's ability to meet market demand for products with recycled content.

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## SASB INDUSTRY WATCH LIST

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The following section provides a brief description of sustainability disclosure topics that are not likely to constitute material information at present but could do so in the future.

**Bio-based Products Innovation:** Bio-based materials present an economic opportunity for existing pulp and paper producers. The market remains small today; therefore it is unlikely that companies earn significant revenues from bio-based products today. Bio-based products could provide a diversified revenue stream and have significantly higher profit margins than traditional pulp and paper<sup>149</sup>, while using the existing fiber supply chain and manufacturing equipment reduces the need for additional capital expenditures. Companies and industry associations including the Forest Products Association of Canada and the American Forest & Paper Association are exploring the use of bio-based materials as feedstocks in the production of renewable chemical, fiber, and energy products. Today, these products are manufactured largely from non-renewable petroleum-based feedstocks. The use of wood fiber has the potential to offset environmental and social impacts associated with petroleum extraction and chemical refining. As increasingly stringent regulations shape the use of petroleum products, renewable wood fiber could become an important industrial raw material. However, the fiber must be produced in forests that follow sustainable forest management guidelines in order to avoid environmental or social harm, such as biodiversity loss and adverse impacts on indigenous communities.

## APPENDIX I

### FIVE REPRESENTATIVE PULP & PAPER PRODUCTS COMPANIES<sup>vi</sup>

COMPANY NAME (TICKER SYMBOL)
Domtar Corp. (UFS)
Resolute Forest Products (RFP)
Fibria Celulose (FBR)
Glatfelter (FLT)
Mercer International (MERC)

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<sup>vi</sup> This list includes five companies representative of the Pulp & Paper Products industry and its activities. This includes only companies for which the Pulp & Paper Products industry is the primary industry, companies that are U.S.-listed but are not primarily traded over the counter, and for which at least 20 percent of revenue is generated by activities in this industry, according to the latest information available on Bloomberg Professional Services. Retrieved on December 1, 2015.

## APPENDIX IIA: Evidence for Sustainability Disclosure Topics

Sustainability Disclosure Topics	EVIDENCE OF INTEREST				EVIDENCE OF FINANCIAL IMPACT				FORWARD-LOOKING IMPACT		
	HM (1-100)	IWGs		EI	Revenue & Cost	Asset & Liabilities	Cost of Capital	EFI	Probability & Magnitude	Externalities	FLI
		%	Priority								
Greenhouse Gas Emissions	83*	76	1	High	•		•	High	•	•	Yes
Air Quality	83*	71	5	Medium	•			High			No
Energy Management	100*	76	4	High	•			High	•		Yes
Water Management	75*	79	3	High	•		•	High	•		Yes
Fiber Sourcing & Recovery	94*	87	2	High	•	•	•	High		•	Yes

**HM:** Heat Map, a score out of 100 indicating the relative importance of the topic among SASB's initial list of 43 generic sustainability issues. Asterisks indicate "top issues." The score is based on the frequency of relevant keywords in documents (i.e., 10-Ks, 20-Fs, shareholder resolutions, legal news, news articles, and corporate sustainability reports) that are available on the Bloomberg terminal for the industry's publicly listed companies. Issues for which keyword frequency is in the top quartile are "top issues."

**IWGs:** SASB Industry Working Groups. During the IWG phase, SASB received stakeholder feedback for the "Forestry & Paper" industry where forestry, logging, and pulp and paper product manufacturing operations were grouped together. After taking into account stakeholder feedback, the Forestry & Paper industry was split into two industries: "Forestry & Logging" and "Pulp & Paper Products". The IWG scores presented in this table were received on the topics as presented in the original Forestry & Paper industry.

**%:** The percentage of IWG participants that found the disclosure topic likely to constitute material information for companies in the industry. (-) denotes that the issue was added after the IWG was convened.

**Priority:** Average ranking of the issue in terms of importance. 1 denotes the most important issue. (-) denotes that the issue was added after the IWG was convened.

**EI:** Evidence of Interest, a subjective assessment based on quantitative and qualitative findings.

**EFI:** Evidence of Financial Impact, a subjective assessment based on quantitative and qualitative findings.

**FLI:** Forward Looking Impact, a subjective assessment on the presence of a material forward-looking impact.

## APPENDIX IIB: Evidence of Financial Impact for Sustainability Disclosure Topics

Evidence of Financial Impact	REVENUE & EXPENSES							ASSETS & LIABILITIES				RISK PROFILE	
	Revenue			Operating Expenses		Non-operating Expenses		Assets		Liabilities		Cost of Capital	Industry Divestment Risk
	Market Share	New Markets	Pricing Power	Cost of Revenue	R&D	CapEx	Extra-ordinary Expenses	Tangible Assets	Intangible Assets	Contingent Liabilities & Provisions	Pension & Other Liabilities		
Greenhouse Gas Emissions		•		•		•	•					•	
Air Quality	•			•		•	•						
Energy Management		•		•		•							
Water Management	•			•		•	•					•	
Fiber Sourcing & Recovery	•		•	•					•			•	

MEDIUM IMPACT
  HIGH IMPACT

## APPENDIX III SUSTAINABILITY ACCOUNTING METRICS – PULP & PAPER PRODUCTS

TOPIC	ACCOUNTING METRIC	CATEGORY	UNIT OF MEASURE	CODE
Greenhouse Gas Emissions	Gross global Scope 1 emissions	Quantitative	Metric tons (t) CO <sub>2</sub> -e	RR0202-01
	Description of long-term and short-term strategy or plan to manage Scope 1 emissions, emission-reduction targets, and an analysis of performance against those targets	Discussion and Analysis	n/a	RR0202-02
Air Quality	Air emissions for the following pollutants: NO <sub>x</sub> (excluding N <sub>2</sub> O), SO <sub>x</sub> , volatile organic compounds (VOCs), particulate matter (PM), and hazardous air pollutants (HAPs)	Quantitative	Metric tons (t)	RR0202-03
Energy Management	Total energy consumed, (1) percentage grid electricity, (2) percentage from biomass, and (3) percentage from other renewables*	Quantitative	Gigajoules (GJ), Percentage (%)	RR0202-04
Water Management	(1) Total water withdrawn and (2) total water consumed, percentage of each in regions with High or Extremely High Baseline Water Stress	Quantitative	Cubic meters (m <sup>3</sup> ), Percentage (%)	RR0202-05
	Discussion of water management risks and description of strategies and practices to mitigate those risks	Discussion and Analysis	n/a	RR0202-06
Fiber Sourcing & Recovery	Percentage of wood fiber sourced (1) from third-party certified forestlands and percentage to each standard and (2) meeting other fiber sourcing standards and percentage to each standard**	Quantitative	Percentage (%) by weight	RR0202-07
	Amount of recycled and recovered fiber procured***	Quantitative	Metric tons (t)	RR0202-08

\* Note to **RR0202-04**—The registrant shall discuss risks and uncertainties associated with the use of biomass for energy.

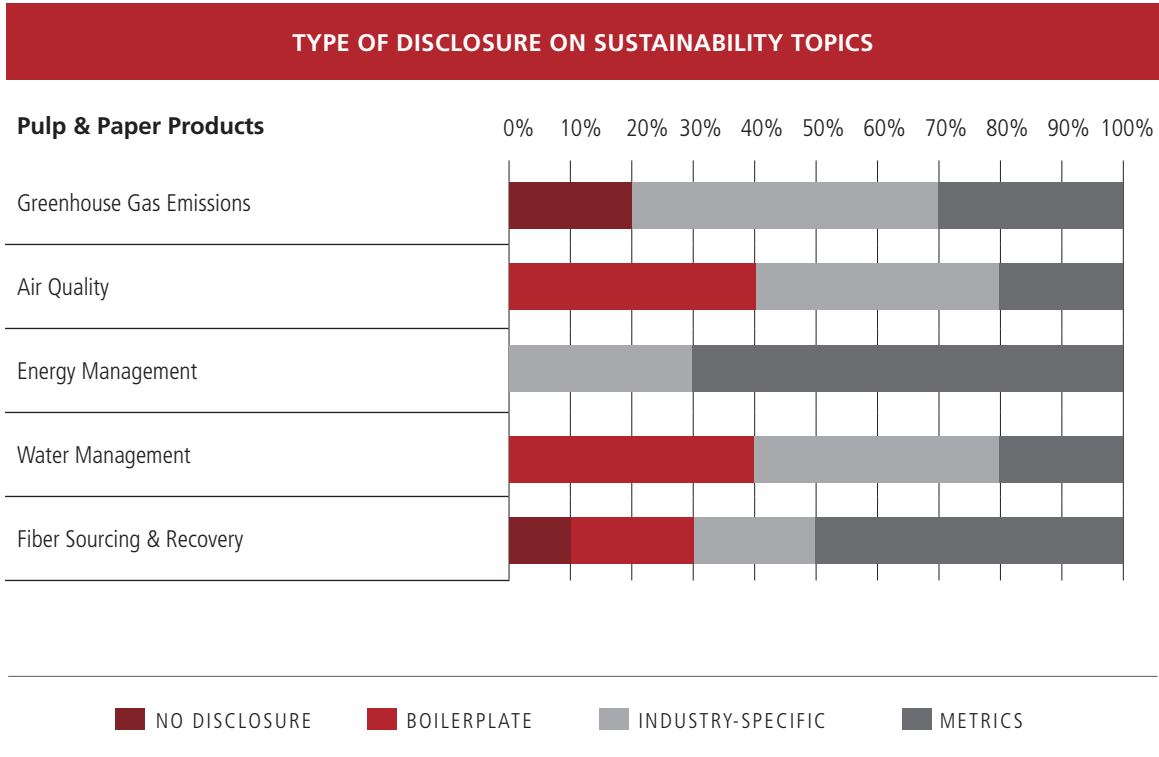
\*\* Note to **RR0202-07**—The registrant shall discuss due diligence practices for fiber that is not from certified forestlands or certified to other fiber sourcing standards.

\*\*\* Note to **RR0202-08**—The registrant shall discuss its strategy to incorporate environmental lifecycle analyses into decisions to source recycled and recovered fiber versus virgin fiber.



## APPENDIX IV: Analysis of SEC Disclosures | Pulp & Paper Products

The following graph demonstrates an aggregate assessment of how representative U.S.-listed Pulp & Paper Products companies are currently reporting on sustainability topics in their SEC annual filings.



\*Percentage of IWG participants that agreed topic was likely to constitute material information for companies in the industry.

Note: During the IWG phase, SASB received stakeholder feedback for the "Forestry & Paper" industry where forestry, logging, and pulp and paper product manufacturing operations were grouped together. After taking into account stakeholder feedback, the Forestry & Paper industry was split into two industries: "Forestry & Logging" and "Pulp & Paper Products". The IWG scores presented in this table were received on the topics as presented in the original Forestry & Paper industry.

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