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Biomass Energy in the Forest Products Industry

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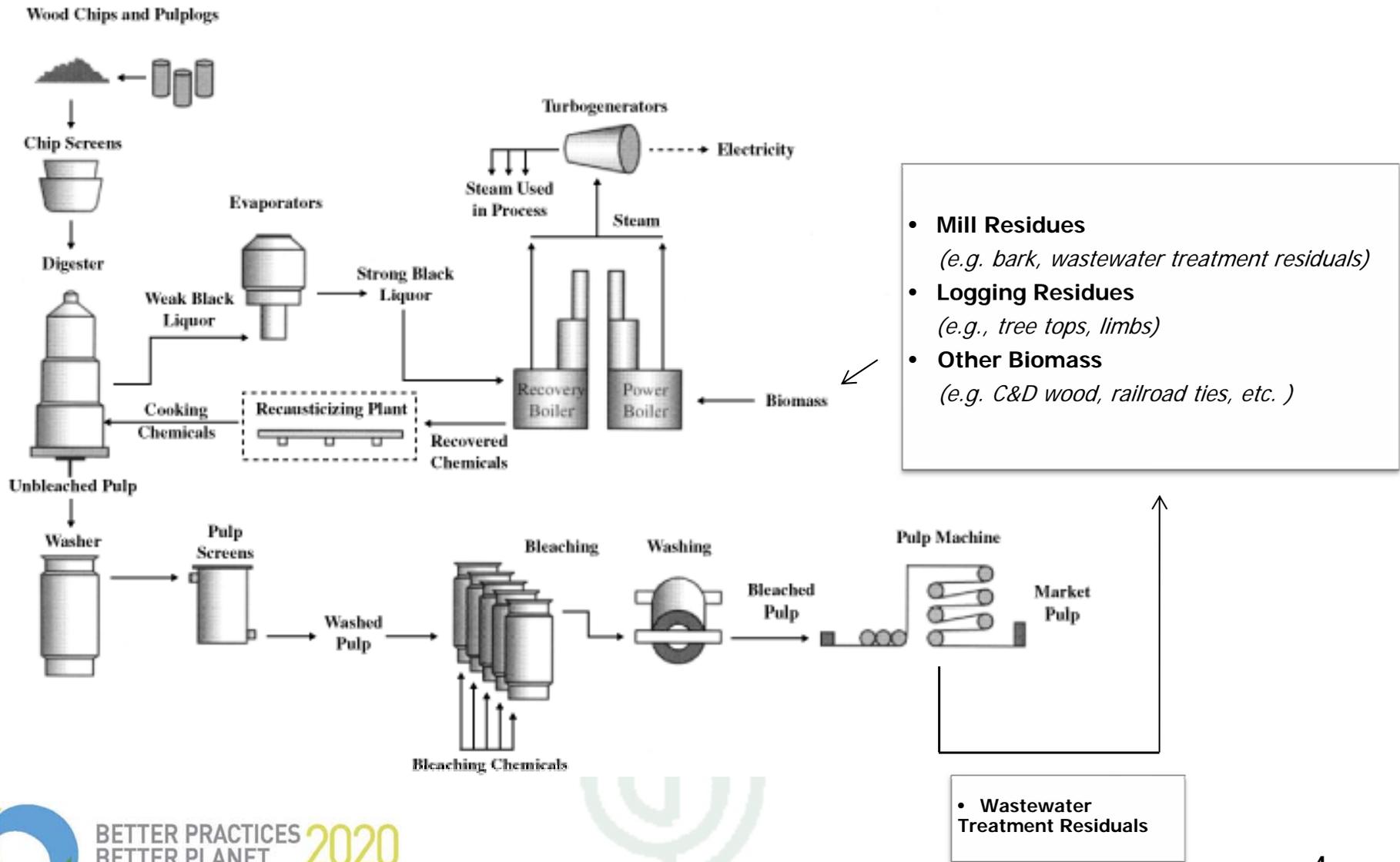
Background

- The forest products industry uses wood biomass to produce pulp, paper, packaging and a spectrum of wood products, and, integral and incidental to the manufacture of those products, produces electric and thermal energy (steam and heat).
- The biomass used to produce energy in forest products mills typically is a residual from the processes used to manufacture these forest products.
- The forest products industry is the leading producer and user of renewable biomass energy and produces more energy from biomass than all the energy produced in the U.S. from solar, wind, and geothermal sources combined. The industry meets over 65% of its energy needs through the use of renewable biomass, largely through the use of highly efficient combined heat and power processes.

Background

- The residuals are generally in two forms – wood residues and bark, and spent pulping liquor.
- The thermal energy (steam and heat) produced in boilers is used to generate electricity and/or in manufacturing processes.
- The electricity produced primarily is used in manufacturing processes but some is sold on the electric grid.
- The electric and thermal energy (steam and heat) produced from biomass displaces energy from other sources, usually non-renewable fossil fuels, such as coal.
- Use of residual biomass for energy production eliminates disposal of the residuals through burning or landfilling.

The Manufacturing Process- Kraft Pulp Mill



Two Primary Sources of Biomass Fuel and Types of Boilers

- Wood residues or bark combusted in solid fuel power boilers
- Spent pulping liquor combusted in recovery boilers (also called recovery furnaces)



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Wood Residues or Bark Combusted in Power Boilers



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Primary Sources of Wood Residues or Bark

- Residuals from logging in the forests (e.g., tops, branches)
- Called “hog fuel”



Sources of Wood Residues or Bark

- Hog Fuel generated on site: Bark and wood residues from unused portions of logs brought to wood products facilities, chip mills or pulp mills.
- Hog fuel from other facilities (e.g., saw dust or shavings from lumber or wood products mills)



Example of Biomass Power Boiler





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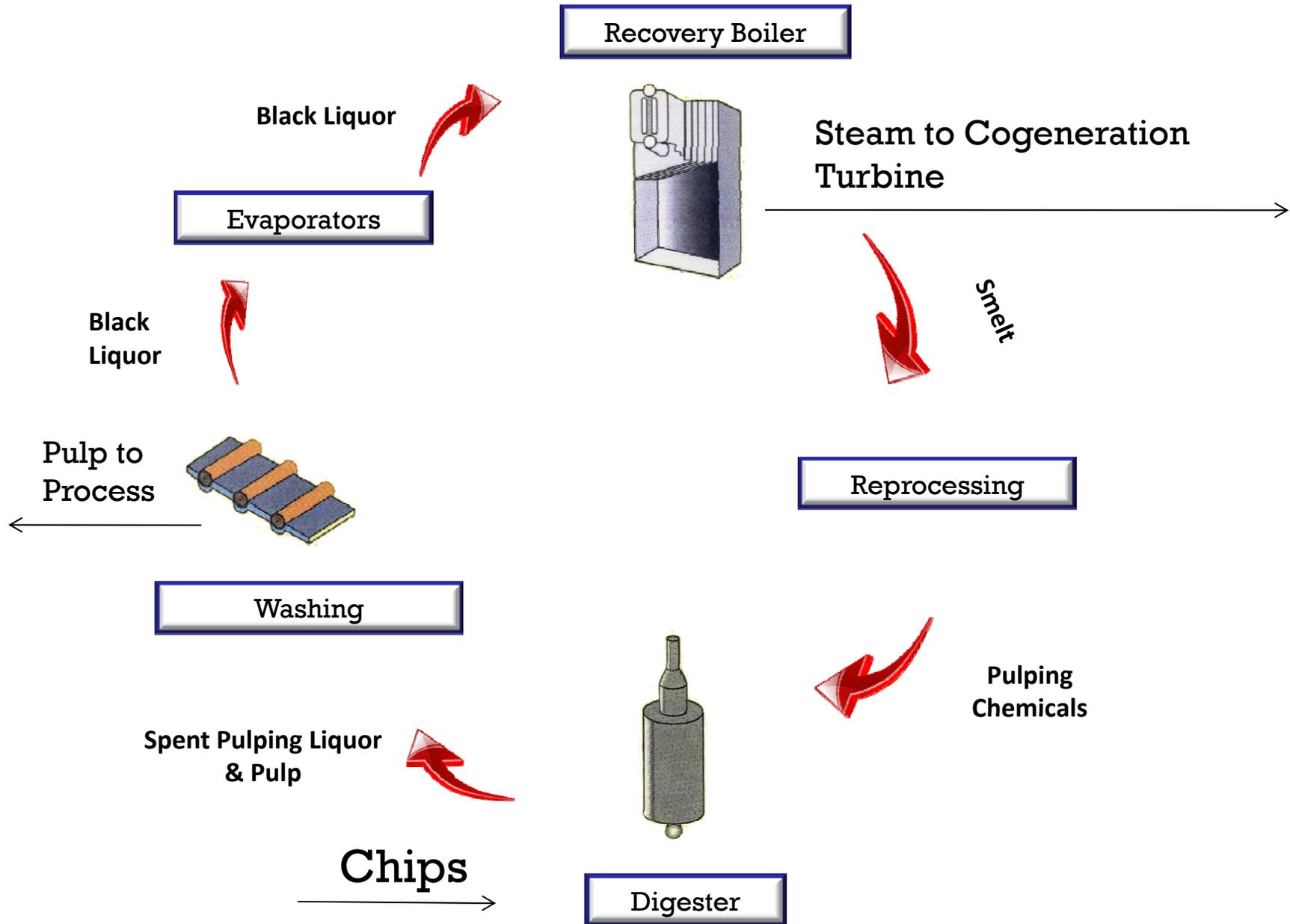
Spent Pulping Liquor and Combustion in Recovery Boilers (Furnaces)



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Spent Pulping Liquor

- When pulp is produced from wood chips using a chemical process, such as the kraft process, the fibers are separated from the remainder of the chip.
- The resulting material is a liquid, known as spent pulping liquor, and can be concentrated to produce a combustible material used as fuel in a recovery boiler.
- The most common form of spent pulping liquor is black liquor produced by the kraft pulping process.



Black Liquor

Black liquor is separated from pulp in washing



Measurement of Energy Entering Recovery Boilers

- Spent pulping liquor volumes are measured as they are pumped into the recovery boiler.
- The heat content of pulping liquor fuels is dependent on water content, and heating value (BTUs per pound). Water content can be metered on-line or by laboratory testing. Heating value is determined by laboratory testing.

Recovery Boilers

- A recovery boiler is a specialized kind of boiler very different from a solid fuel boiler.
- High concentration or heavy liquor is pumped to the boiler and sprayed into the boiler fire box through liquor guns, which produce small droplets.
- Smelt from the inorganic chemicals in the liquor collects and is removed from the bottom of the boiler, and the heat is transferred to the steam tubes.
- The smelt is reprocessed to recover chemicals for pulping. The very high recovery rate of the pulping chemicals, which are used again for the pulping process, makes the papermaking process sustainable.

Recovery Boiler





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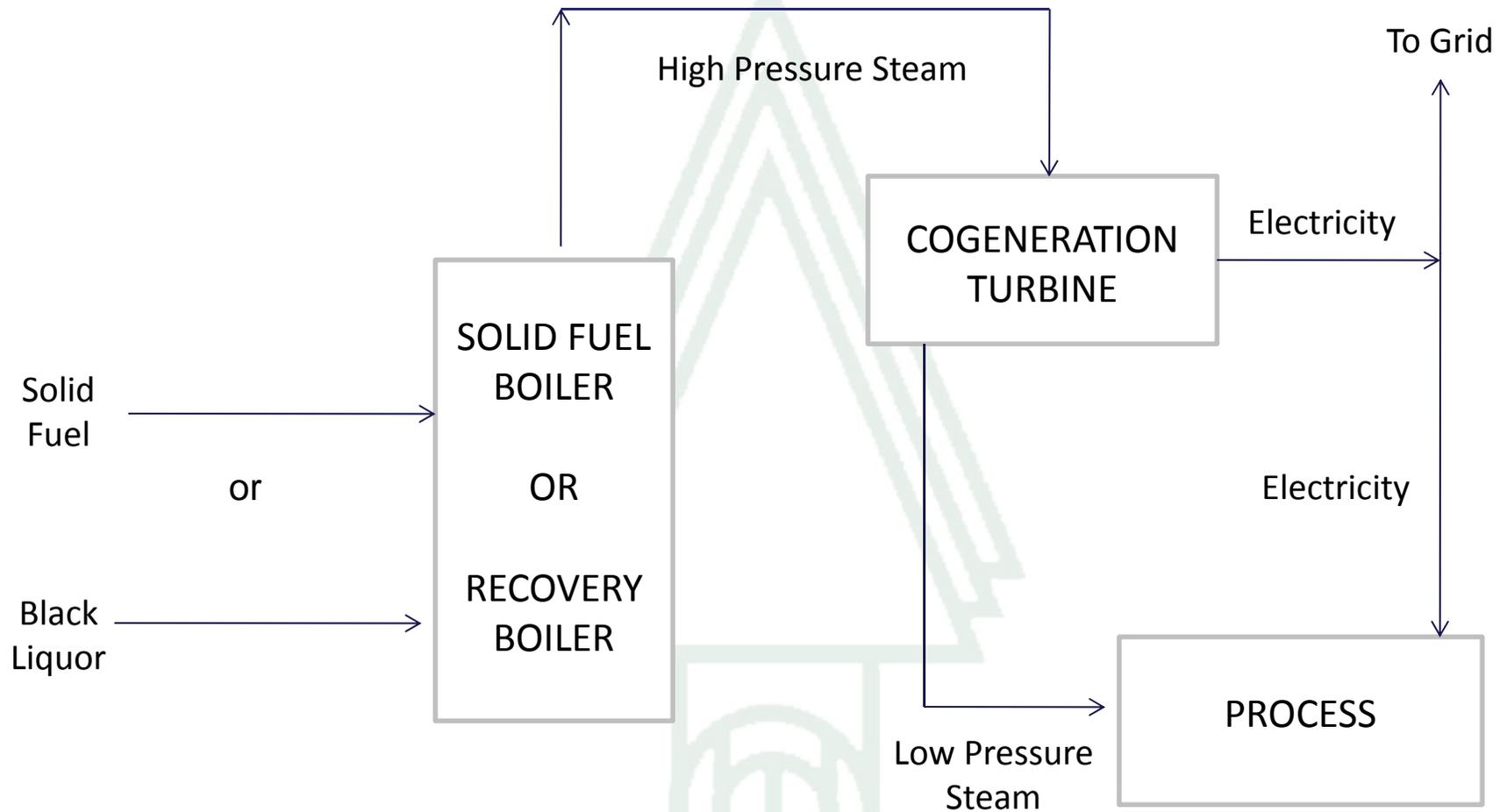
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Cogeneration (or Combined Heat and Power)



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Basic Cogeneration System in Forest Products Industry



Energy Products – Steam & Electricity Through CHP or Cogeneration

- Heat from combustion of fuel is used to boil water and make high pressure steam.
- Virtually all forest products facilities that produce high pressure steam and use it to generate electricity do so through a process called Combined Heat and Power (CHP) or Cogeneration
- CHP or Cogeneration is the sequential production of electricity and useful thermal energy (low pressure steam) from a single source of energy.

Energy Products – Steam & Electricity Through CHP or Cogeneration

- The steam is initially produced at a high pressure and a superheated temperature so that it can be used at high efficiency to produce electricity in a turbine generator.
- Exhaust steam from the turbine is taken at a lower pressure and directed to the manufacturing processes to be used for heating and drying.