Illustration of Top Down Energy Efficiency BACT

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NESCAUM/EDF

Goals and Cautions

- Goal
  - Provide a simplified version of a concrete example to demonstrate concept of Top-Down Energy Efficiency BACT
- Cautions
  - NOT a regulatory proposal
  - Illustration does not imply judgment about BACT for pulp and paper industry

Top Down Energy Efficiency BACT

- Identify benchmarks
  - EPA EnergyStar, DOE Industrial Technologies Program, Lawrence Berkeley Laboratory reports
- Step 0: Frame use of benchmark
  - Level A: Consider full facility
  - Level B: Consider source and those portions of production that create a load for that source
  - Level C: Consider only source and energy distribution system
  - All levels should include consideration of efficiency management systems

Top Down Energy Efficiency BACT

- Step 1: Identify all energy efficiency options
  - Conduct audit of facility for comparison to benchmark
  - Consider CHP and water efficiency improvements where not included in benchmark
- Step 2: Eliminate technically infeasible options
  - Benchmarks are generally based on available technology
- Step 3: Rank efficiency options
  - Include consideration of pollutant emissions reductions, water usage, etc.
  - Efficiency gains are likely to be additive, and ranking should address grouping of compatible technologies
- Step 4: Eliminate control options
  - Look to impact on other pollutants, cost-effectiveness, etc.

Some Observations

- Appropriate level of analysis may vary by industry
  - Pulp plant: Steam generated is used throughout plant, so Level C may be appropriate.
  - Chemical Industry: Multiple, widely varying production lines per plant could make Level B appropriate starting point.
  - EGU's: Where most efficiency gains are available from source itself, Level C might be appropriate.
    - But consider demand-side management if available.

- When addressing multiple pollutants, efficiency gains from GHG BACT may influence emissions rates for other pollutants.

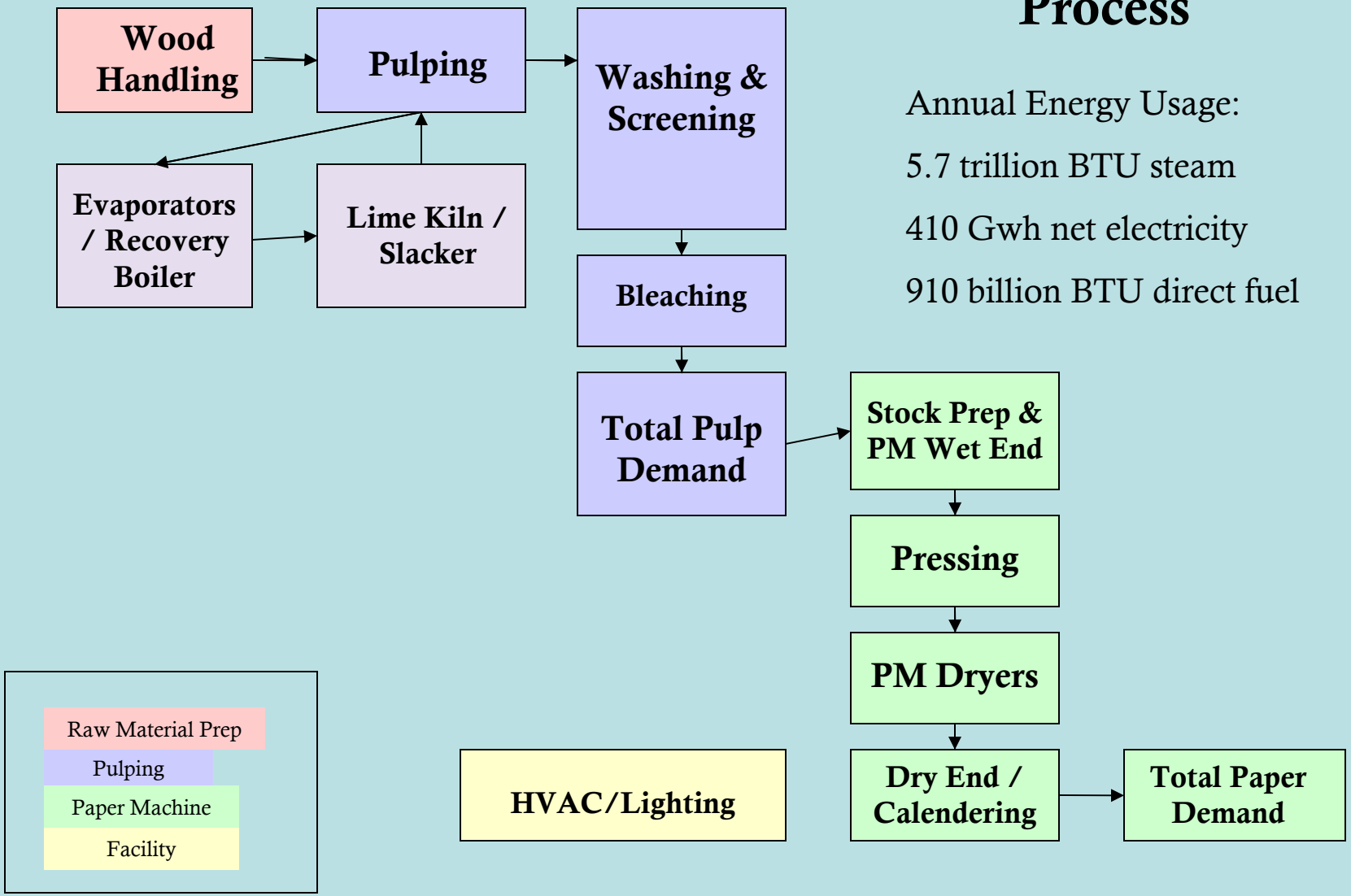
Some Observations (2)

- Cost-efficiency
  - Lack of prior PSD determinations requires alternative comparisons
    - Consider payback periods for efficiency gains
      - Do payback periods below (2, 5, 10) years create a presumption of cost-effectiveness?
      - Improvements without an available payback period should still be considered.
    - Avoid strict comparisons with early GHG BACT permits to avoid path-dependent lock-in.
      - Allow time for a broad array of examples to be developed.

Illustration: Pulp and Paper Industry

- Based on 2006 DOE Energy Bandwidth study
- Baseline is based on average industry energy usage in 2002
- Efficiency gains are based on new or model plant designs from 2006 for a bleached hardwood Kraft pulp and printing and writing paper plant

Pulp and Paper Mill Process



Annual Energy Usage:

5.7 trillion BTU steam

410 Gwh net electricity

910 billion BTU direct fuel

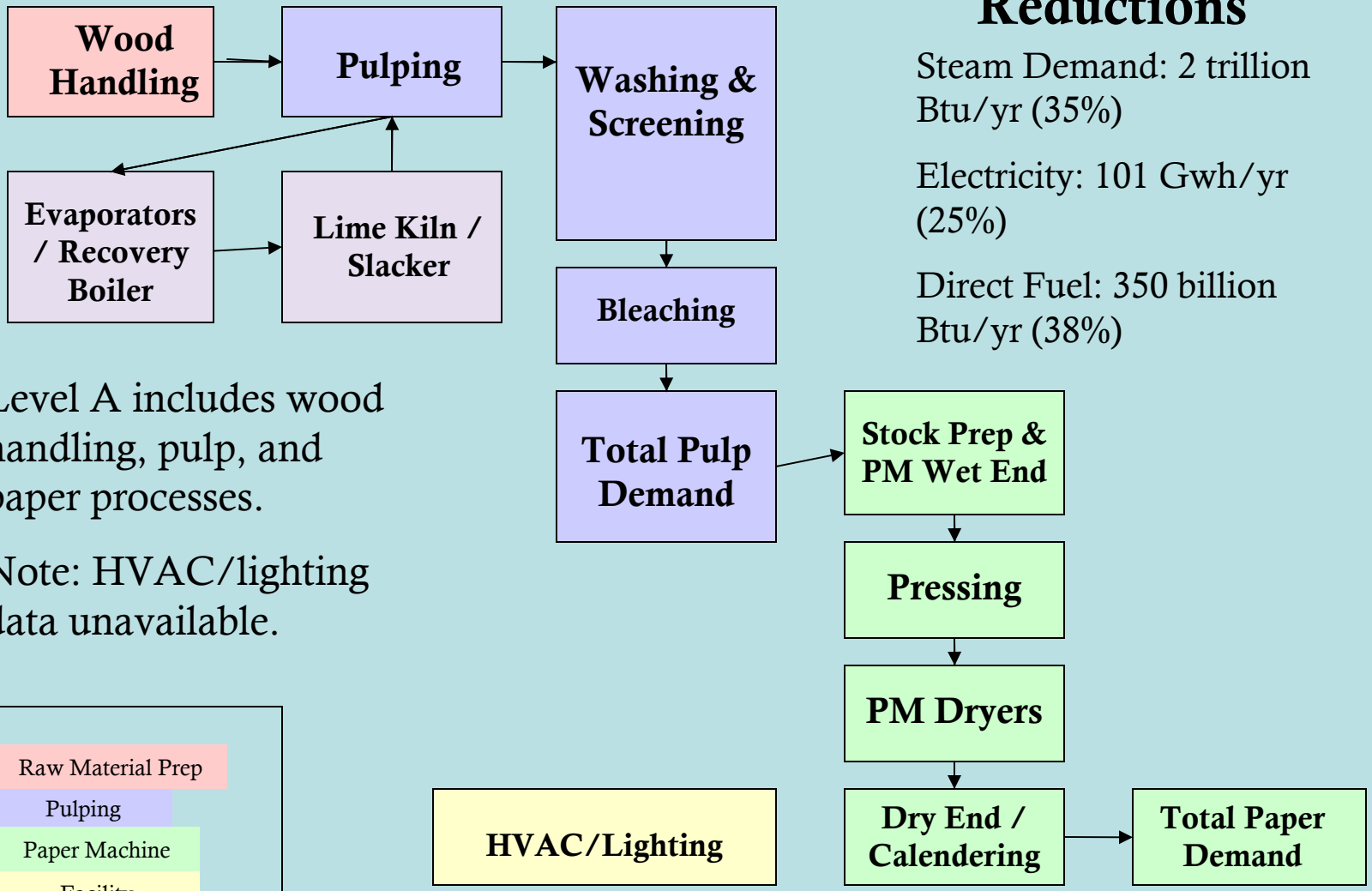
From figure 4.6 of Jacobs & IPST, Pulp and Paper Industry Energy Bandwidth Study (2006), http://www1.eere.energy.gov/industry/forest/bandwidth.html
Based on production figures from Sappi Cloquet Mill (455,000 mt pulp/yr.; 330,000 mt paper/yr), http://www.na.sappi.com/aboutus/mills

Level A Energy Use Reductions

Steam Demand: 2 trillion Btu/yr (35%)

Electricity: 101 Gwh/yr (25%)

Direct Fuel: 350 billion Btu/yr (38%)

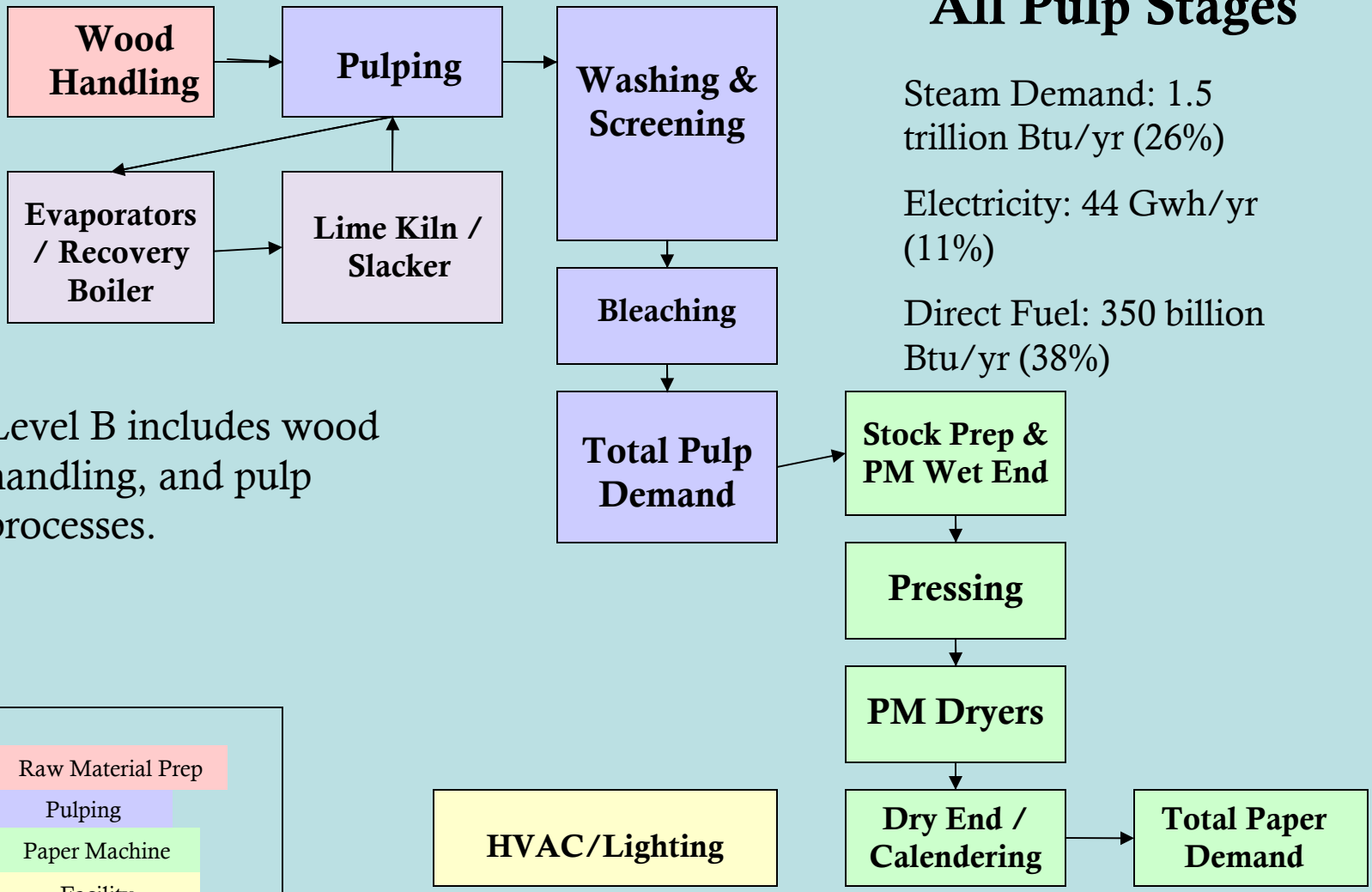


Level A includes wood handling, pulp, and paper processes.

Note: HVAC/lighting data unavailable.

From figures 4.6 and 6.7 of Jacobs & IPST, Pulp and Paper Industry Energy Bandwidth Study (2006), http://www1.eere.energy.gov/industry/forest/bandwidth.html
Based on production figures from Sappi Cloquet Mill (455,000 mt pulp/yr.; 330,000 mt paper/yr), http://www.na.sappi.com/aboutus/mills

Level B Reductions: All Pulp Stages



Steam Demand: 1.5 trillion Btu/yr (26%)

Electricity: 44 Gwh/yr (11%)

Direct Fuel: 350 billion Btu/yr (38%)

Level B includes wood handling, and pulp processes.

From figures 4.6 and 6.7 of Jacobs & IPST, Pulp and Paper Industry Energy Bandwidth Study (2006), http://www1.eere.energy.gov/industry/forest/bandwidth.html
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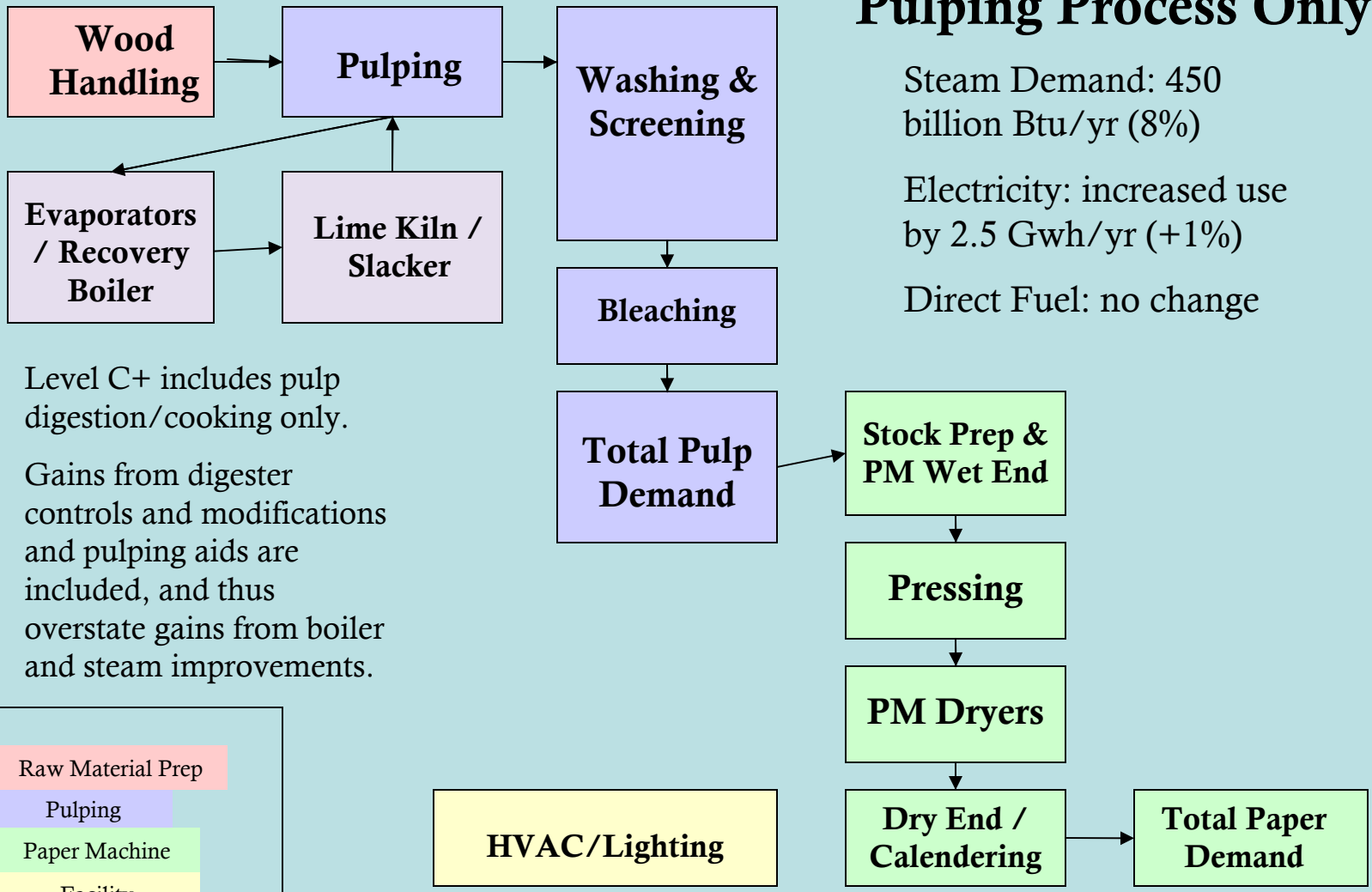
Level C+ Reductions: Pulping Process Only



Steam Demand: 450 billion Btu/yr (8%)

Electricity: increased use by 2.5 Gwh/yr (+1%)

Direct Fuel: no change

Level C+ includes pulp digestion/cooking only.

Gains from digester controls and modifications and pulping aids are included, and thus overstate gains from boiler and steam improvements.

From figures 4.6 and 6.7 of Jacobs & IPST, Pulp and Paper Industry Energy Bandwidth Study (2006), http://www1.eere.energy.gov/industry/forest/bandwidth.html
Based on production figures from Sappi Cloquet Mill (455,000 mt pulp/yr.; 330,000 mt paper/yr), http://www.na.sappi.com/aboutus/mills