The Competitiveness of Packaging Papers

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Ville Henttonen
Senior Product Manager, Mill Intelligence
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Senior Product Manager, Mill Intelligence

• M.Sc. in Paper Technology from Helsinki University of Technology
• With RISI for 12 years
• Manager of RISI Mill Intelligence Service in EMEA region
• Analyzes pulp, graphic paper, packaging and tissue mills
• Develops RISI benchmarking models based on mass and energy balances
• Expertise in energy usage and costs
• Special knowledge of machine conversions and risk analysis

vhenttonen@risi.com
You will learn...

The competitiveness of packaging papers

- Packaging papers vs. plastics
- Key cost drivers of packaging papers
- Machine conversions from graphic papers
- Risk of closure analysis
Resins are raw materials for plastics

Moldable thermoplastics compete with packaging papers in various packaging applications

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Packaging examples</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>PET Polyethylene terephthalate</td>
<td>Soft drink bottles</td>
<td>Low temperature resistance, good mechanical consistency</td>
</tr>
<tr>
<td>#2</td>
<td>PEHD High-density polyethylene</td>
<td>Bags, bottles, food containers, tubes</td>
<td>Low temperature resistance, high strength-to-density ratio</td>
</tr>
<tr>
<td>#3</td>
<td>PVC Polyvinyl chloride</td>
<td>Chemical bottles</td>
<td>Good temperature and mechanical resistance</td>
</tr>
<tr>
<td>#4</td>
<td>PELD Low-density polyethylene</td>
<td>Bags, bottles, paper &amp; board coating, wraps, foams</td>
<td>Low temperature and mechanical resistance, formability</td>
</tr>
<tr>
<td>#5</td>
<td>PP Polypropylene</td>
<td>Cups, food containers, detergent bottles</td>
<td>Flexible and resilient</td>
</tr>
<tr>
<td>#6</td>
<td>PS Polystyrene</td>
<td>Cups, food containers, CD/DVD cases, foams</td>
<td>Clear, hard, brittle, low melting point (100 °C), littering</td>
</tr>
</tbody>
</table>

Plastics raw material prices

Resin commodities are sold as both virgin pellets and somewhat cheaper recycled regrind flakes.

Source: Plasticker.de
Plastics raw material prices
Crude oil price has only partially explained the recent resin commodity price fluctuations
Paper vs. plastics: Cost benchmarking of cup & shopping bag raw materials

Bag: unbleached MF kraft paper vs. recycled PELD

Cup: PE-coated cupstock cartonboard vs. virgin PS

Source: RISI
Paper vs. plastics: Shopping bag

Unbleached MF bag paper is a relatively simple paper product, where softwood is a key cost driver.
Paper vs. plastics: Shopping bag

Unbleached MF bag paper is a more expensive but more price-stable raw material than PELD.
Paper vs. plastics: Drinking cup

Cupstock is a bleached multi-layer base board, which is PE-coated in a separate off-machine operation.
Paper vs. plastics: Drinking cup
The cost of PE-coated cupstock is more stable and even lower than PS, but market price is not reported

Source: RISI, Plasticker.de
You will learn...

The competitiveness of packaging papers

- Packaging papers vs. plastics
- The key cost drivers of packaging papers
- Machine conversions from graphic papers
- Risk of closure analysis
Key cost drivers have varying volatility
Typical risk scenarios focus on those that fluctuate the most and make the biggest difference

Cost Index (EUR based, 13H1 = 100), Representative for EU

- Recovered Paper
- BSKP Market Pulp
- Labor
- Sea Freight
- Road Freight
- BHKP Market Pulp
- Electricity
- Caustic Soda
- Wood
- Natural Gas
- Starch

Labor: Eurostat labor cost index, EUR-based, EU28 average, Manufacturing, Compensation to employees plus taxes minus subsidies
Natural Gas: Eurostat, Gas prices for industrial consumers, EUR/MWh, EU28 average, Excluding VAT and other recoverable taxes and levies, Band I5: 1000-4000 TJ/Y.
Electricity: Eurostat, Electricity prices for industrial consumers, EUR/MWh, EU28 average, Excluding VAT and other recoverable taxes and levies, Band IF: 70-150 GWh/Y.
Starch: EUWID, Average of high and low prices of wheat and corn starch, EUR/MT, Western Europe.
Caustic Soda: EUWID, Average of high and low prices of caustic soda, EUR/MT, Western Europe, free delivered, 50% solution, calculated on a 100% concentration basis.
Recovered paper: FOEX, OCC, EUR/MT, Western Europe.
Wood: Metla, Roadside price of roundwood, Pulpwood total, EUR/CM UB converted from SEK, Sweden.
Market Pulp: RISI Price Watch, NBSK & BHK Birch, EUR/ADMT converted from USD, Western Europe.
Road Freight: Eurostat, Service producer prices, Freight transport by road and removal services, Total output price index, local currency unadjusted data, EU28 average.
Sea Freight: HARPEX, Harper Petersen, converted from USD-based to EUR-based.

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Fiber is a key cost driver everywhere

Energy strategy can also make winners and losers
Recycled containerboard dominates

Various OCC and mixed recovered paper qualities are the most common containerboard raw materials.
Energy prices can be especially volatile
Different fuels can have very different costs in heat production, due to both market and policy reasons.
Fossil fuels have a wide range of CO₂ emission factors and calorific values. Also, biofuels have CO₂ emissions, which are exempt.
The average regional fuel mix varies

European recycled mills use mostly natural gas, while virgin pulp mills have high biomass usage

Source: RISI
The average European mill has a relatively small carbon footprint.

The coal-fired power plants in Asia are often sources of much higher fossil CO₂ emissions.
You will learn...

The competitiveness of packaging papers

• Packaging papers vs. plastics
• Key cost drivers of packaging papers
• **Machine conversions from graphic papers**
• Risk of closure analysis
Asset quality is critical in conversions
Successful conversions depend on various factors

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Relative Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closure</td>
</tr>
<tr>
<td>Manufacturing cost position</td>
<td>40 %</td>
</tr>
<tr>
<td>Market outlook - current grade</td>
<td>25 %</td>
</tr>
<tr>
<td>Regional supply balance</td>
<td>15 %</td>
</tr>
<tr>
<td>Mill role in corporate portfolio</td>
<td>10 %</td>
</tr>
<tr>
<td>Paper machine capacity / size</td>
<td>5 %</td>
</tr>
<tr>
<td>Paper machine technology / age</td>
<td>5 %</td>
</tr>
</tbody>
</table>

Key conversion success factors found in case studies
• Fiber availability and delivery costs
• Manufacturing cost position (scale, efficiency, inputs)
• Product quality and performance characteristics
• Sales and marketing plan
• Project definition and rebuild concept
• Capital requirements

Source: RISI
There is a wide range of conversions

Summary of the announced European conversion cases from graphic papers to containerboard

<table>
<thead>
<tr>
<th>Containerboard Company</th>
<th>Mill</th>
<th>Region</th>
<th>PM#</th>
<th>Graphic Paper Capacity Estimate (1000 MT/Y)</th>
<th>Converted Containerboard Capacity Estimate (1000 MT/Y)</th>
<th>Start of Containerboard Production</th>
<th>Tmm Width (m)</th>
<th>Pre-conversion Grade</th>
<th>Main Containerboard Grade After Conversion</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburger</td>
<td>Frohnleiten</td>
<td>Austria</td>
<td>1</td>
<td>20-45</td>
<td>93</td>
<td>1984</td>
<td>2.5</td>
<td>UM</td>
<td>Recycled (UB)</td>
<td>Closed</td>
</tr>
<tr>
<td>Hamburger</td>
<td>Frohnleiten</td>
<td>Austria</td>
<td>2</td>
<td>20-45</td>
<td>78</td>
<td>1984</td>
<td>2.6</td>
<td>UM</td>
<td>Recycled (UB)</td>
<td>Closed</td>
</tr>
<tr>
<td>Europac</td>
<td>St. Etienne du Rouvray, Rouen</td>
<td>France</td>
<td>5</td>
<td>220</td>
<td>300</td>
<td>1998</td>
<td>7.0</td>
<td>CM</td>
<td>Recycled (UB)</td>
<td>Operating</td>
</tr>
<tr>
<td>DS Smith</td>
<td>Kemsley, Sittingbourne</td>
<td>UK</td>
<td>6</td>
<td>230</td>
<td>265</td>
<td>2008</td>
<td>6.8</td>
<td>CM</td>
<td>Recycled (UB)</td>
<td>Operating</td>
</tr>
<tr>
<td>Blue Paper</td>
<td>Strazel, Strasbourg</td>
<td>France</td>
<td>1</td>
<td>300</td>
<td>270</td>
<td>2013</td>
<td>8.5</td>
<td>CM</td>
<td>Recycled (UB)</td>
<td>Operating</td>
</tr>
<tr>
<td>Avietta</td>
<td>Ettringen</td>
<td>Germany</td>
<td>4</td>
<td>175</td>
<td>180</td>
<td>2015</td>
<td>6.5</td>
<td>UM</td>
<td>Recycled (UB)</td>
<td>Operating</td>
</tr>
<tr>
<td>Stora Enso</td>
<td>Varkaus</td>
<td>Finland</td>
<td>3</td>
<td>285</td>
<td>390</td>
<td>2015</td>
<td>7.7</td>
<td>UF</td>
<td>Virgin (UB / WT?)</td>
<td>Operating</td>
</tr>
<tr>
<td>Parenco</td>
<td>Renkum</td>
<td>Netherlands</td>
<td>2</td>
<td>225</td>
<td>385</td>
<td>2016</td>
<td>8.5</td>
<td>NP</td>
<td>Recycled (UB)</td>
<td>Operating</td>
</tr>
<tr>
<td>Hinojosa</td>
<td>Sarria de ter</td>
<td>Spain</td>
<td>4</td>
<td>85</td>
<td>90</td>
<td>2016</td>
<td>3.2</td>
<td>UF</td>
<td>Recycled (UB)</td>
<td>Start-up</td>
</tr>
<tr>
<td>Leipa</td>
<td>Schwedt</td>
<td>Germany</td>
<td>11</td>
<td>290</td>
<td>450</td>
<td>2017</td>
<td>8.5</td>
<td>NP</td>
<td>Recycled (WT / UB?)</td>
<td>Planned</td>
</tr>
<tr>
<td>International Paper</td>
<td>Madrid</td>
<td>Spain</td>
<td>62</td>
<td>330</td>
<td>360</td>
<td>2017</td>
<td>8.9</td>
<td>NP</td>
<td>Recycled (UB)</td>
<td>Planned</td>
</tr>
<tr>
<td>Heinzl Group</td>
<td>Laakirchen</td>
<td>Austria</td>
<td>10</td>
<td>260</td>
<td>450</td>
<td>2017</td>
<td>7.2</td>
<td>UM</td>
<td>Recycled (UB)</td>
<td>Planned</td>
</tr>
<tr>
<td>Burgo Group</td>
<td>Avezzano</td>
<td>Italy</td>
<td>2</td>
<td>150</td>
<td>200</td>
<td>2017</td>
<td>5.3</td>
<td>UF</td>
<td>Recycled (UB)</td>
<td>Planned</td>
</tr>
<tr>
<td>Schumacher</td>
<td>Myszkw (or Grudziadz)</td>
<td>Poland</td>
<td>6</td>
<td>95</td>
<td>250-300</td>
<td>18-19</td>
<td>5.4</td>
<td>NP</td>
<td>Recycled (UB)</td>
<td>Planned</td>
</tr>
</tbody>
</table>

Source: RISI
Biomass is one way to lower cash costs
Machines converted from graphic papers can have varying containerboard cash cost competitiveness

Cash Manufacturing Cost* (EUR/MT) - 3Q 2106 - UB Recycled Containerboard
*Capacity Weighted Average - Grouped by Grade - Machine by Grade - Western Europe

Source: RISI
Containerboard machine’s trim width should match corrugator widths

Most European corrugators are 2.5 m or 2.8 m wide, but other 1.6-3.3 m widths can also be found

Source: RISI
Only certain graphic paper machines have optimal width for containerboard.

Wide machines have more width options and better productivity, but not necessarily flexibility.
You will learn...

The competitiveness of packaging papers

- Packaging papers vs. plastics
- Key cost drivers of packaging papers
- Machine conversions from graphic papers
- Risk of closure analysis
Risk of closure matrix analysis
Company risk is combined with machine risk and compared to the industry average

Source: RISI
Closures happen for two main reasons
Forced closures differ from planned closures

**Forced closures**
- In most forced closures, companies have faced bankruptcy
- Typically family-owned single mill operations with 1-3 machines
- Mills closed due to bankruptcy have often been restarted

**Planned closures**
- Typically have high costs and/or high technical age compared to the company’s other assets
- Often aiming for efficient cutting of overcapacity
- Mostly executed by companies with high capacity share
- These have been more permanent than forced closures
Company risk evaluation methods
Both universal and market specific categories

Net Gearing
• Net Gearing (%) = Net Debt / Total Equity
• >100% means that the company has more debt than the assets are worth
• High net gearing may identify potential divestments and/or closures

Importance for the Industry
• Market share of the company’s combined capacity in the market
• Big players can influence the industry more than small players

Market Specific Categories
• Any factors that may give some companies competitive advantage
• Typically something that creates major difference in cost structure
  • For example: fiber supply, energy supply, converting capacity, etc.
Integration to converting lowers risks

Western European containerboard companies have on average 53% integration level to corrugating.
Local competition may increase risks
Other nearby producers of competing products and especially raw material demand are potential risks
Machine risk evaluation methods

Combination of cost rankings with technical age and product specific categories

**Cash Cost Ranking** = Fiber + Chemicals + Energy + Labor + Materials

**Direct Cost Ranking** = Cash Cost + Capital Costs

**Technical Age**
- Based on the investment history of the machine
- Can be used as a measure for future investment needs

**Importance for the Company**
- PM capacity per company’s total capacity at the defined market

**Technology & Strategy**
- Anything that may give competitive advantage
  - Trim, flexibility, forming, sizing, coating, finishing, converting, etc.
  - Mill’s fiber supply, energy supply, chemical supply, etc.
Direct cost = cash cost + capital cost

High direct cost despite low technical age means high risk of closure/divestment
Technical age correlates with output
High technical age may also give a signal for the need of investments
Containerboard basis weight analysis

Ultra-lightweight grades are often produced on technologically advanced high capacity machines.

Identified basis weight ranges of the Western European recycled corrugating medium machines

Sorted by Low End, then by High End
- High End
- Low End
- Average Low End

Source: RISI, company websites
Containerboard basis weight analysis

Heavyweight producers are rare, but typically those machines produce a wide range of basis weights.

Identified basis weight ranges of the Western European recycled unbleached linerboard machines

Source: RISI, Company websites
Containerboard basis weight analysis
A wide basis weight range illustrates flexibility, while efficiency may require a narrow window.

Identified basis weight ranges of the Western European recycled unbleached containerboard machines

Source: RISI, Company websites
Take away

Competitiveness of packaging papers

- Packaging papers may have higher costs than plastics, but prices are more stable
- Fiber and energy are the key cost drivers of packaging papers
  - Especially volatile recovered paper costs for recycled mills
  - Wood supply and costs are critical issues for integrated mills
  - Natural gas and electricity are the most important energy cost drivers
Take away
Competitiveness of packaging papers

• Graphic paper machine conversions still are a hot topic
  • There already are a few converted containerboard machines in Europe
  • More conversions are likely to follow in the near future
  • Grade swing/conversion does not necessarily improve cost competitiveness

• Two-dimensional risk analysis includes Company Risk and Machine Risk
  • Fiber and energy price scenarios help our understanding of profit volatility
Take away

Competitiveness of packaging papers

• Forced closures vs. planned closures
  • Planned closures have been more permanent than forced closures

• Not every high risk mill will close, they are just more likely to do so
  • For every mill closure, the reduction in competition diminishes the overall risk
  • Even high risk mills are only vulnerable in a weak market
Thank you!

For more information: www.risi.com/benchmarking