Advances in Pulp and Paper Manufacturing Technologies

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Overview

• The global pulp and paper industry
• Biorefineries and biofuels
• Advances in pulping and papermaking
• Advances in paper products and use
• What does it mean for Australia and New Zealand?
The global pulp and paper industry

- Total paper production 366 million tonnes per annum (mtpa)
- Total pulp production 368 mtpa
- USA, China and Canada account for 47% of world production
- China rapidly becoming biggest – 77 mtpa now, 18.5% growth pa
- Australia (3.1 mtpa) and New Zealand (0.94 mtpa) are minnows
The global pulp and paper industry


Share of total global demand, %

Source: Pöyry Forest Industry
The global pulp and paper industry

Consumption of Newsprint and Printing & Writing Paper in Western Europe

Source: Pöyry Forest Industry/RISI
Technological developments

• Little interest in new pulp and paper manufacturing technologies

• Current technological issues relate to biofuels, energy management, climate change and sustainability

• Cooperation with other industries, eg petroleum industry, may become common
Biorefineries and biofuels

- Future forests may be used for much more than wood products and paper
- 53% of all wood harvested globally is used for fuel; 37% for panels and paper; 11% for sawn timber

“Traditional forest industries produce wood products, pulp, paper and energy. However, by applying a biorefinery concept, the industry could extend its value streams and produce alternative fuels, plastics, textiles, pharmaceuticals, functional food additives and fragrances.”

Dr Simon Potter, Ensis - Bio 2007, Boston MA
Biorefineries and biofuels

Source: Stuart, 2008
Lignoboost:

- Extracted, solid lignin
- More efficient than black liquor
- Saleable product
- Partial substitution for fossil fuels
Biorefineries and biofuels

Tembec, Temiscaming, Canada

The first forest products biorefinery?

Source: Stuart, 2008
Biorefineries and biofuels

Chevron- Weyerhaeuser Partnership

Creating technologies to bring biofuels to an industrial scale:
• Hydrolysis & fermentation
• Pyrolysis
• Gasification
• Catalytic conversion to transportation fuels
Pulping and Papermaking

Pulp mills

- Pulp bleaching technologies
  - Chlorine → ECF → TCF
- Air emissions control
  - Sulfur compounds, odour
- Hexenuronic acid and Kappa Number
Pulping and Papermaking

Hexenuronic acid (HexA)
- Kappa number previously regarded as indication of lignin content, or bleachability of pulp
- HexA formed in kraft digestion process
- HexA reacts with bleach chemicals, consuming without brightening
- Process developed to selectively remove HexA
- Reduces bleach chemical costs, more stable pulp brightness

Source: Buchert and Teleman, 2003
Pulping and Papermaking

Paper mills

- Wider, faster machines
- Lower basis weight for same product use
- Shoe press
- On-line supercalendering
- Cogeneration
Pulping and Papermaking

Paper mills

- Wider, faster machines
  - Newsprint up to 11 m wide
  - Newsprint speed
    - 1200 → 1800 → 2000 m/min
  - Recycled corrugating liners speed
    - 1000 → 1200 → 1600 m/min

Images: Metso Paper

PMD at Ningbo, China. The world’s largest corrugating linerboard machine. 8.1 m wide, 872 m/min, 3013 tpd 350 gsm folding boxboard

PM6 at Palm, Germany. 10.3 m wide, 2262 tpd newsprint
Pulping and Papermaking

Paper mills

- Lower basis weight for same product use
  - Newsprint
    - 48 → 45 → 42 gsm
  - Recycled corrugating liners
    - 105 → 90 → 80 gsm

*Challenge for papermakers: Bigger, wider, faster machines to make lighter products*
Pulping and Papermaking

Paper mills

- Shoe Press
  - Pressing applied over greater area compared to conventional nip press
    - more even pressing
  - Very good for bulk-sensitive grades such as tissue
  - Improves sheet smoothness, uniformity
  - Improves machine runnability
  - Tandem shoe press with closed draw now standard on high speed graphic paper machines

Images: Voith Paper
Pulping and Papermaking

Paper mills

- On-line supercalendering
  - For glossy uncoated magazine and printing papers
  - Saves double-handling of rolls
  - Improves production rates

Images: Voith Paper

Wood Innovations 2008
Cogeneration

Currently topical as electricity prices increase and emissions trading schemes implemented

Examples:

- Norske Skog Tasman, geothermal cogeneration will make mill electrically self-sufficient and supply steam for paper drying
- Hayat Tissue Mill, Turkey, gas turbine generates electricity and waste heat via heat exchangers used to dry tissue
Paper products and use

- Lighter weight papers
- Improved strength
- Improved printing properties
- ‘Smart’ packaging
Paper products and use

Improved surface properties

- Example: Better surfaces on cheaper paper
  - Functionalised pigment coatings
    .....improved ink-jet quality…
  - Atmospheric plasma treatment
    .....improved paper surface…
  - Conductive polymers
    .....ink-jet printing of simple electronic devices…

Images: CSIRO/Scion
Paper products and use

‘Smart’ packaging

- Example: active barcode labels for refrigerated beverages

    ...a labelling system which incorporates information on the status of a product which is digitally communicable...

- E-paper – tomorrow’s news on yesterday’s paper?
What does it mean for Australia and New Zealand?

Issues

- Our domestic markets are mature
- Existing equipment is generally old and small
- Exports critical for NZ, less so for Australia
- China is swamping everyone else
- New, bigger, faster machines will be mainly built in China
- Environmental concerns – pulp mill emissions, carbon trading
- Rising energy costs
What does it mean for Australia and New Zealand?

Opportunities

- Good fibre resources
- Proven track record in environmental performance
- Biofuels and bioproducts in conjunction with pulp and paper
- Research capability to produce innovative, added-value, products
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Thank you for your attention

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