



Reduced energy consumption in / by fibre processing

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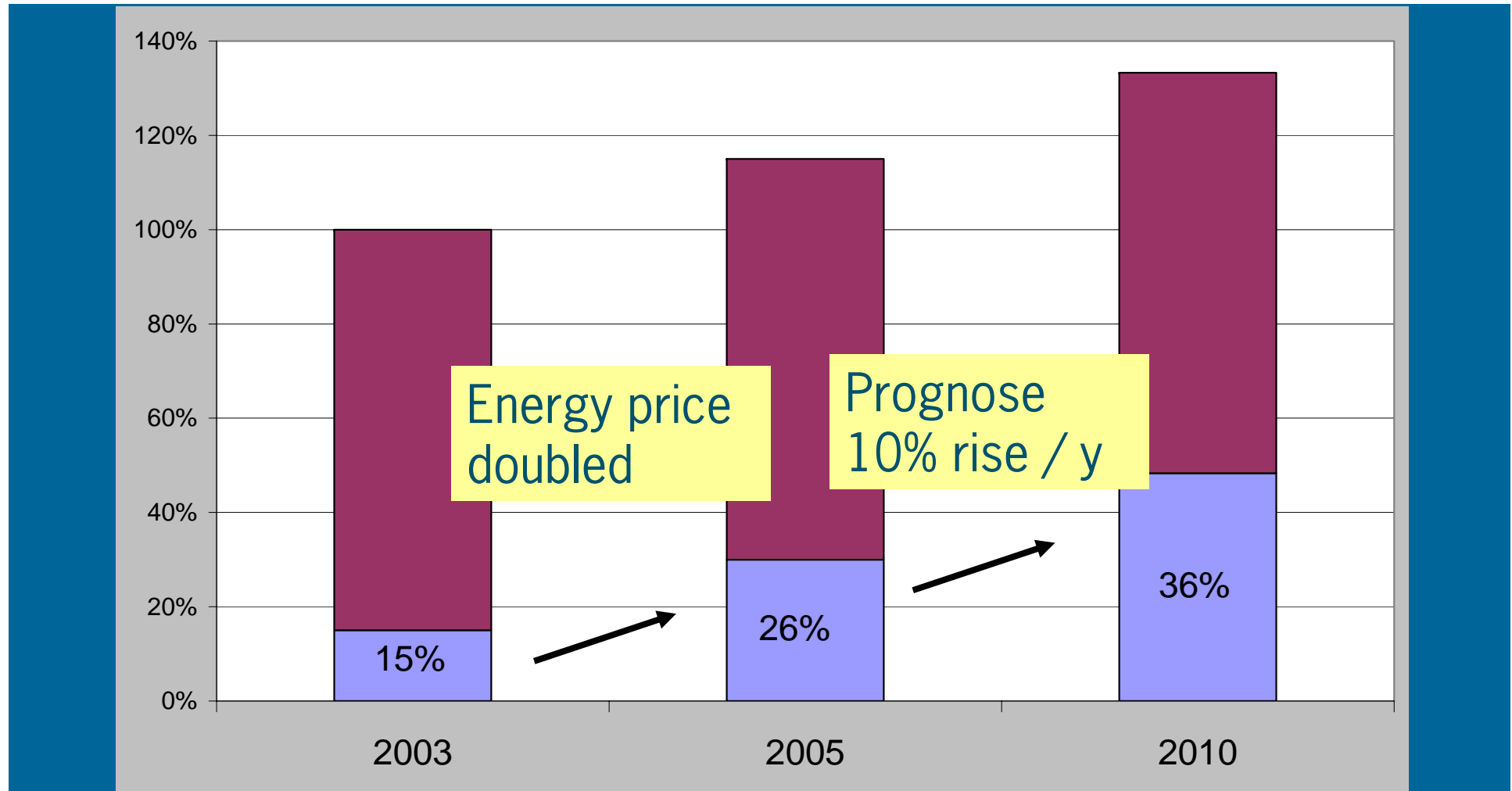
PTS Pulp Technology Symposium

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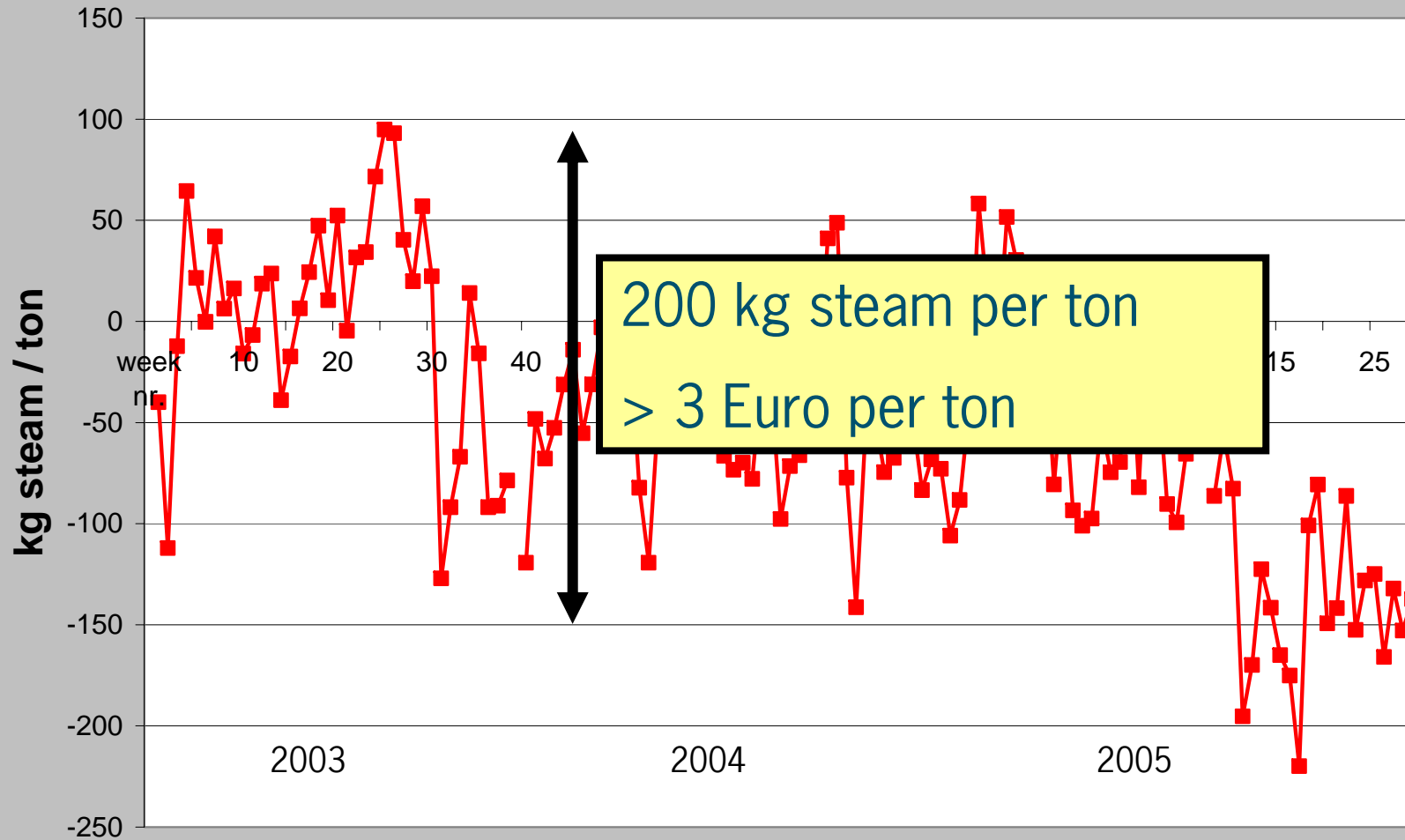
Energy consumption

- Dutch Paper and Board industry: 30 PJ
- European Paper and Board industry: 940 PJ
- In 2003 energy costs were 15 % of the production costs - this percentage has increased rapidly with increasing energy prices

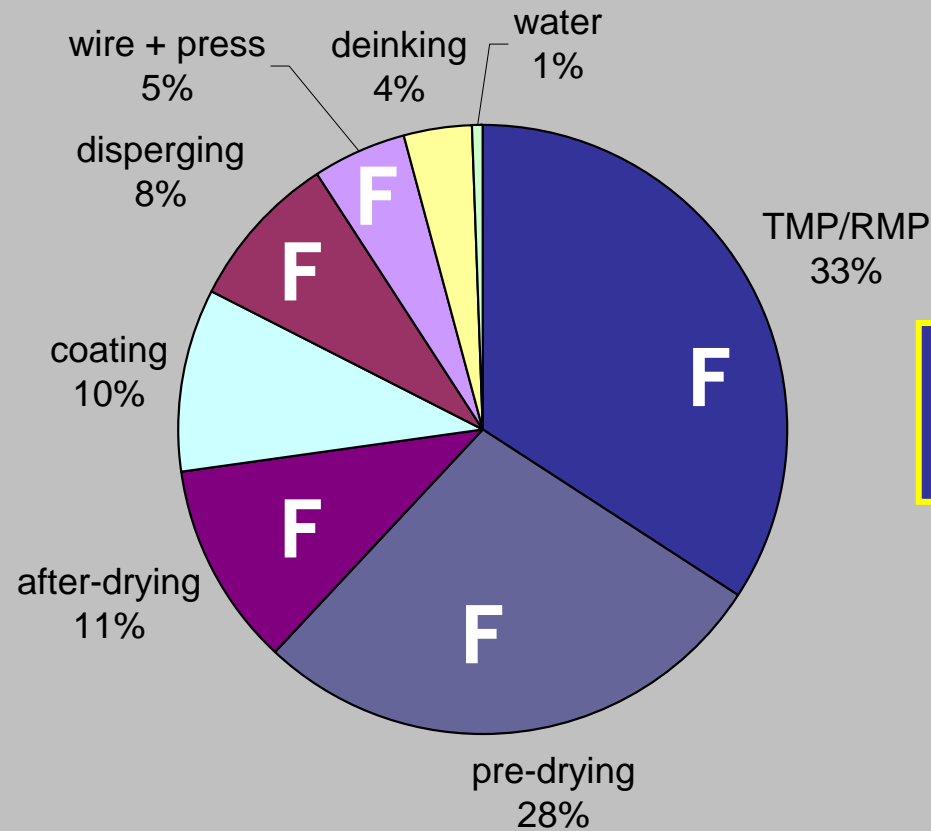
Energy share of total production costs



Strong fluctuations in energy consumption



'Top 10' energy consuming units (NL)



F = fibre related energy

Contents: Energy control by fibre control

- Control of fibre selection
- Control of refining
- Homogeneous treatment
- Other energy consuming and reducing fibre treatments



Reduction of energy in:

- Refining
- Wire and press section
- Drying section

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Fibre selection

Effect on paper properties

- Fibre dimensions
- Energy needed for fibre development
 - External fibrillation →
 - Fines content

 - Internal fibrillation →
(flexibility, relative bonded area)

Effect on processing properties

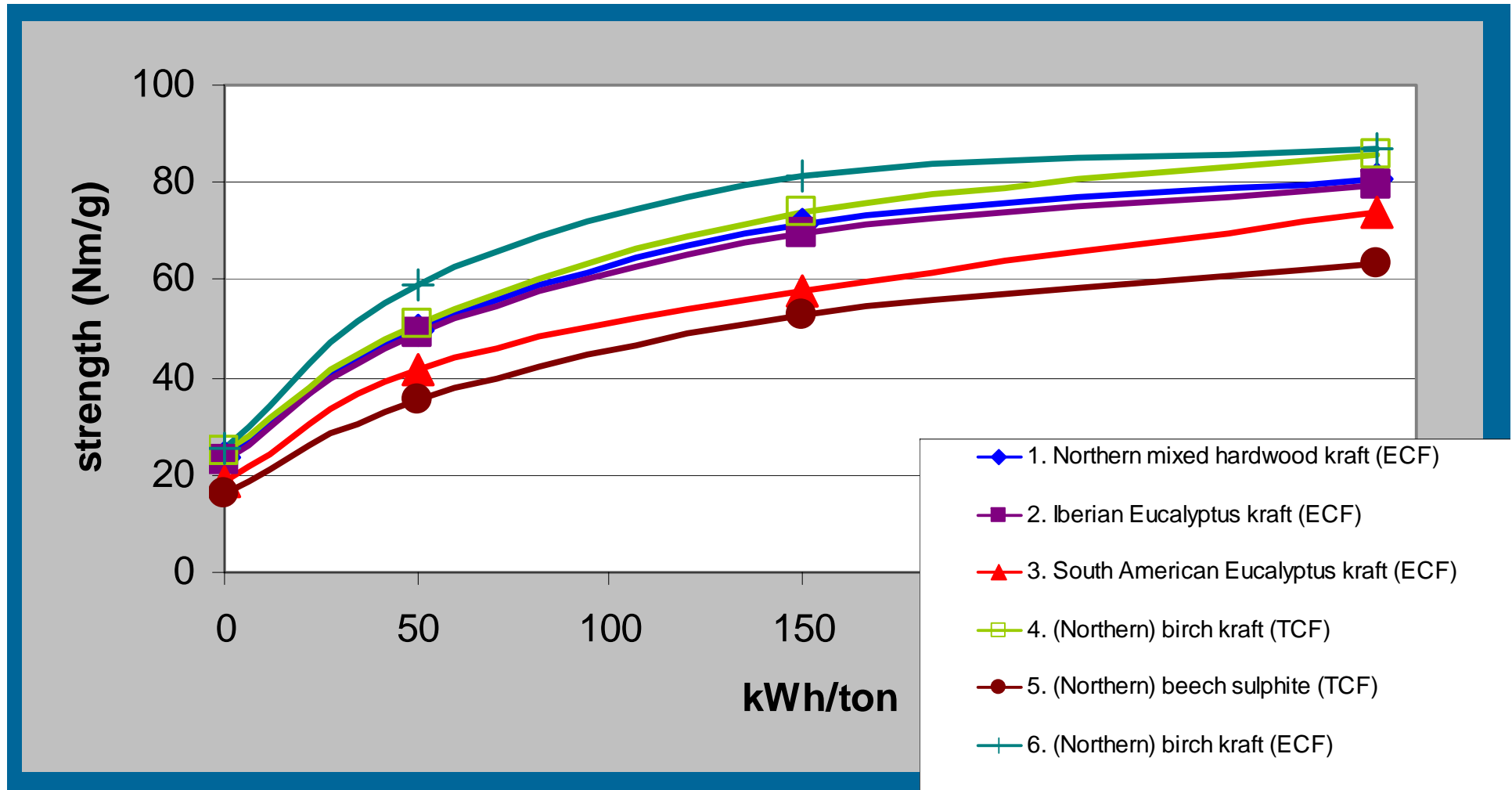
Beating degree (°SR)

Wire and press section

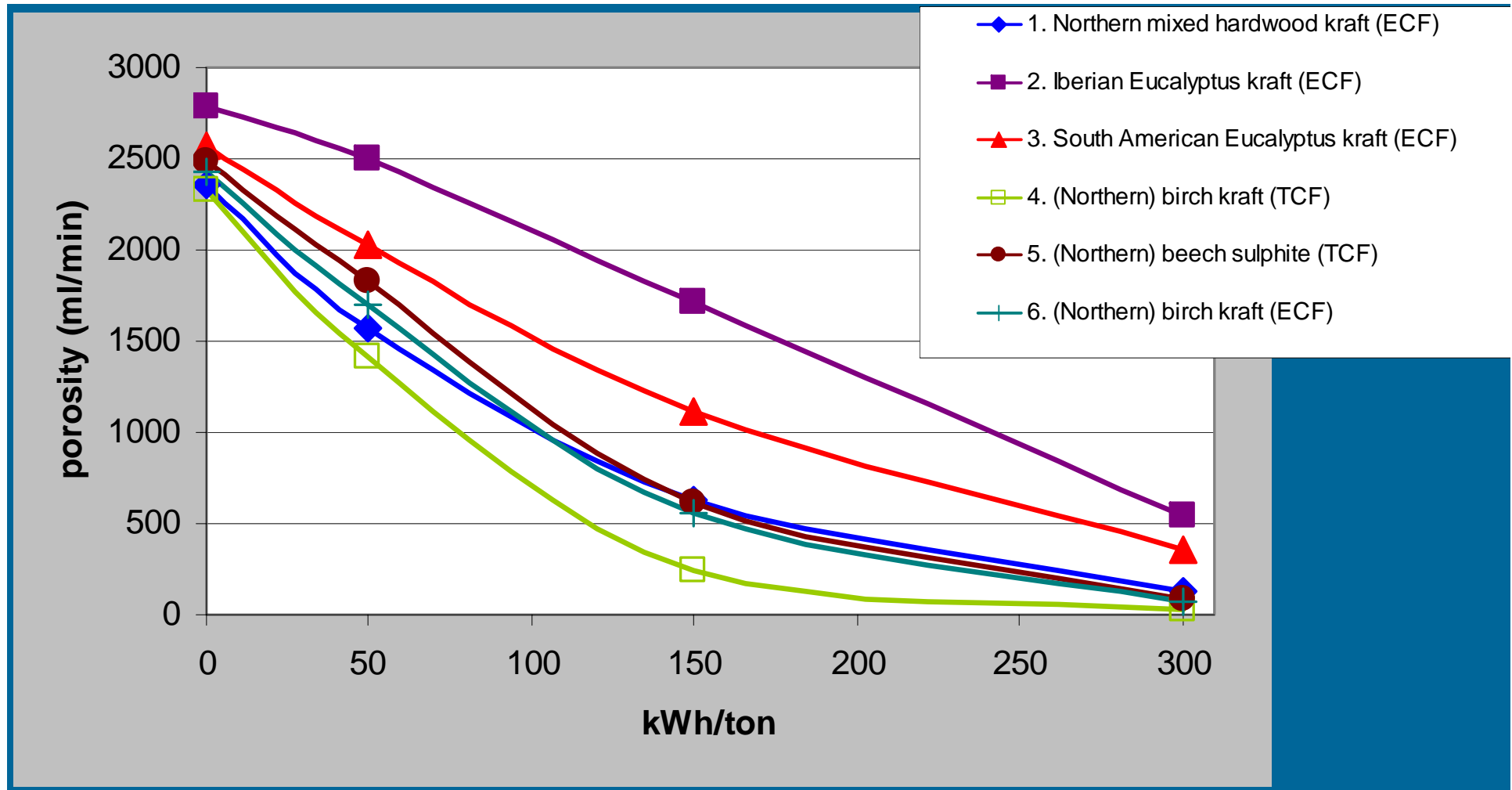
Water retention value

Drying section

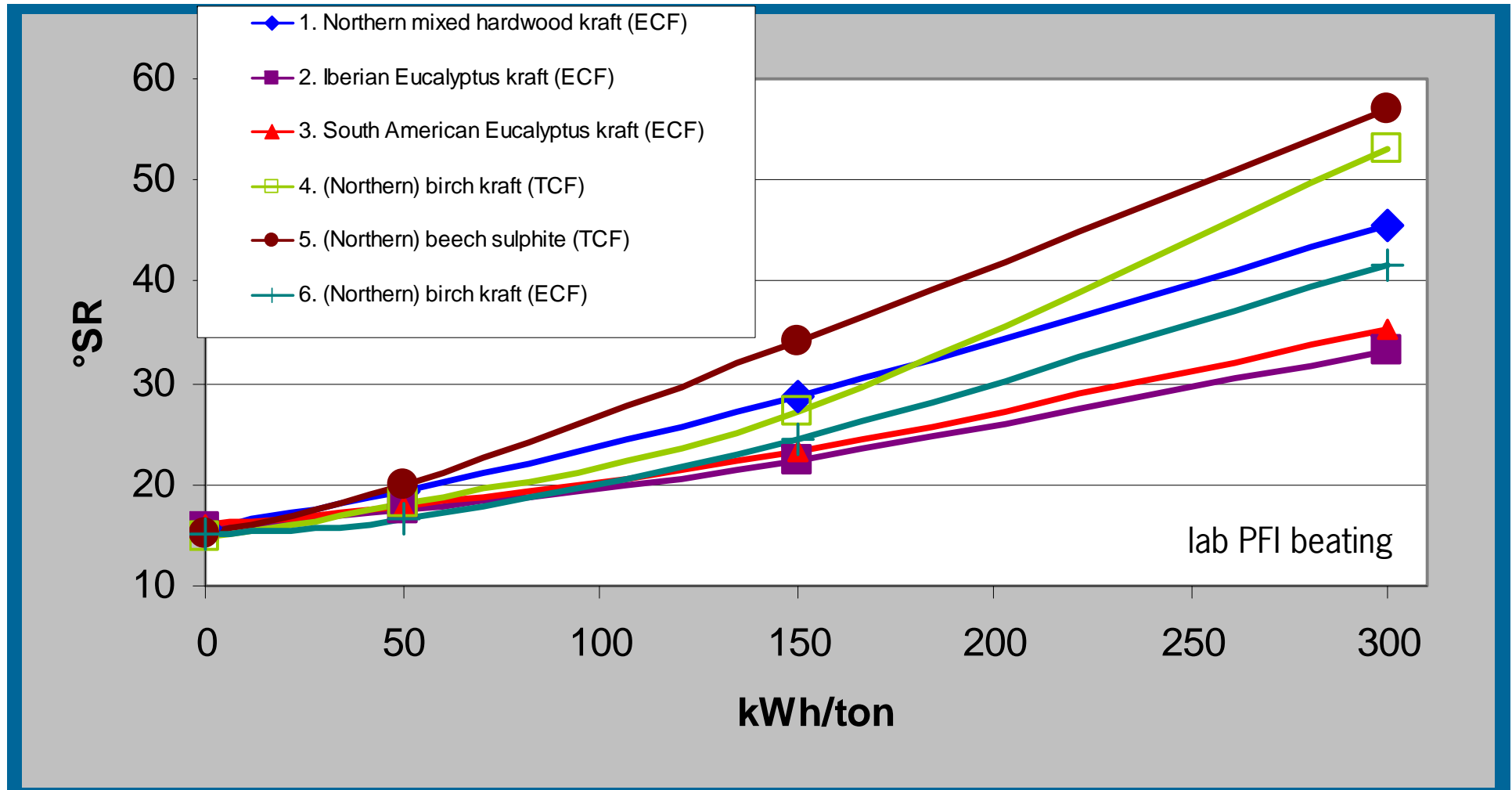
Tensile strength – lab beating curve



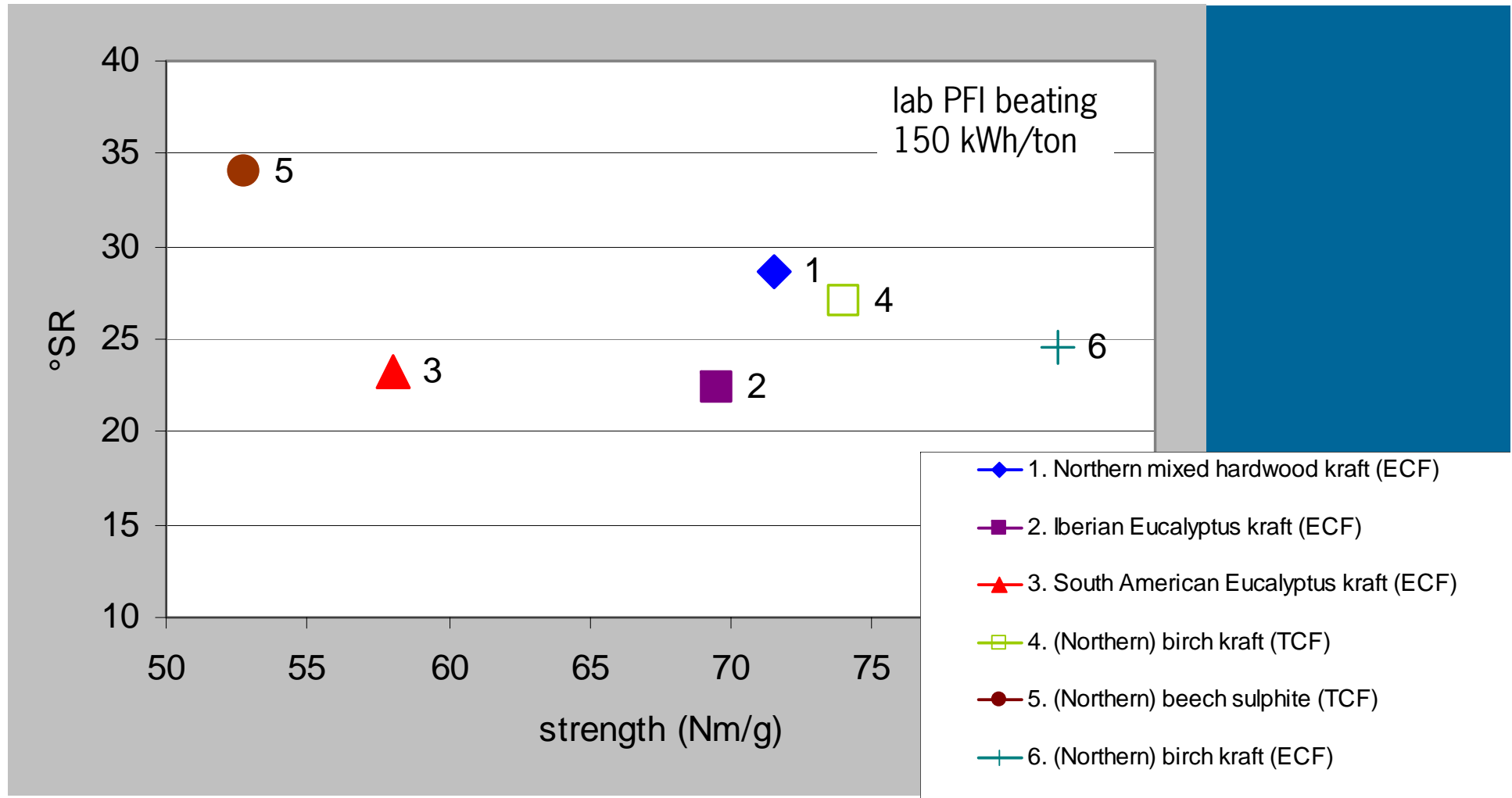
Porosity – lab beating curve



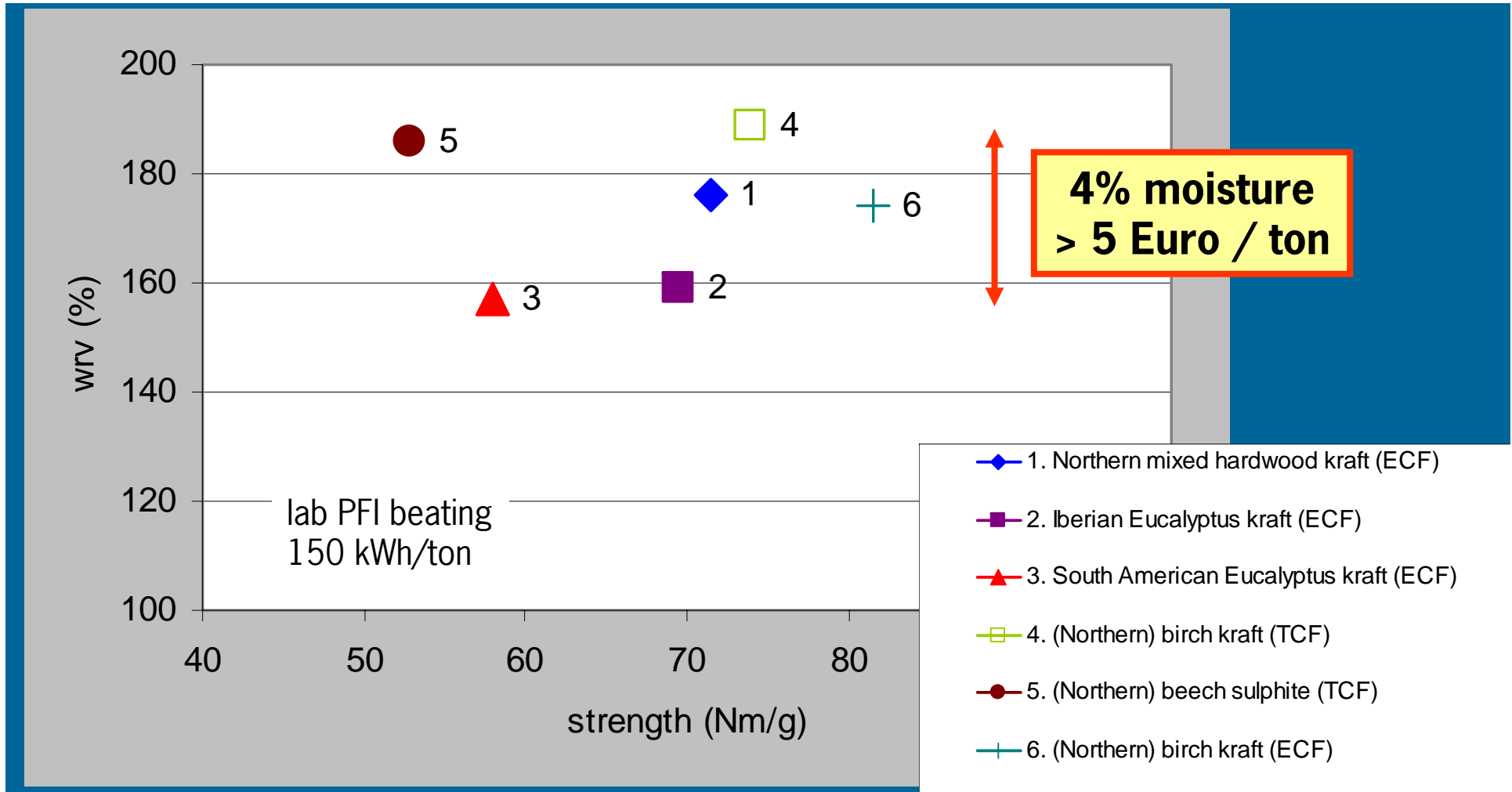
Beating degree development



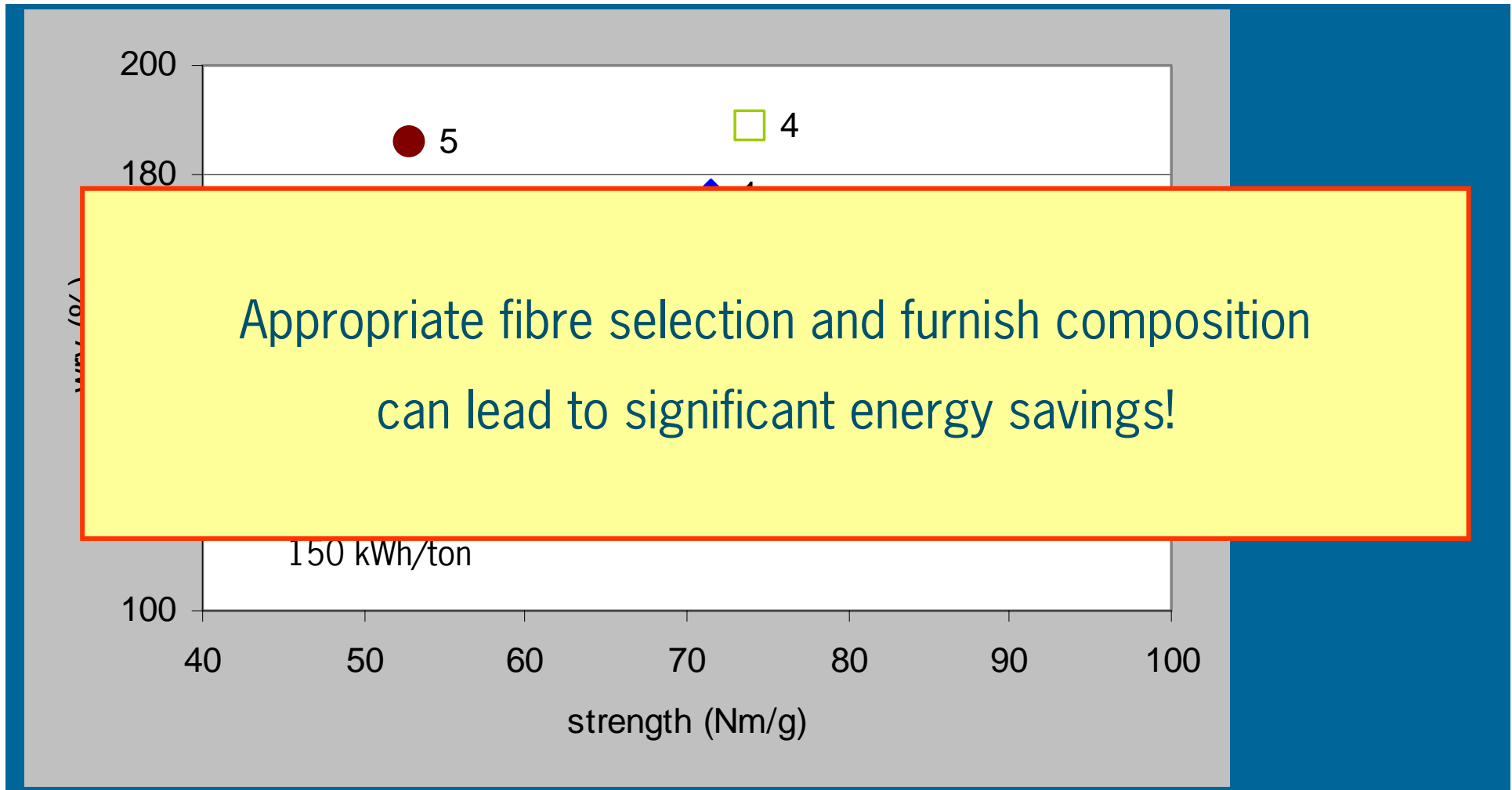
Energy in press section depends on fibre type



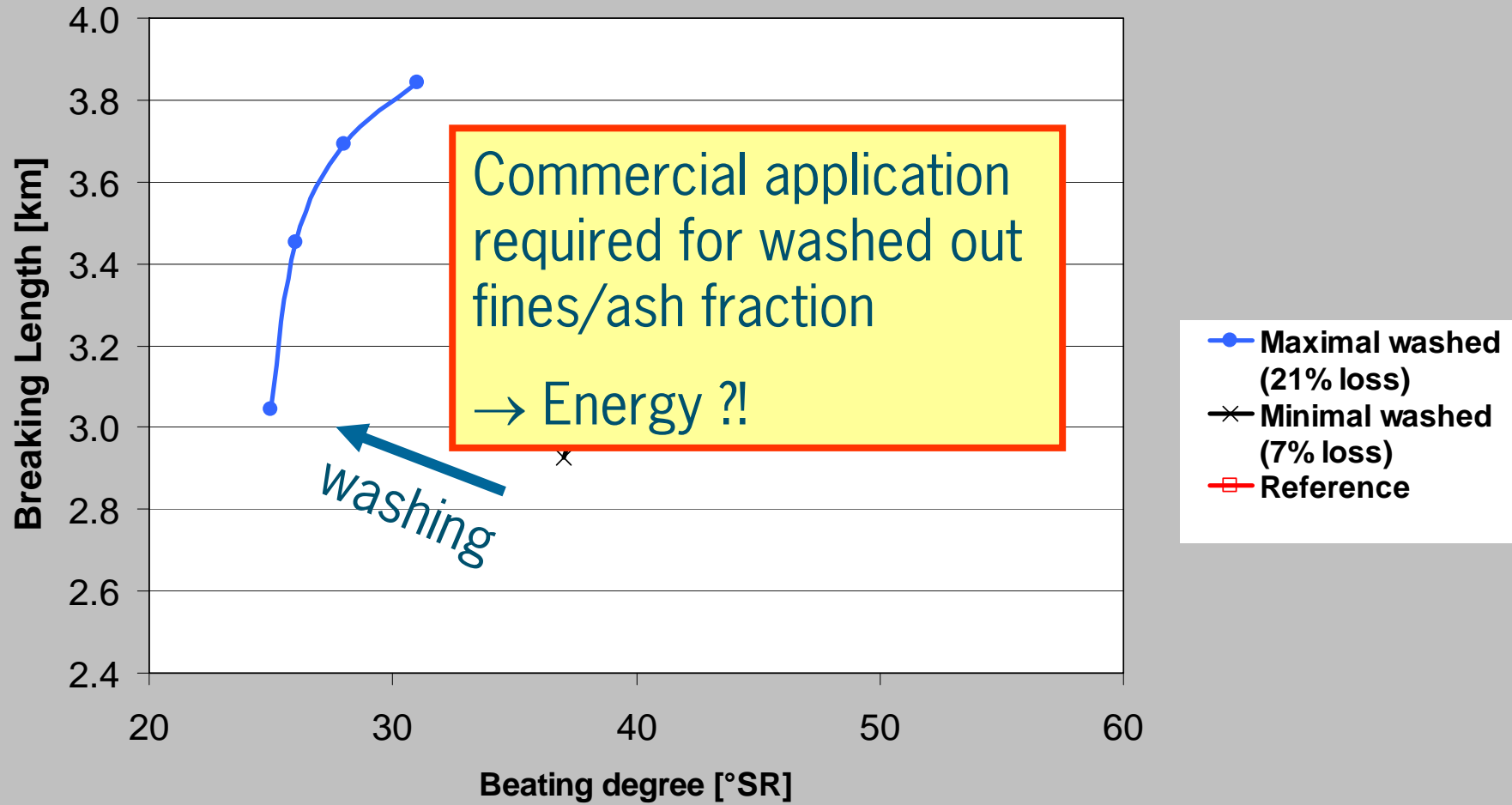
Drying energy depends on fibre type



Drying energy depends on fibre type



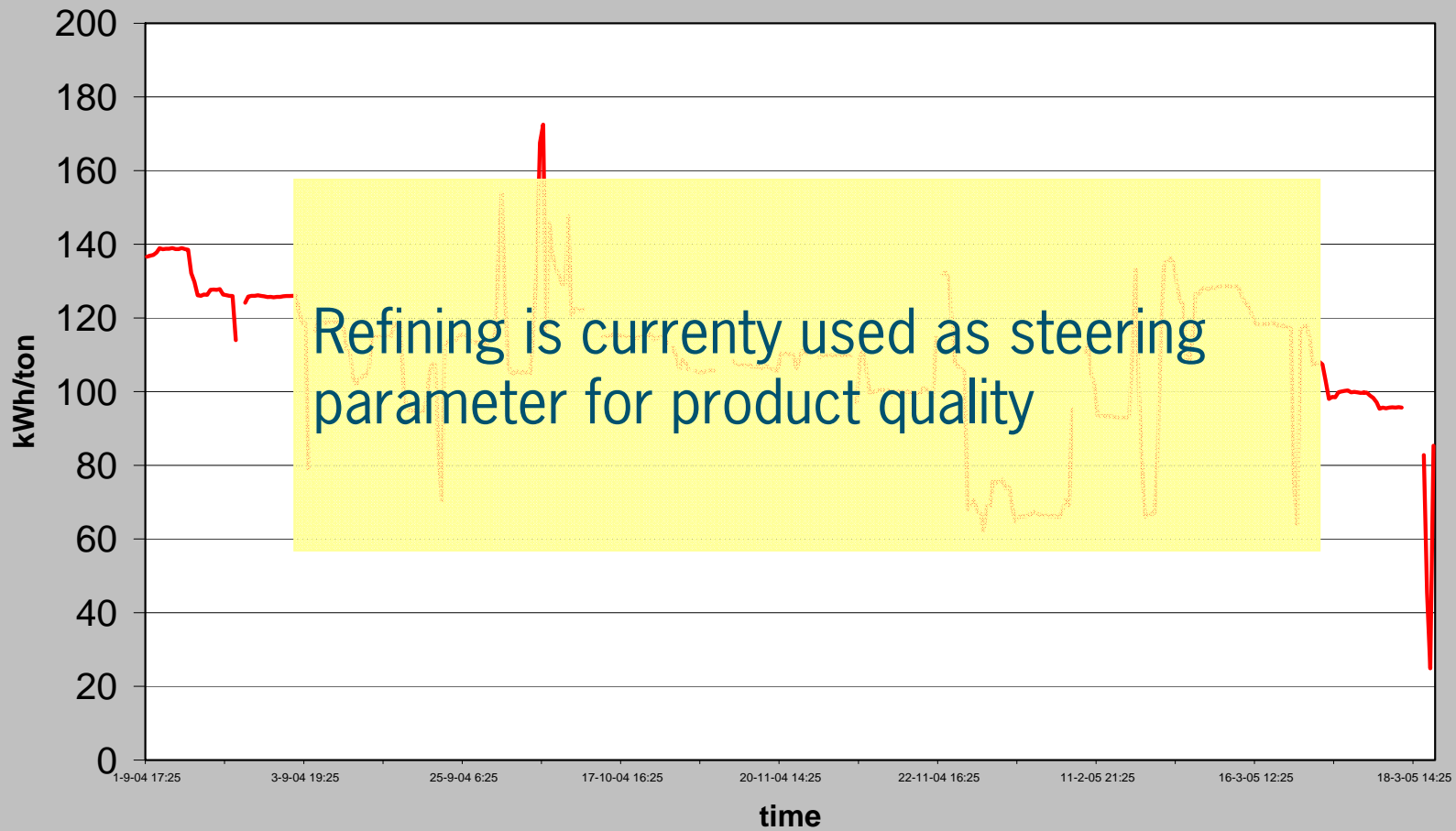
Recovered fibres



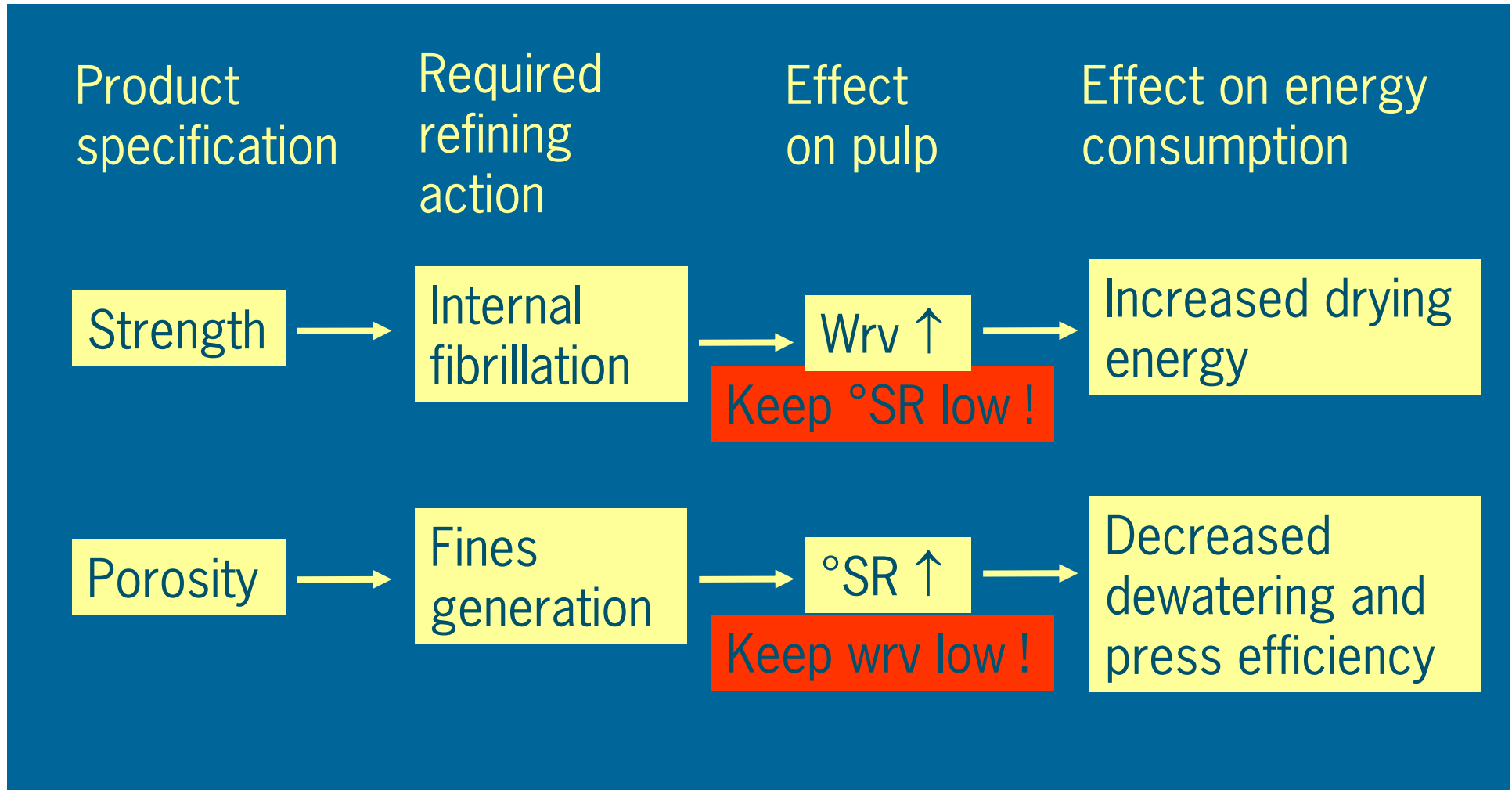
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Refining energy



Purpose of refining



Purpose of refining

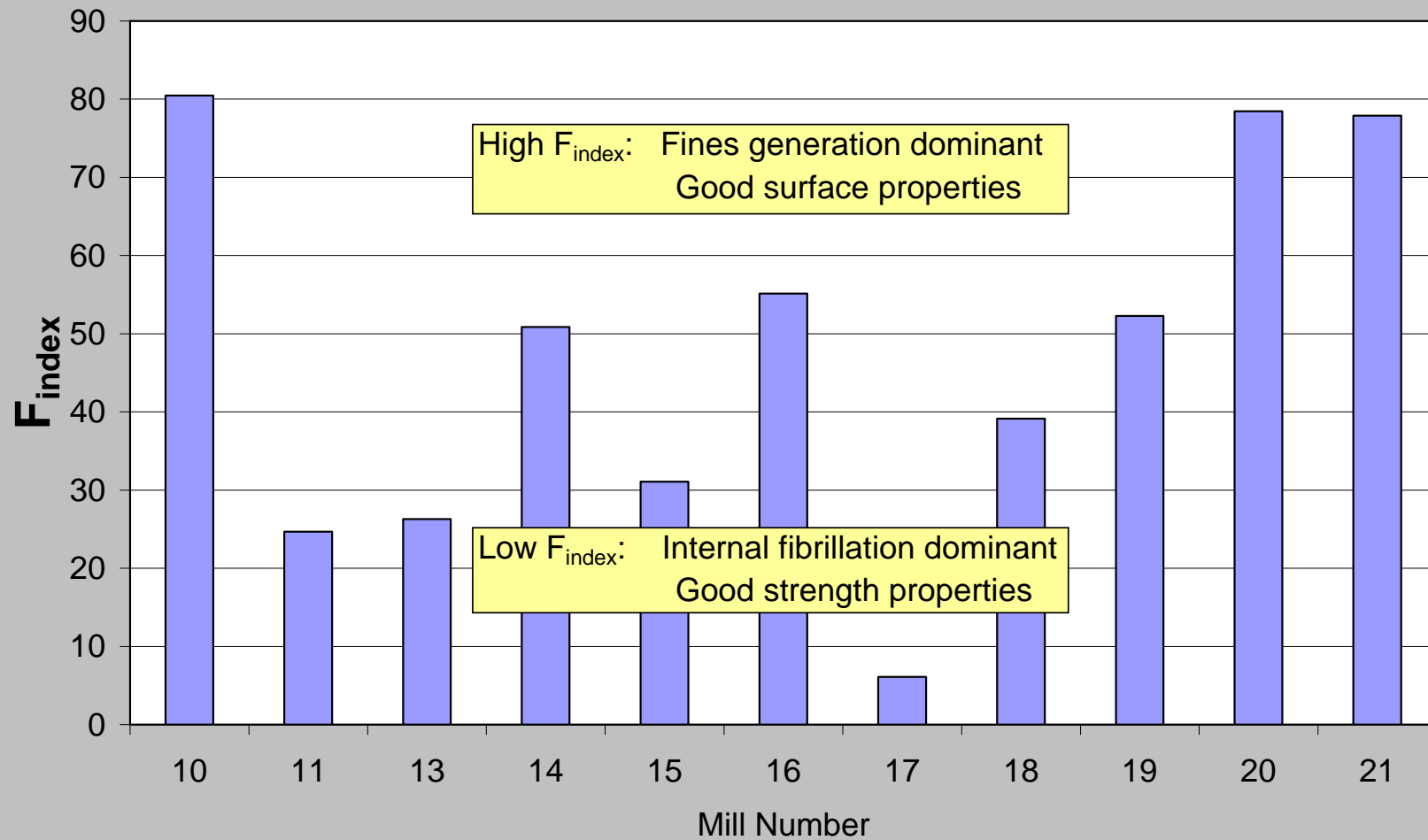
F_{index} ratio between fines generation and internal fibrillation by refining [J.C. Dekker]

$$F_{index} = \frac{\Delta^{\circ}SR}{\Delta wrv_{washed}}$$

$\Delta^{\circ}SR$ = increase in beating degree by refining

Δwrv_{washed} = increase of wrv of washed pulp (g_{H_2O}/g_{pulp})

Benchmark Dutch paper mills



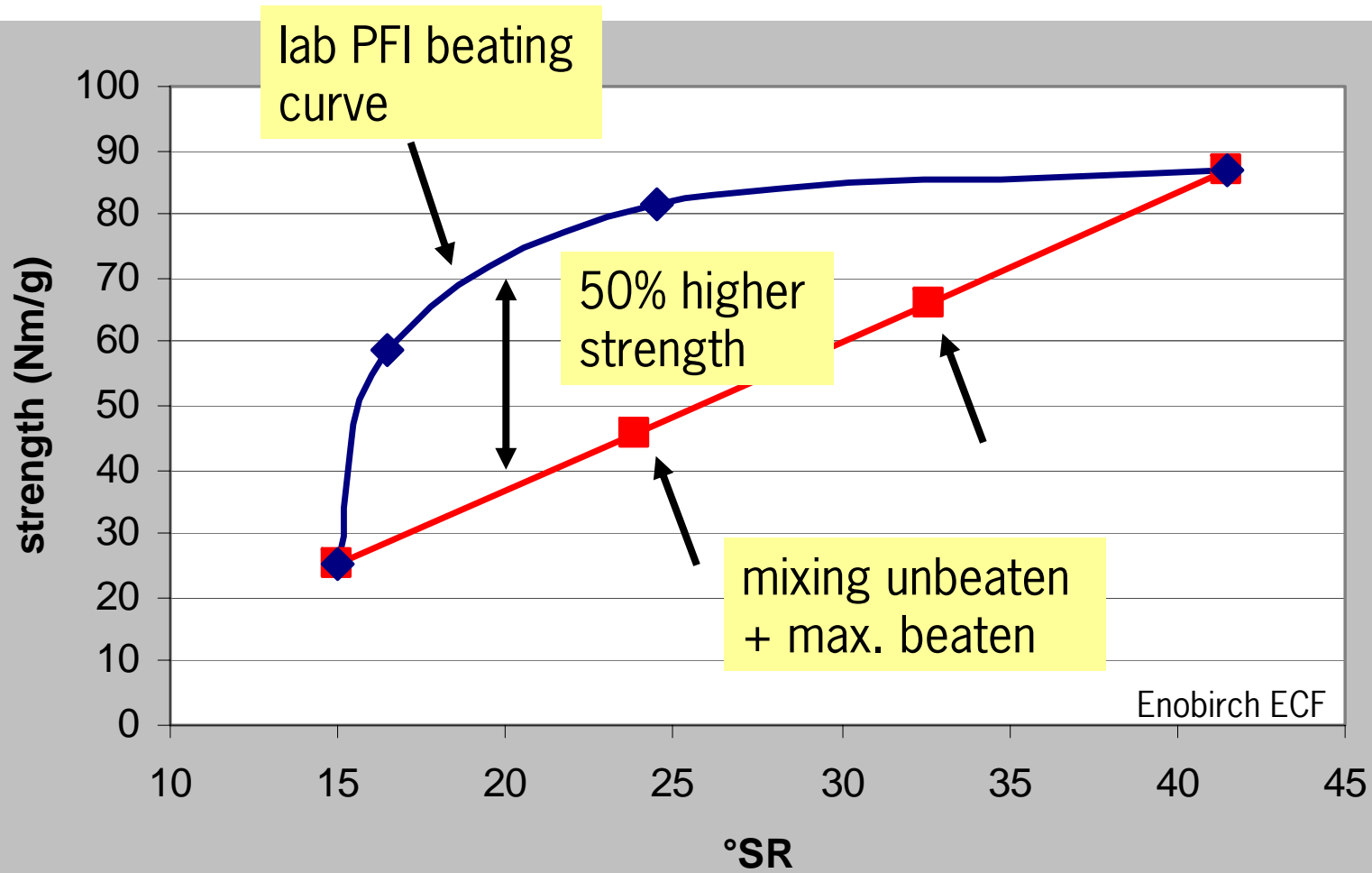
Refiner control

- F_{index} depends on:
 - Fibre type
 - Refiner plates and configuration
- F_{index} is not directly related to
 - Specific refining energy (SRE)

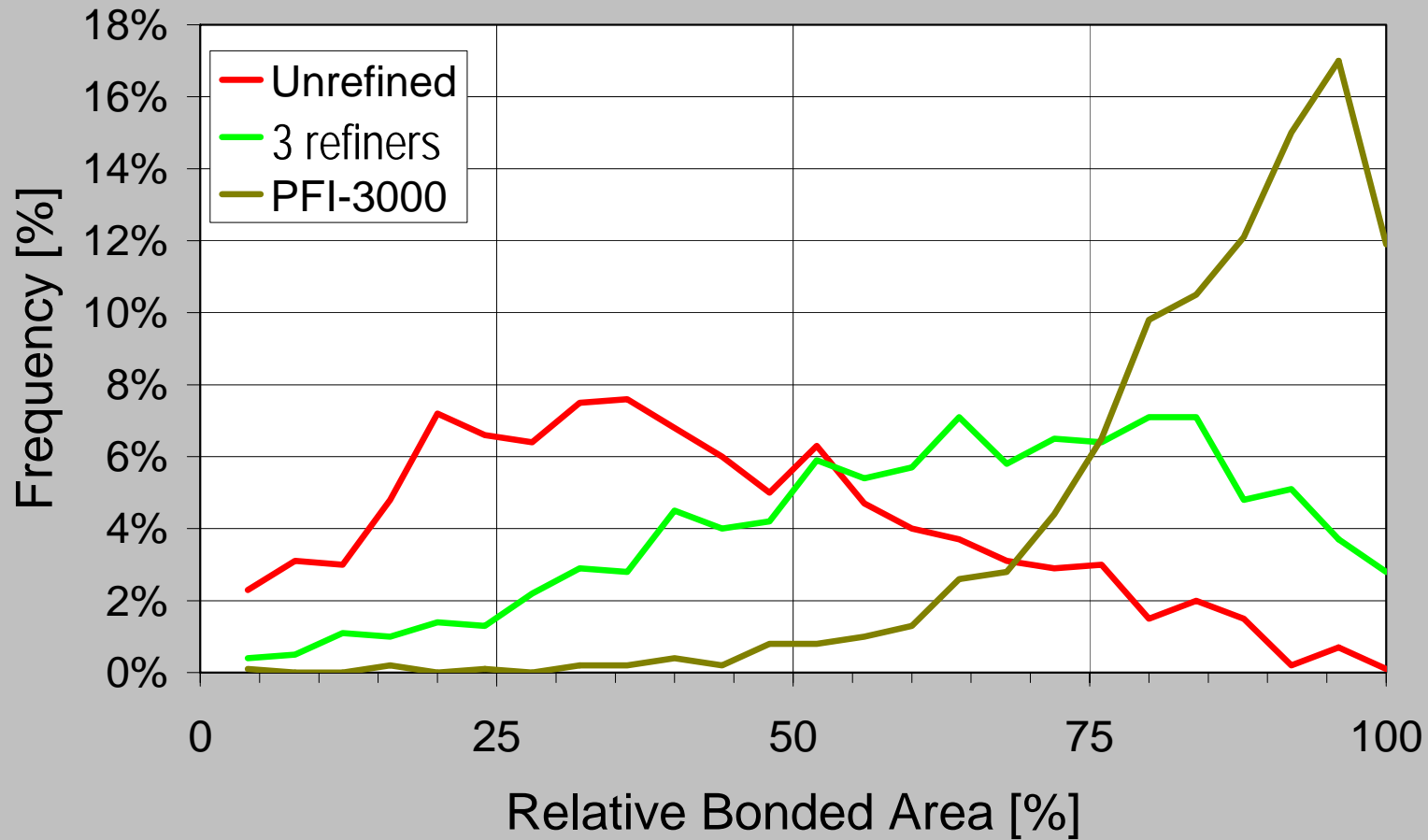
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Importance of homogeneous treatment



Importance of homogeneous treatment



Homogeneous treatment

- It is more energy efficient to give each fibre the same treatment than having an inhomogeneous treatment or mixing treated fibres with untreated fibres



Development of homogeneous industrial fibre processing technologies

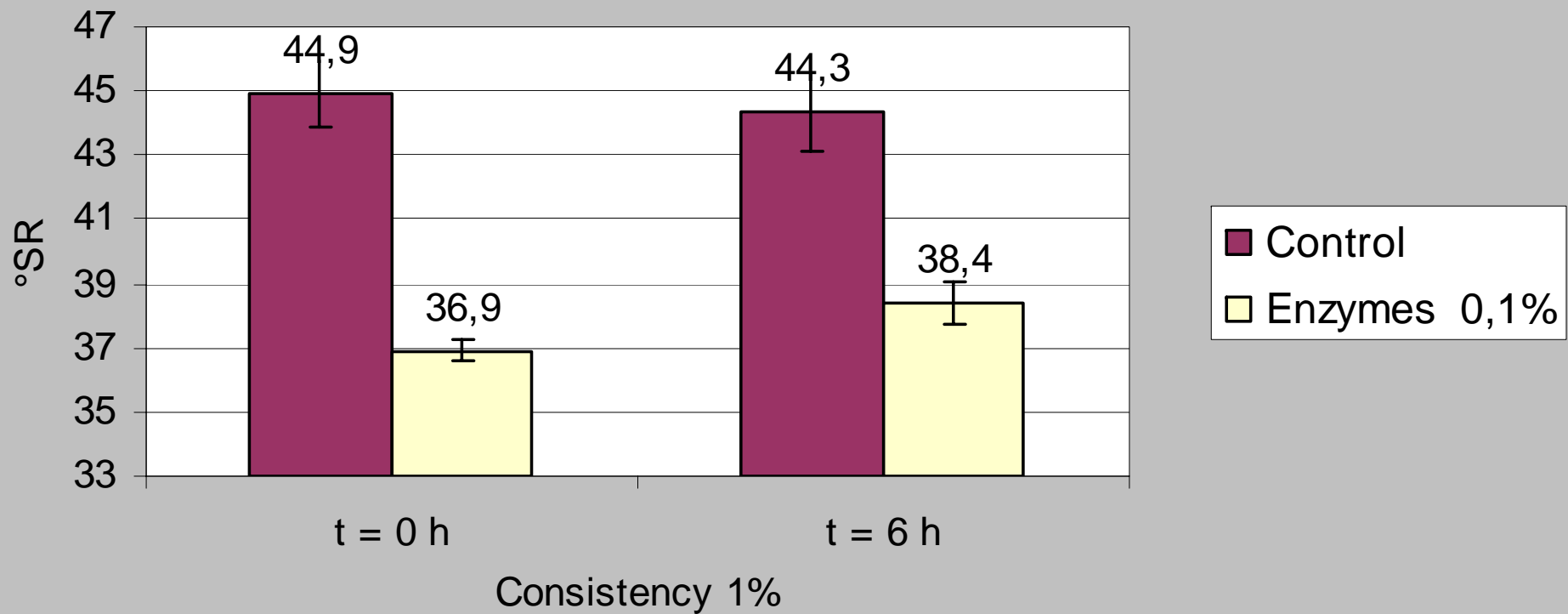
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Energy affecting fibre treatments

- Pulp residence time in stock preparation
- Chemical or enzymatic treatments
 - Reduction of refining energy
 - Reduction of pressing and/or drying energy by
 - * Reduction of beating degree
 - * Reduction of water retention value

Enzymatic dewatering improvement



Summary

- Higher energy prices require focus on energy reduction
- Control of fibre selection and processing can lead to significant energy reduction in papermaking
- Required energy for water removal should play an important role in fibre selection and control of fibre processing
- Refining energy should not be a steering parameter, but a parameter to be controlled
- Refining efficiency can be increased when effects on wire, press and drying sections are viewed in optimisation
- Homogeneous treatments are more energy efficient
- Chemical or enzymatic fibre treatment has high potential to reduce energy consumption in papermaking

Recommendations

- Move towards 'control of overall energy'-strategy
- Focus R&D on fibres and fibre treatment should shift towards the effect on 'required energy for water removal'
- Development of innovative fibres with new functional properties (improved refinability, dryability, recyclability)
- More homogeneous refining technologies
- Development of alternative fibre treatment technologies to reduce dewatering energy
- New applications for pulp part that increases dewatering energy (fines) → Energy production !?
- Development of proper and reliable (on-line) analysis equipment for fibre drying resistance (WRV).