



“Niche markets for specialty industrial crops”

The role of Chimar Hellas in the Crops2industry project

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The role of Chimar in the Crops2industry project

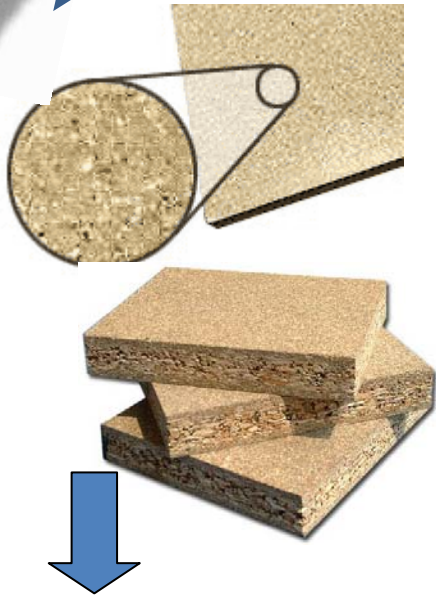
Provide advice on the possible effective utilization of various natural materials, in products related to the wood-based panels industry.



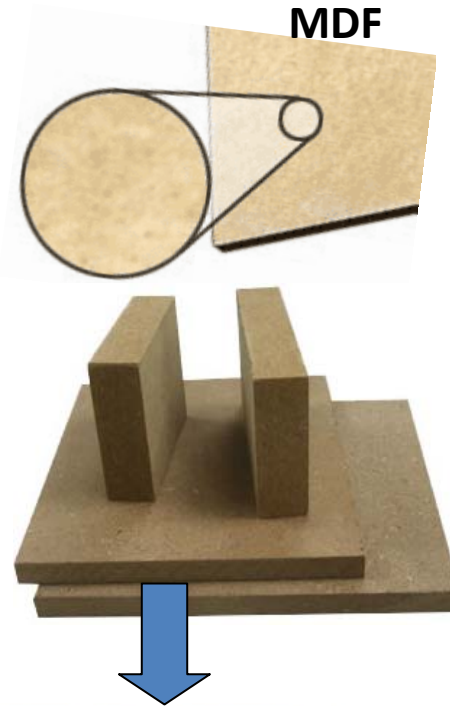
Main wood-based panels

+ Adhesive

Particleboard



MDF



OSB



Plywood

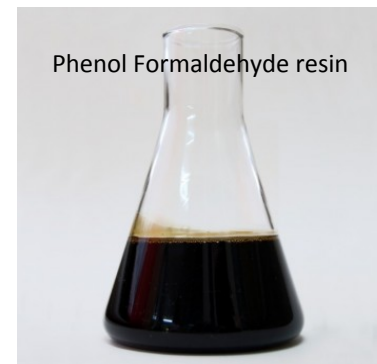


Common adhesives in the wood-based panels industry

Polymers from petroleum-derived raw materials

Main categories

- Formaldehyde based resins: UF, MUF, MF, PF
 - Suitable for PB, MDF, PW, OSB and impregnated papers
- Isocyan based resins: pMDI
 - Suitable for PB & OSB



Why to shift over other raw materials

Petrochemical adhesives

Advantages	Disadvantages
Cheap	Fossil fuel resources are finite.
Effective	They are harmful to the human health.
World wide available at relatively standard quality	They have been considered liable for various environmental damages e.g greenhouse gas emissions.

Promising alternative solution = **BIOMASS**

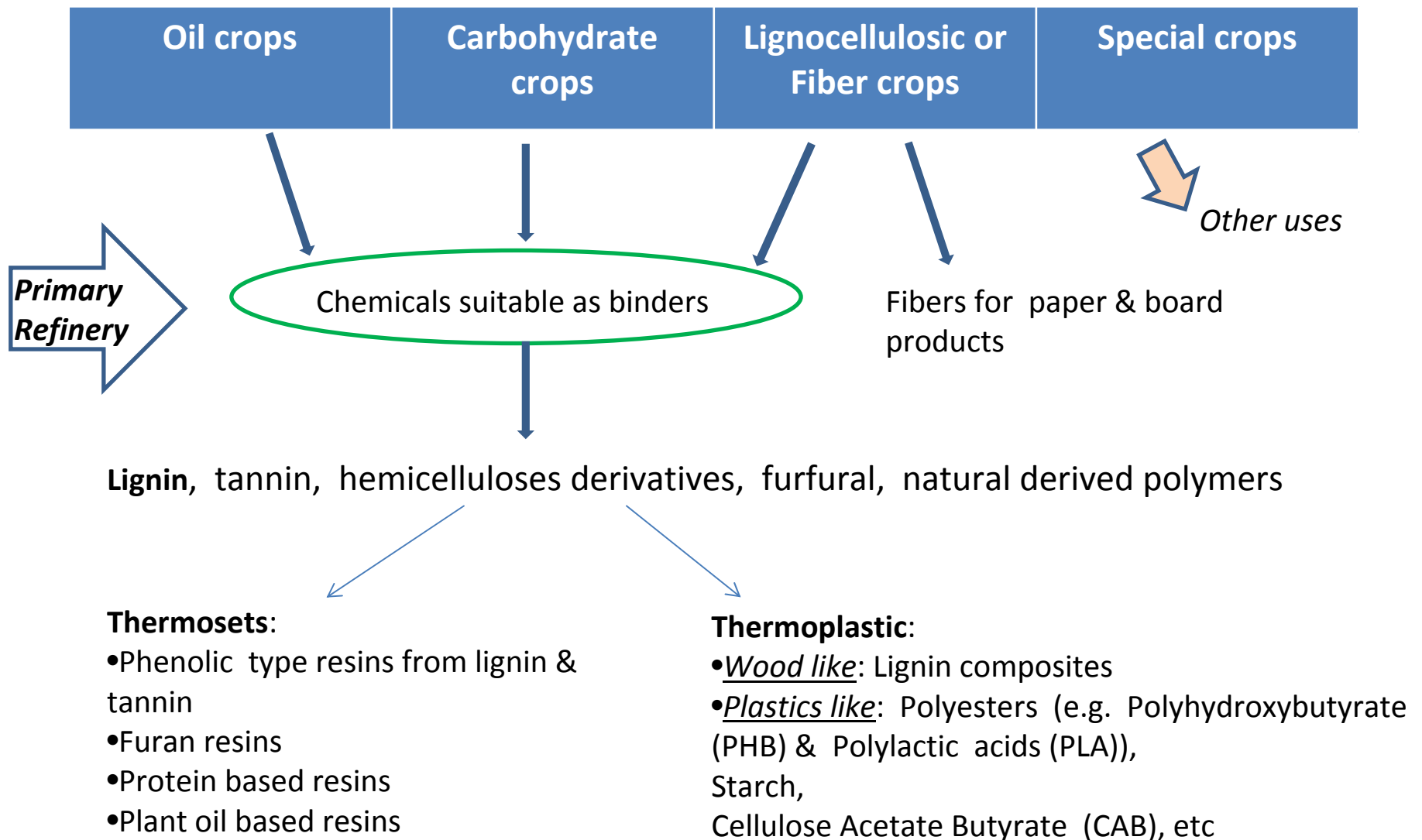


sustainable resource for energy, fuels, chemicals and materials

Exploitation of biomass - Biorefinery concept



Categories of crops and their utilisation



State of the art in thermosetting bio-based binders *(in brief...)*

Material	Type/origin	Adhesive type	Application
Tannins	Condensed type, mainly from mimosa	Totally natural or in combination with synthetic adhesives.	Various grades of PB and MDF.
Lignins	By-products of the cellulose processing main types: Kraft & organosolve	Used in combination with synthetic adhesives	Various grades of PB, MDF & PW
Proteins	Isolated proteins from soy	Used in combination with synthetic adhesives, or as additives.	PB & PW
Furfural	Derived from hemicelluloses	Furan resins	PW & MDF, compression mouldings
Oils	Modified vegetable oils	Example: Maleinised & epoxidised oils	MDF and insulating panels

Chimar products with renewable raw materials

Used as phenol substitutes in PF resins

	<i>Production scale</i>			Panel
	Industrial	Pilot	lab	
Materials	<i>Phenol substitution level, %</i>			
Lignin		50	80	Ply
			30	PB
Wood pyrolysis bio-oil	40	50		OSB
Tannin	30			Ply
Soy Protein			25	Ply
Olive stone liquefat	50		75	Ply

Other binding systems tested in lab scale PB production:

- Totally natural resin based on Tannin
- UF resins modified with 1% Soy flour/isolated protein gave improved dimensional stability and mechanical strength.

Which are the best crops for adhesives suitable for wood-based panels?

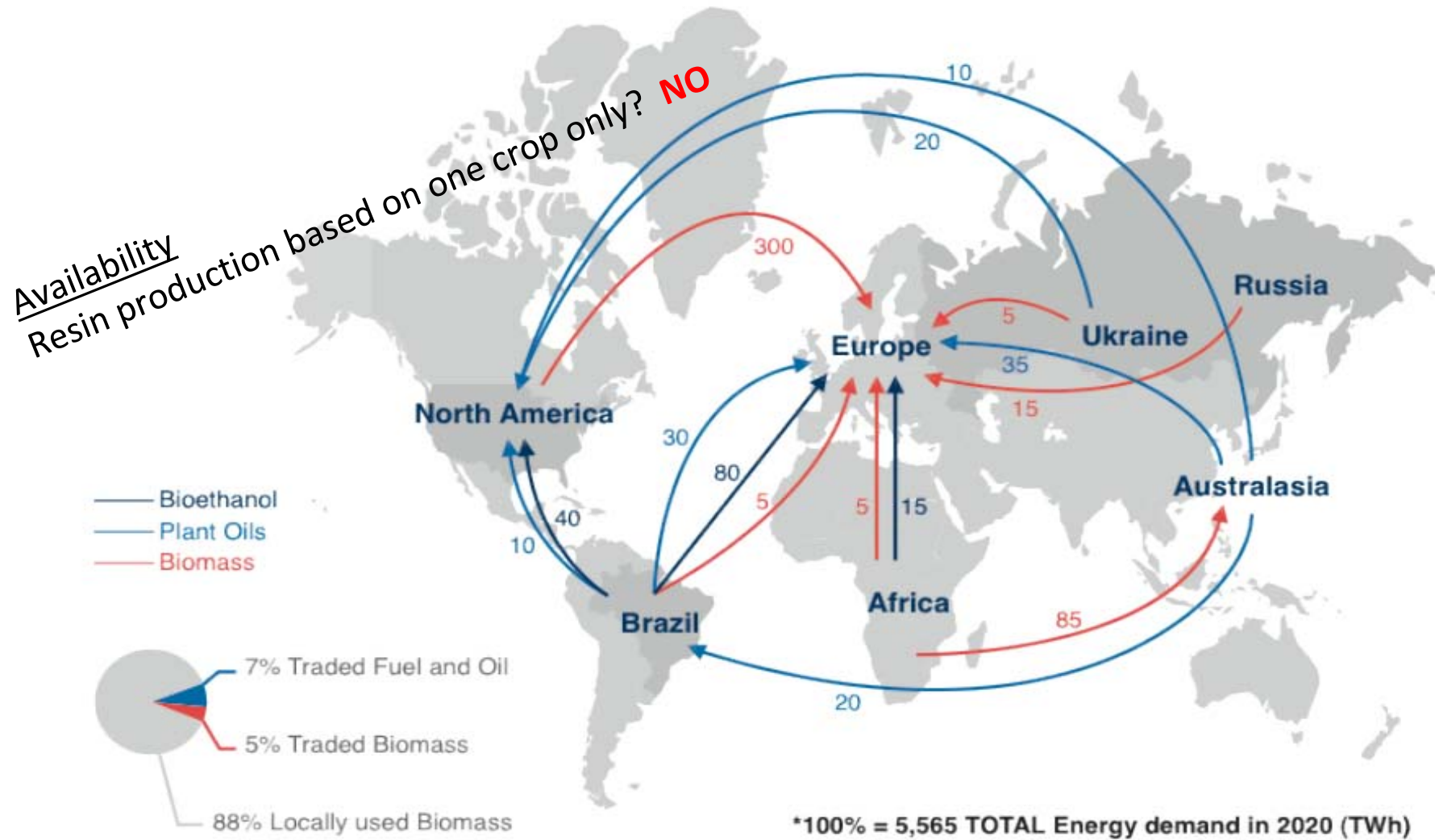
Composition of various crops



Lignocellulosic material	Cellulose %	Hemicellulose %	Lignin %
Switch grass	45	31.4	12-20
Miscanthus ?	40	18	25
Coastal Bermuda grass	24	35.7	9-18
Corn Stover	34-50	17-35	7-18
Wheat straw	30	50	15
Rice straw	36-47	19-25	10-24
Cotton seed hairs	80-95	5-20	0

Sources: Reshamwala et.al., 1995, Cheung & Anderson, 1995; Boopathy, 1998, Dewes & Hünsche, 1998; Sorensen et al., 2008.

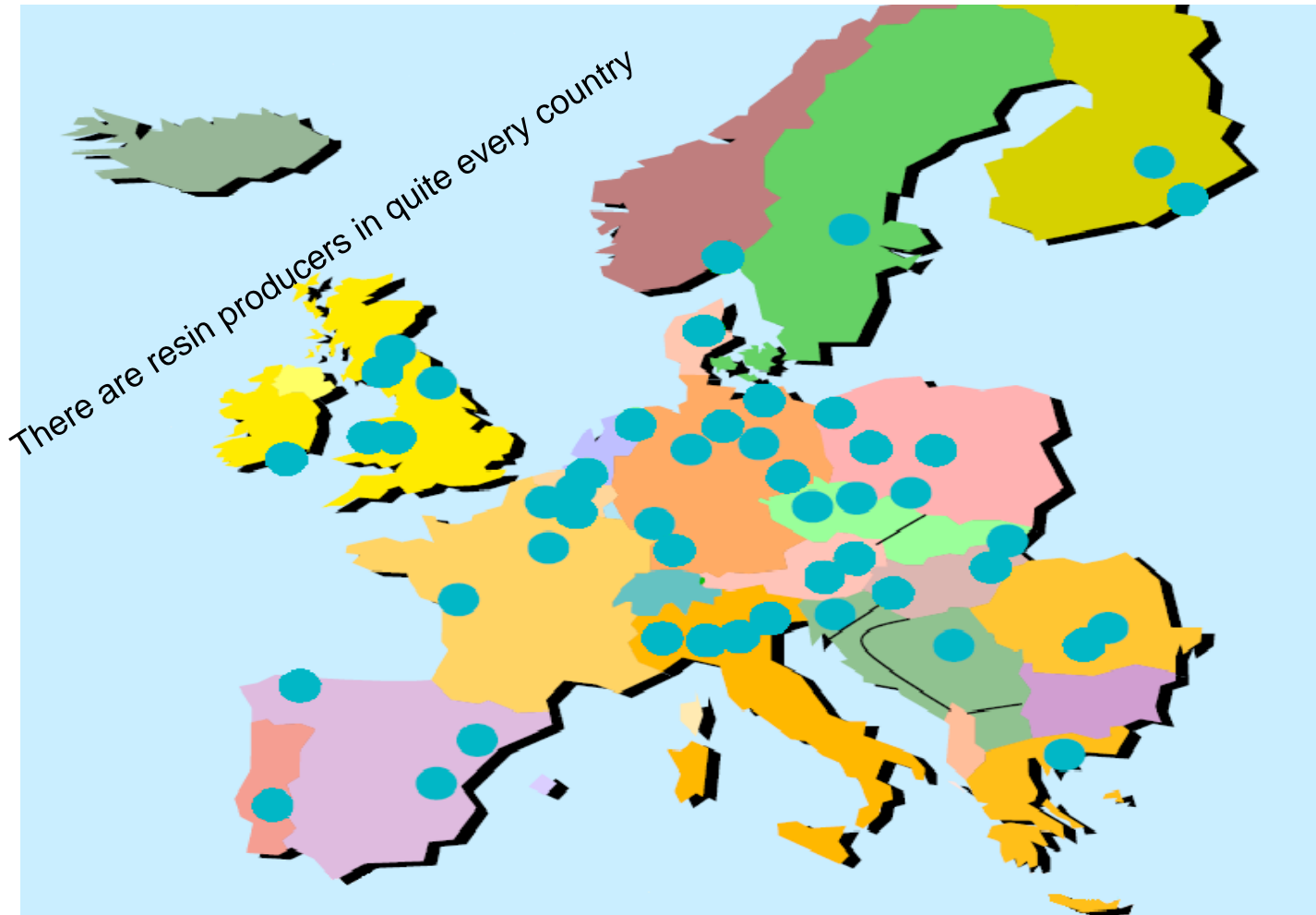
Expected biomass trade routes



Values represent energy demand in 2020 (TWh)

Source: *The future of industrial biorefineries*. World Economic Forum, Geneva, Switzerland, 2010

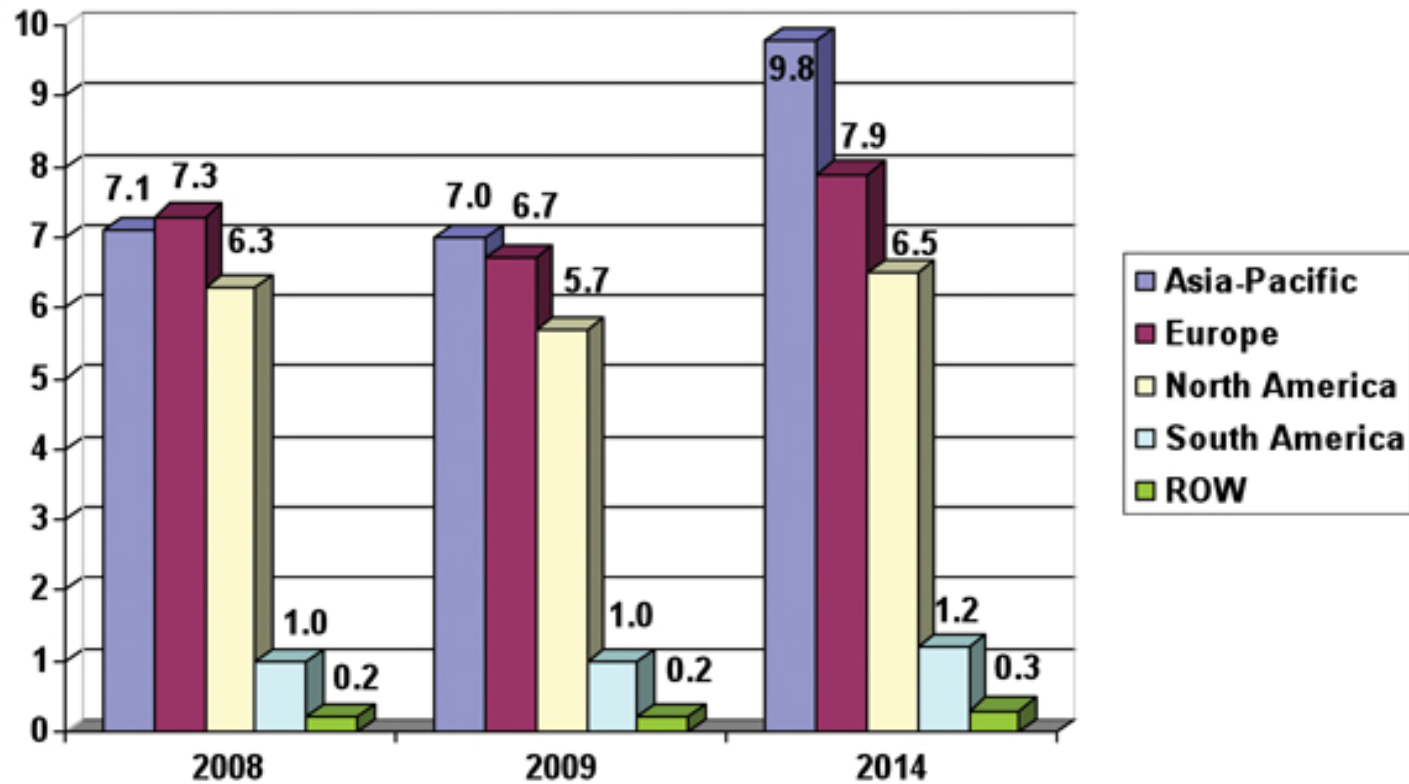
Resin producers in Europe, 2005



Source: Lukkaroinnen & Dunkey, San Diego, 2005

Market forecasting

Economic value of petrochemical adhesives consumption by region



Adhesive Consumption by region (\$ billion) (*Kusumgar 2011*)

Conclusion

- Sustainability of lignocellulosic crops is of major importance from an environmental and economical perspective.
- For their further exploitation technology advancements and standards are necessary.
- Legislation would be of help to their sooner use in industrial applications.

Thank you for your attention!

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