

**European Market for Adhesives
for Panel Board Products:
Current State and
Challenges for the Future**



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Content

- **European market size for panels and adhesive**
- Annual growth in wood based panels production in Europe
- Overview on adhesives and their application
- Business drivers in the European market
- Trends and requirements in the wood based panels industry
- What does the market (the wood based panels industry) ask from the adhesive producers
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- Outlook

Production volumes in 2003 in Europe (Mill. m³/year)

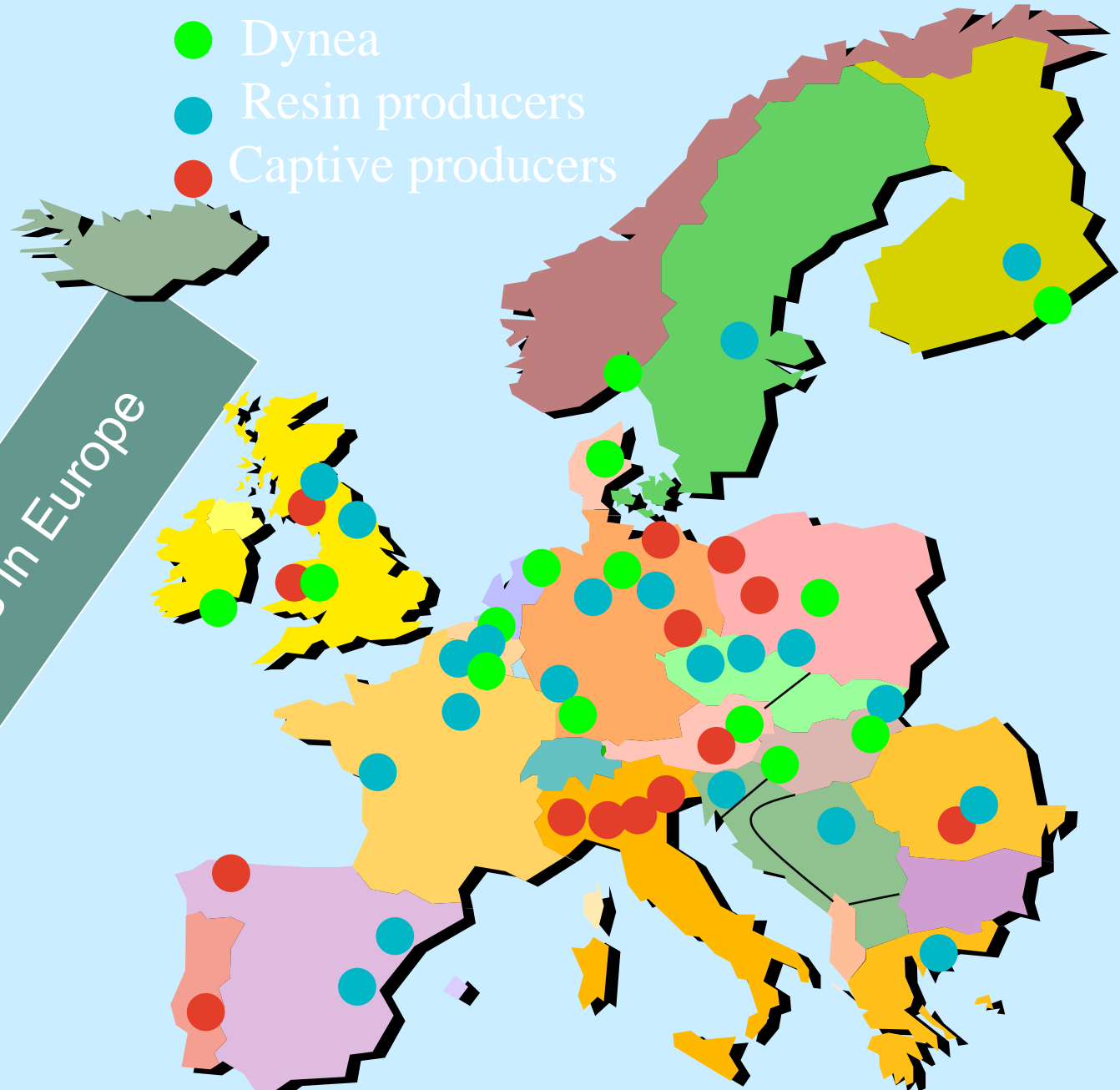
Europe without Russia			50.1
	Particleboard	36.2	
	MDF and HDF	11.2	
	OSB	2.7	
Russia			3.4
	Particleboard	3.2	
	MDF and HDF	0.2	
	OSB	---	
Total			
	Particleboard	39.4	
	MDF and HDF	11.4	
	OSB	2.7	
Total Europe (all types of wood based panels)			53.5

Demand in adhesives for the PB/MDF/OSB industry in Europe incl. Russia (1000 tons)

Formaldehyde condensation resins		
	Particleboard	3.550
	MDF and HDF	1.350
	OSB	150
	total	5.050
PMDI		
	Particleboard	10 – 15
	OSB	40 – 50
	total	60
Total amount of adhesives		~ 5.100

- Dynea
- Resin producers
- Captive producers

Resin producers in Europe



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Anticipated annual growth in wood based panels production in Europe

- Annual growth in wood based panels is **lower than in the decades before**, but still a distinct growth is given; growth is **different in regions and for various products**.
- EPF sees **higher percentage increase in Eastern Europe**; based on the much higher existing volumes still the absolute increase in production would occur in Western Europe.
- On the other side we see new plants mainly now in construction and recently going into operation in the countries in **Eastern Europe** as well as in the European part of Russia, with a concentration in the **area around Moscow**.

Estimated annual growth (%) in the PB/MDF/OSB production in Europe excl. Russia in the time frame 2006 – 2010 and additional volume produced per year in 2010 compared to 2005 (according to EPF)

		% per year	Mio.m ³ (2010)
Western Europe	PB	1	+ 1.2
	MDF	4	+ 1.6
	OSB	3	+ 0.3
Eastern Europe	PB	2	+ 0.6
	MDF	5	+ 0.3
	OSB	18	+ 0.7
Western + Eastern Europe	PB	1.2	+ 1.8
	MDF	4.1	+ 1.9
	OSB	6.9	+ 1.0
Total (all types of wood based panels)		2.2	+ 4.7

Estimated number of new plants

- Assuming
 - particleboard plant: yearly capacity of 500.000 m³
 - MDF plant: 300.000 m³
 - OSB plant: 250.000 m³
- up to **14 new plants** to go into operation within the five years 2006 – 2010 in **Europe (excl. Russia)**.
- For **Russia** the estimations are at least 4 new particleboard plants, 2 MDF plants and 3 OSB plants (in total **9 plants**).
- **All in all: 25 new plants estimated for the next 5 years**

Annual adhesive demand in Europe incl. Russia (1000 tons/year): 2010 compared to 2005

PB		+ 300
MDF		+ 370
OSB	Condensation resin	+ 100
	PMDI (1)	+ 30
Total		+ 800

(1) assumption of PMDI used as adhesive in the core layer

Growth in adhesive demand in Russia

- In these 800.000 tons Russia is included with an increased demand of up to **350.000 ton/y** in 2010 compared to 2005.
- This is a rough number which still could even increase significantly due to rather coarse estimation of the growth of the wood based panels industry in Russia in the next 5 years.

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Overview on adhesives used in the European wood based panels industry (i)

Type of adhesive		Application
UF	urea-formaldehyde resin	<ul style="list-style-type: none"> •Standard PB: P2 according to EN 312 •MDF: type MDF according to EN 622-5 •interior plywood: class 1 according to EN 314 •solid wood panels: according to EN 13353-1
“meUF”	melamine fortified UF-resin	<ul style="list-style-type: none"> •PB and MDF with reduced thickness swelling •for widening the production window •Core board for laminate flooring •Plywood: class 2 according to EN 314
MUF	melamine-urea-resins, in case M(U)F + UF	<ul style="list-style-type: none"> •PB: P3, P5, and P7 according to EN 312 •MDF: type MDF.H and MDF.HLS (EN 622-5) •Plywood: class 3 according to EN 314 •Solid wood panels (EN 13353-2 and -3)
MUPF	melamine-urea-phenol-formaldehyde-resin	<ul style="list-style-type: none"> •PB: P5 and P7, both option 2 •OSB: OSB/3 and OSB/4 (EN 300); mainly in face; also in core in combination with PMDI

Overview on adhesives used in the European wood based panels industry (ii)

Type of adhesive		Application
PF	phenol-formaldehyde-resin	<ul style="list-style-type: none"> • PB: P3, P5, and P7 according to EN 312 • MDF: type MDF.H and MDF.HLS (EN 622-5) • OSB: OSB/3 and OSB/4 (EN 300); core and in face; liquid as well as powder resins • Plywood: class 3 according to EN 314
PUF	phenol-urea-formaldehyde-resin	<ul style="list-style-type: none"> • PB: P3, P5, and P7 according to EN 312

Overview on adhesives used in the European wood based panels industry (iii)

Type of adhesive		Application
PMDI	Polymethylene-diisocyanate	<ul style="list-style-type: none">• PB: P3, P5, and P7 (EN 312); application seldom, but then mainly in core• OSB: OSB/2, OSB/3, and OSB/4 (EN 300); mainly in core, very seldom also in face
Tannins	mainly based on Mimosa	<ul style="list-style-type: none">• Various grades of PB and MDF• only very small amounts, rather in combination with synthetic adhesive resins
lignins	byproduct of the cellulose processing, e.g. lignosulfonates	Not in use as sole adhesive; in case used in very small amounts as additives in the production of PB and MDF

Distribution of the various types of adhesives in the production of PB/MDF/OSB (i)

Resin type	% volume	1000 tons/year
UF (including melUF)	80 – 85	4000 – 4300
MU(P)F	10 – 15	500 – 750
P(U)F		~150
PMDI	1 - 2	60

Distribution of the various types of adhesives in the production of PB/MDF/OSB (ii)

- This distribution might change, if the more stringent limitations in the subsequent formaldehyde emission (**F******) will come into force.
 - Big furniture producers might establish F**** as new state of the art for the board production.
 - Adhesives for the production of the so-called **F**** boards** (JIS A 5908 and JIS A 5905):
 - melamine fortified UF resins
 - phenolic resins
 - PMDI

Advantages and disadvantages of various adhesives used in the production of wood based panels (i)

Property	Type of adhesive			
	UF	MUF	PF	PMDI
Price	<u>low</u>	medium to high	medium	<u>high</u>
Necessary hardening temperature	low	medium	<u>high</u>	low
Press time	<u>short</u>	medium	medium to long	medium
Susceptibility against wood species	high	medium	low	low

Advantages and disadvantages of various adhesives used in the production of wood based panels (ii)

Property	Type of adhesive			
	UF	MUF	PF	PMDI
Efficiency	low	medium to high	medium to high	<u>high</u>
Manipulation	easy	easy	easy	<u>difficult</u>
Resistance against hydrolysis	<u>no</u>	medium to high	<u>high</u>	<u>high</u>
Use in humid conditions	<u>no</u>	partly yes	<u>yes</u>	<u>yes</u>
Formaldehyde emission	<u>E1</u>	E1; E Zero possible	<u>more or less no emission</u>	<u>no</u> (only from wood substance)

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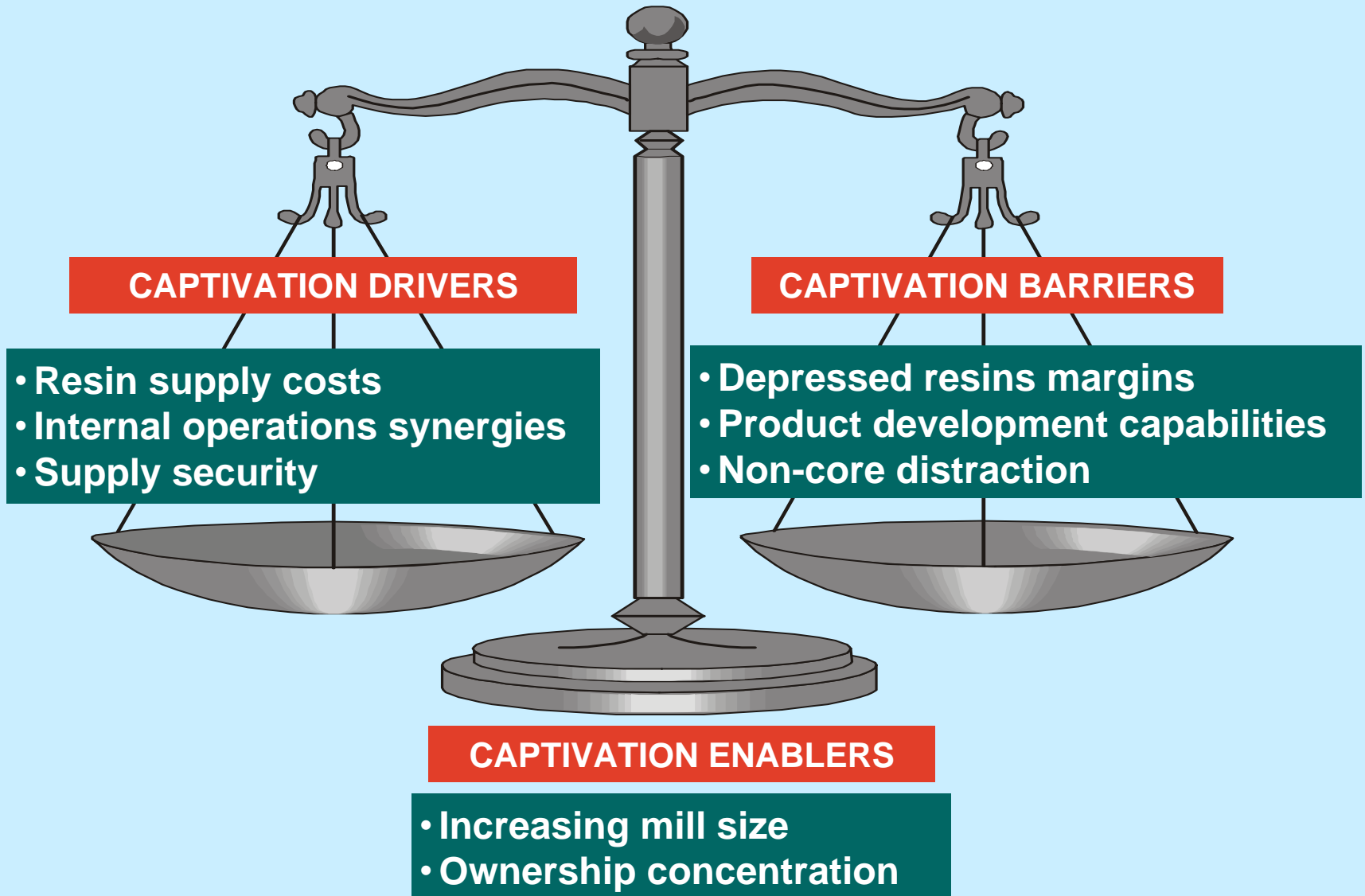
Business drivers in the European wood based panels industry and the European adhesive market (i)

- Situation very different for Europe North and Central Europe.
- The big players in the board production show:
 - high demand on resin volumes
 - but also a high pressure on adhesive prices, based on:
 - their purchasing power
 - the given overcapacity in condensation resins
- Strong competition on the market, due to the existing overcapacity.

Business drivers in the European wood based panels industry and the European adhesive market (ii)

- Partly **captive resin production** of the big board producers:
 - Threat for increased capacities existing, but this trend has rather stopped for the moment
 - Captive resin producers partly offer resins to the open market:
 - volumes/freight optimization
 - still purchasing considerable volumes from the open market (location of captive resin production versus board production).

Motives for and against captive resin production



Russia

- still a unexplored market
- steep possible **increase in board demand** for construction and furniture
- steep **increase in board production**
- New operations mainly started by the **big players** in the European industry (Egger, E.Kaindl, P.Kaindl, Pfleiderer).
- Additionally Russia looks for high input of **European technology**, e.g. in order to completely switch in the subsequent formaldehyde emission from E2 to E1.

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Trends and requirements in the PB/MDF/OSB industry (i)

Trends and requirements	Options	Offered adhesive solution
low cost and cost effective production to survive on the high competition market of wood based panels	<ul style="list-style-type: none">• Increased output of the line by <u>shorter press times</u>• <u>reduction of board density</u> (substantial savings in wood raw material costs)• <u>reducing the portion of off spec material</u>• <u>reduction of the necessary resin consumption</u>	<ul style="list-style-type: none">• <u>high reactive systems</u>, e.g. UF-accelerator hybrid system• <u>flexible resins</u> (systems) for low density boards• <u>optimization of the whole production</u>:<ul style="list-style-type: none">➤ better resin distribution➤ mat preheating systems

Trends and requirements in the PB/MDF/OSB industry (ii)

Trends and requirements	Options	Offered adhesive solution
Strong competition on the board market	<ul style="list-style-type: none">• <u>Cost leader</u> production• Going for <u>specialities</u> and niche markets	<ul style="list-style-type: none">➤ low adhesive prices➤ tailor made adhesives to fulfil special demands of the board producers
building up new capacities in Eastern Europe and Russia	<ul style="list-style-type: none">• jointly moving of resin and board producers to the <u>East</u>• if necessary: board producer will establish captive production	<u>Secure delivery</u> with appropriate adhesives also in more remote regions by building up in case new capacities

Trends and requirements in the PB/MDF/OSB industry (iii)

Trends and requirements	Options	Offered adhesive solution
possible decrease in emission limits in production plants as well as out of the boards themselves	Reduction of the emission mainly by using: <ul style="list-style-type: none">➤ resin systems with low content of formaldehyde➤ formaldehyde free adhesives	Resin systems able for the production of boards with emission distinctly below actual limits <ul style="list-style-type: none">➤ F**** for Japan➤ similar requirements in Europe

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What does the market (the wood based panels industry) ask from the adhesive producers? (i)

- **high and constant resin quality**
- for special applications top performance **tailor made bonding solutions**:
 - low emission boards like F****
 - boards for use in humid conditions
 - Boards with lower thickness swelling
 - fire retardant boards
- for standard products rather **uniform adhesive properties** (similar to products from other suppliers), in order to easily change from one product to the other one without any (bigger) changes in the production conditions

What does the market (the wood based panels industry) ask from the adhesive producers? (ii)

- good and skilled **Technical Service** of the adhesive/resin supplier
- **short response time** and high capability of the resin producers in the development of suitable products for:
 - new requirements
 - occurring problems
- just in time deliveries
- high flexibility in deliveries to compensate for often occurring changes in the board production program

What does the market (the wood based panels industry) ask from the adhesive producers? (iii)

- **access to the European or even global wide experiences of the suppliers:**
 - improvement of their production
 - development of their board portfolio
- **joint projects** between board producers and one of their main adhesive suppliers
- **Special** two or more component **bonding solutions** (including not only the adhesive resin, but also additives plus some special processing technology) are often only interesting for the board producers, if:
 - a clear technical advantage is given
 - at least two suppliers can offer these packages.

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Threats for the adhesive industry? (i)

- **Concentration in ownership** in the customer industry; this, however, also can be an opportunity for the adhesive industry (making bigger contracts, skilled customers)
- **Few big customers**, with partly captive production of resins in so-called megasites
- **Internationalisation and even globalisation** in customer industry, which again can also be an opportunity for global acting adhesive producers in terms of global contracts

Threats for the adhesive industry? (ii)

- **High pressure on efficiency** at customers, need for low cost solutions; strong pressure on adhesive prices
- **No** suitable, quick and sufficient **development of new and improved resins** and adhesive solutions:
 - due to limited resources in research and development as consequence of the given financial pressure
 - missing to gain additional business and Value Add through innovation and development of high margin products.

Threats for the adhesive industry? (iii)

- **missing differentiation** from competitors by lack of innovative adhesive solutions as basis for higher margins
- **customer upstream investments** in the value chain
- **supplier downstream investments** in the value chain
- When going captive customers might **hire experts** out of the adhesive industry.

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Actual requirements of the wood based panels industry in terms of new products

- The actual requirements for the adhesive industry to serve the wood based panels production shall only **shortly summarized** below; this topic will be or has been covered more in detail by other presentations these days:
 - cost effective bonding solutions
 - further decrease in the formaldehyde emission
 - Improved hygroscopic behavior of the produced boards by using fortified and modified resins
 - alternative raw materials and novel bonding solutions.

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Prices of adhesives and influence parameters for prices (i)

Adhesive	% melamine	Price factor	€/ton
UF	---	1	---
Melamine fortified UF	2 – 12	1.3 – 1.7	---
MU(P)F	> 20	2.0 – 2.5	---
P(U)F	---	2.0 – 2.5	---
PMDI	---	---	2000 - 2400

Prices of adhesives and influence parameters for prices (ii)

- **Influence parameters** for formaldehyde condensation **resin prices**:
 - costs for the main raw materials:
 - methanol as raw material for formaldehyde
 - urea, melamine, and phenol
 - can sum up to 70% of the total production costs of the adhesives (including inbound freight).

Prices of adhesives and influence parameters for prices (ii)

- **Raw material prices:**
 - partly linked to the price of crude oil and natural gas
 - partly linked to the production capacity and the actual demand
- Methanol and melamine are raw materials traded on global basis, so also influences from various continents can be seen in Europe.

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Outlook

- The overall situation for the European wood adhesive industry is by sure not easy, but a **high commitment** is given:
 - to serve the wood based panels industry with **state of the art products**
 - to support them in the application of these products and the optimization of the board production process.
- **The close link between these two industries is the best basis for a successful future even under sometimes difficult frame conditions.**



**Thank You for
Your attention!**