



# Leadership built on unique strengths

Information Day 2013 – A Deep Dive into the LC&OLED Business

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**Merck KGaA**

**Darmstadt · Germany**

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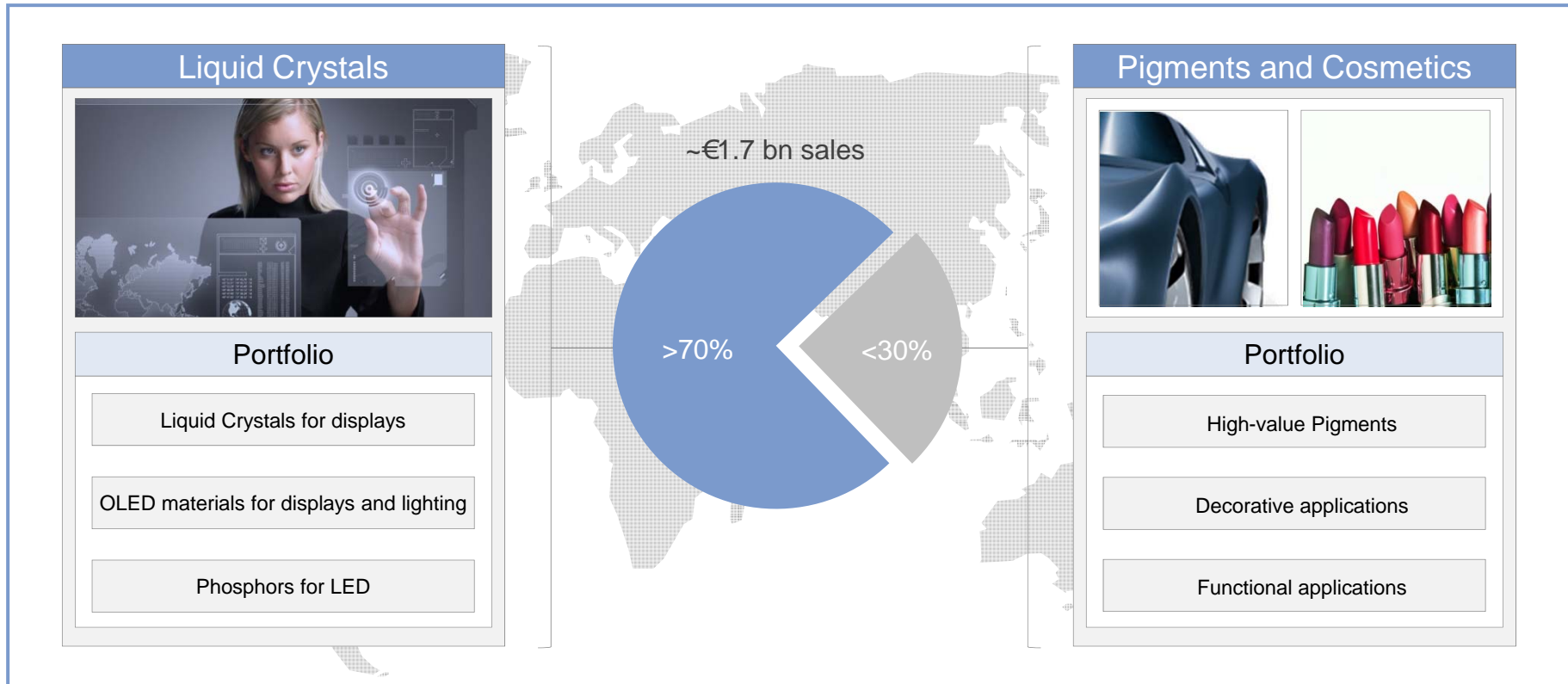
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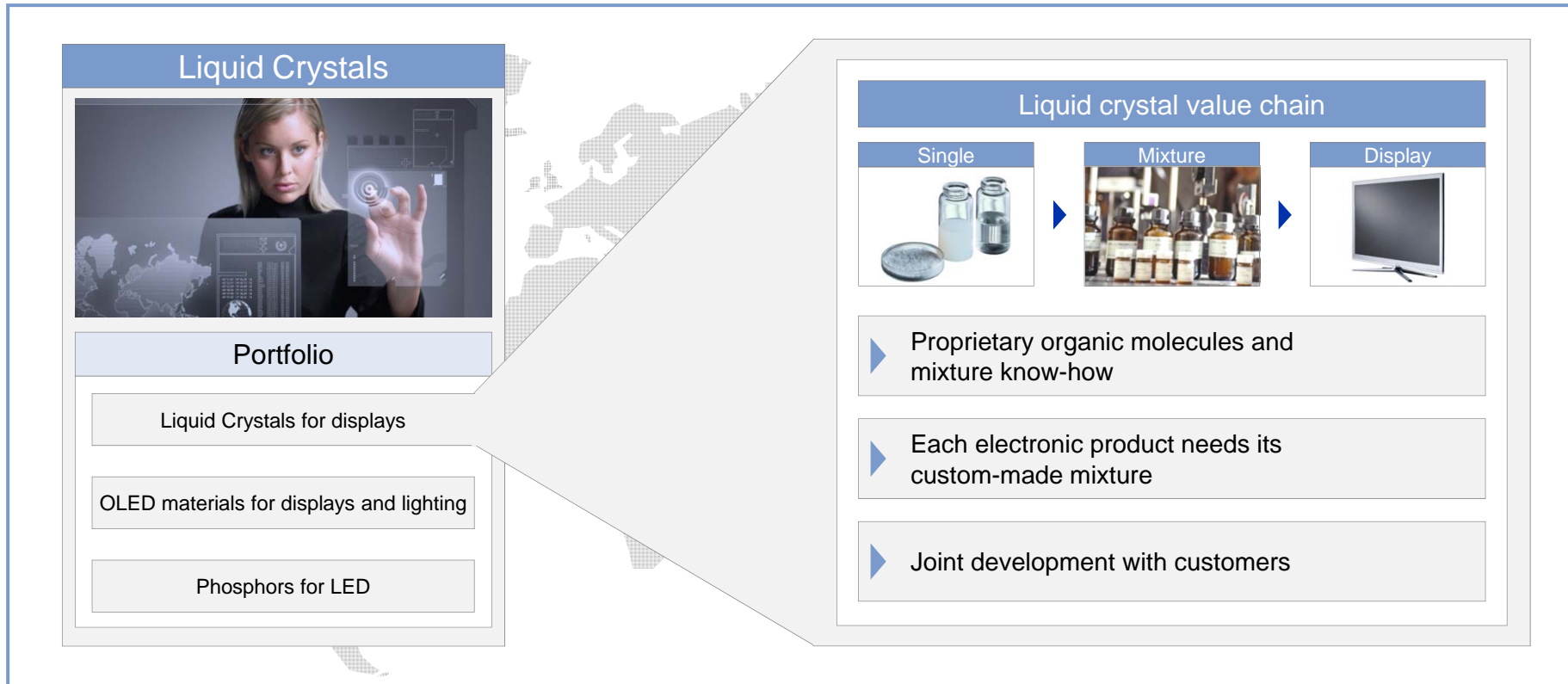
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# Liquid crystals are the largest part and key driver of Performance Materials



# Liquid crystals are a mixture made of several singles and a critical display component



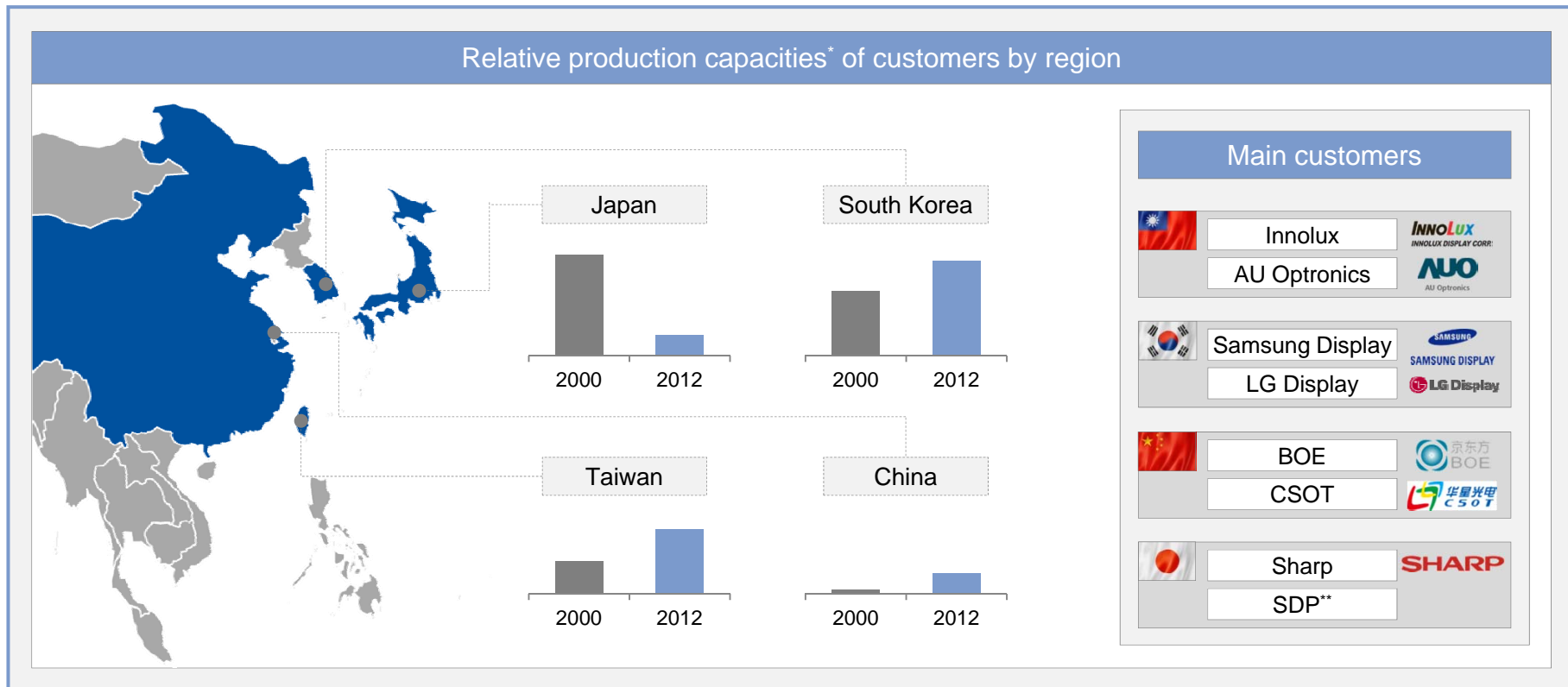
# Liquid Crystals stand apart from typical players in the chemical industry

<b>Bulk chemicals</b>	Companies Players like BASF**, Bayer Materials Science, Dow	Volumes kt	Margins* 10-15%
<b>Specialty chemicals</b>	Companies Companies like DSM, Evonik, AkzoNobel, DuPont	Volumes t	Margins* 15-20%
<b>High value added chemicals</b>	Companies Specialty chemicals firms like Symrise, Givaudan, Croda	Volumes kg	Margins* 20-30%
	Companies €bn business with small volumes at high value per gram and decisive function for customer	Volumes g	Margins* Premium
<b>Our chemical activities are the exact opposite of bulk</b>			



\*On EBITDA \*\*BASF without Oil and Gas

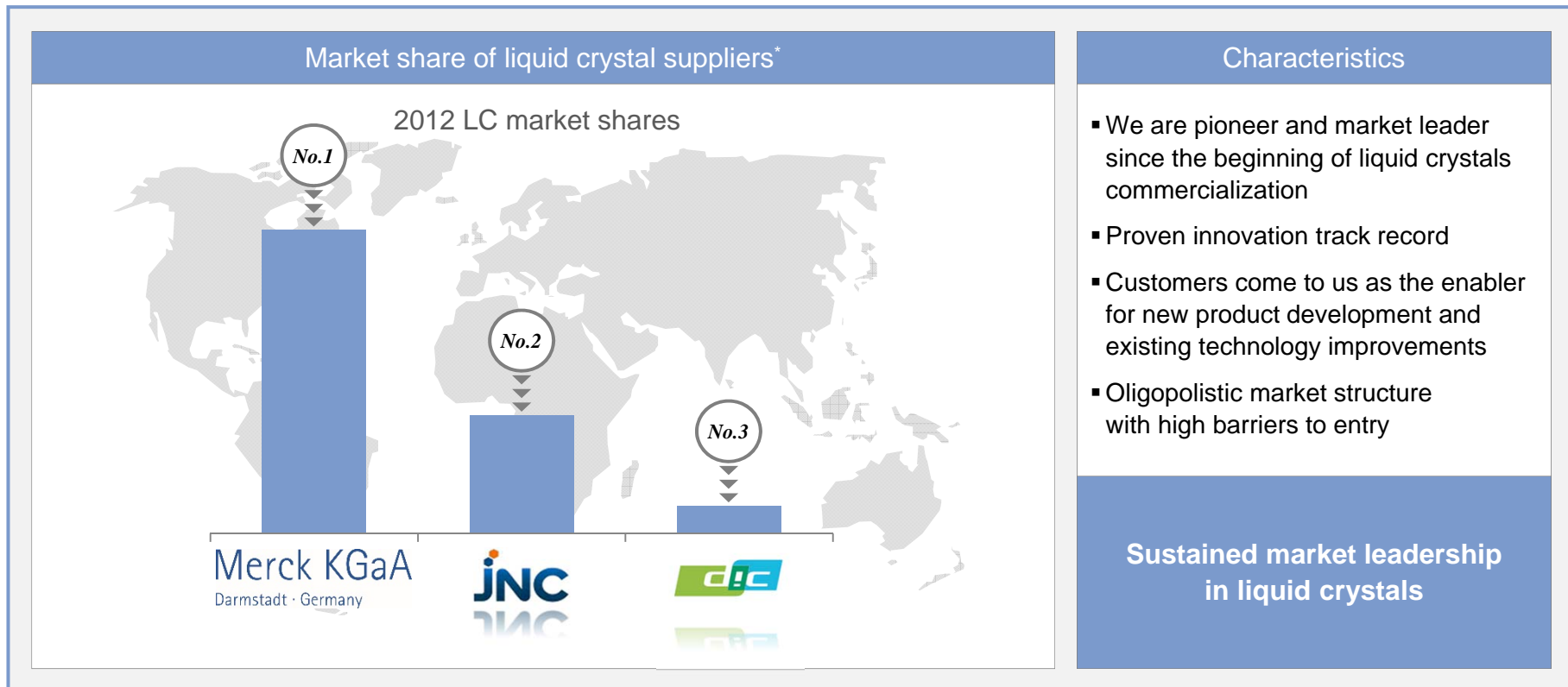
# Our customers, panel and set makers alike, are based in Asia



\*DisplaySearch 2013 \*\*Sakai Display Products







# We are THE innovation leader in the highly consolidated liquid crystals market



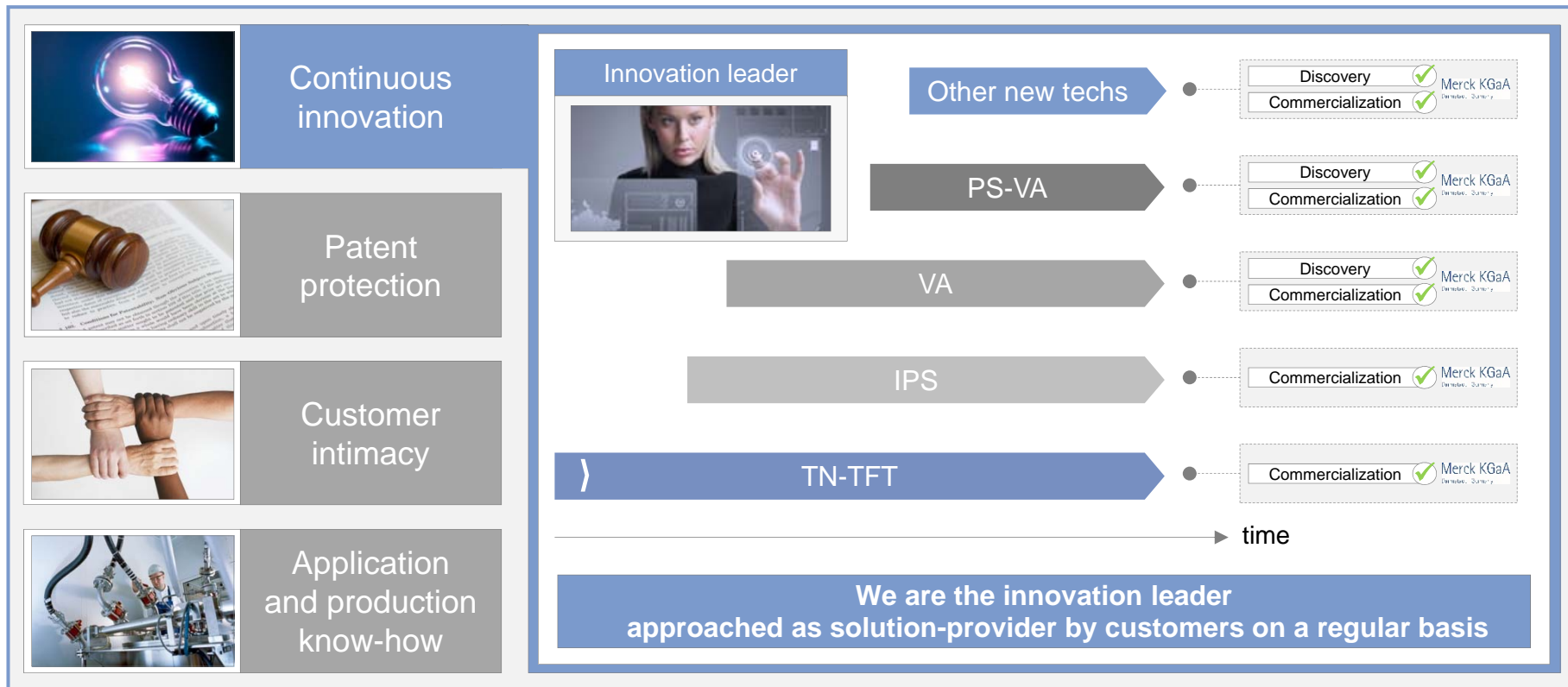
\*Merck KGaA, Darmstadt, Germany research



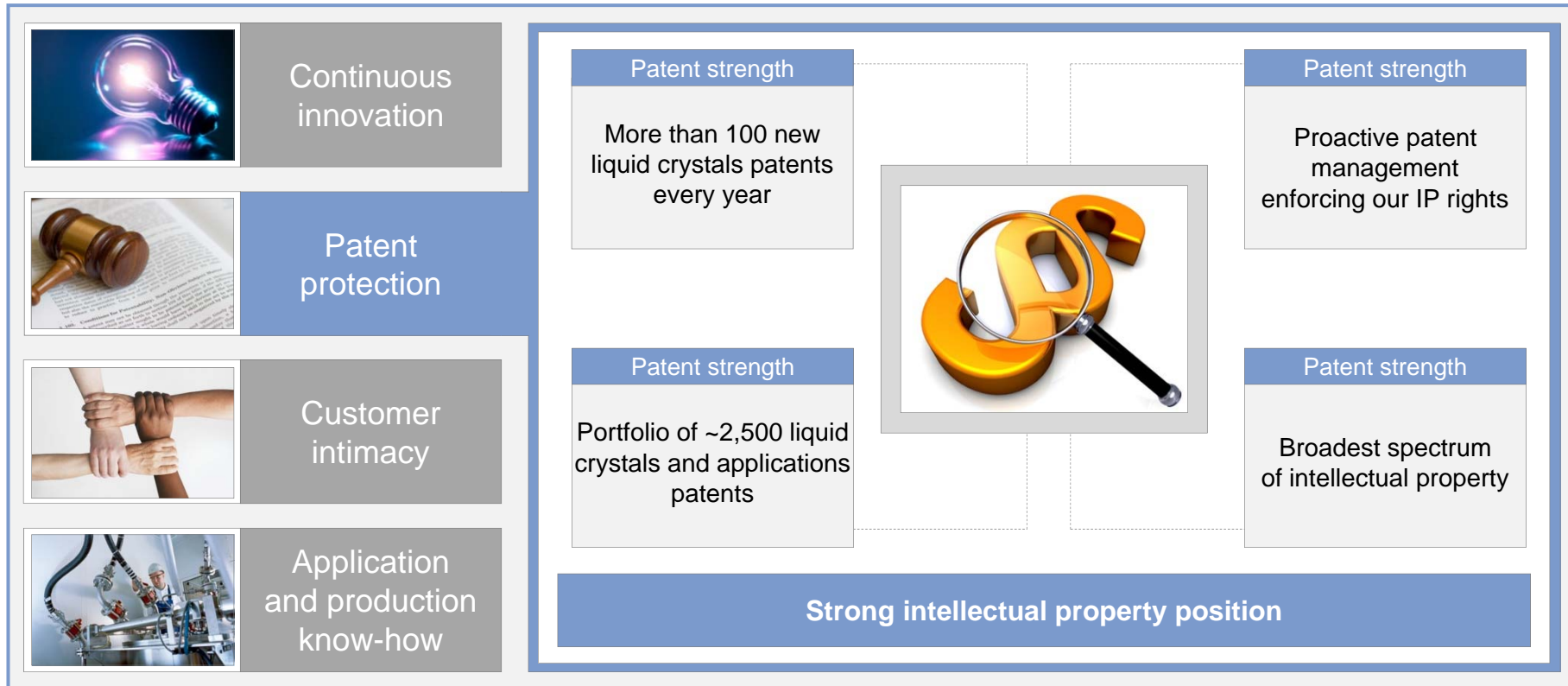
# The liquid crystals market boasts high barriers to entry with sophisticated requirements

	Continuous innovation	<ul style="list-style-type: none"><li>▪ Increasingly shorter life cycles in consumer electronics require continuous innovation</li><li>▪ Customers constantly need and expect new formulations to differentiate against competitors</li></ul>
	Patent protection	<ul style="list-style-type: none"><li>▪ Know-how and intellectual property driven market</li><li>▪ Patents determine competitive advantages like product quality and exclusivity</li></ul>
	Customer intimacy	<ul style="list-style-type: none"><li>▪ Suppliers need customers' trust to identify future innovation needs and potentials</li><li>▪ Products customized to fit clients' specific requirements</li></ul>
	Application and production know-how	<ul style="list-style-type: none"><li>▪ Ultra-high quality standards: one part in a billion impurity can lead to display defects</li><li>▪ Modern, highly efficient and flexible production technologies required</li></ul>





# We are the enabler of ALL key display technologies in the last decades





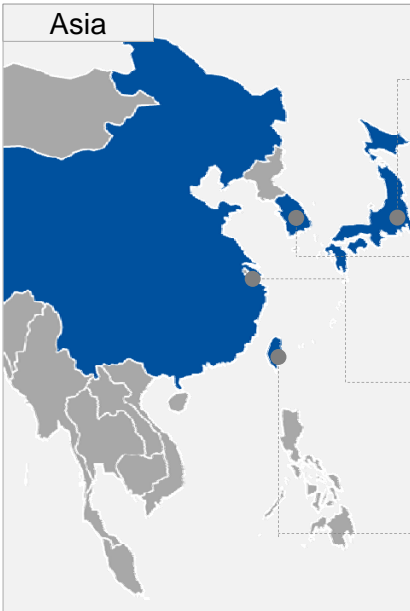












# Leadership in liquid crystals IP



# We are the only player with complete geographic coverage of its customers

	Continuous innovation
	Patent protection
	Customer intimacy
	Application and production know-how

Europe	Asia																								
 <p> <b>The Group</b> Single production</p>	 <table border="1"><tr><td></td><td>Sharp</td></tr><tr><td></td><td>SDP</td></tr><tr><td></td><td><b>Group's presence</b></td></tr><tr><td></td><td>Samsung</td></tr><tr><td></td><td>LG Display</td></tr><tr><td></td><td><b>Group's presence</b></td></tr><tr><td></td><td>BOE</td></tr><tr><td></td><td>CSOT</td></tr><tr><td></td><td><b>Group's presence</b></td></tr><tr><td></td><td>Innolux</td></tr><tr><td></td><td>AUO</td></tr><tr><td></td><td><b>Group's presence</b></td></tr></table>		Sharp		SDP		<b>Group's presence</b>		Samsung		LG Display		<b>Group's presence</b>		BOE		CSOT		<b>Group's presence</b>		Innolux		AUO		<b>Group's presence</b>
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**Customer proximity - at the front door of each key customer**

# We run premium multi-purpose production facilities including largest plant globally



Continuous innovation



Patent protection



Customer intimacy



Application and production know-how



- Multi-purpose and multi-product small to large-scale production facilities for liquid crystals, active pharmaceutical ingredients and specialties
- Production cost leadership by high flexibility of production assets
- Applied technology leadership, e.g. micro-reaction technology in industrial scale for process intensification and improved sustainability
- Advanced capability to develop and perform highly complex multi-step organic synthesis with minimum time-to-market
- Best in class for quality and reliability in customer application

Leading in expertise and scale

# We fulfill all requirements for sustained leadership in a sophisticated market

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Continuous innovation



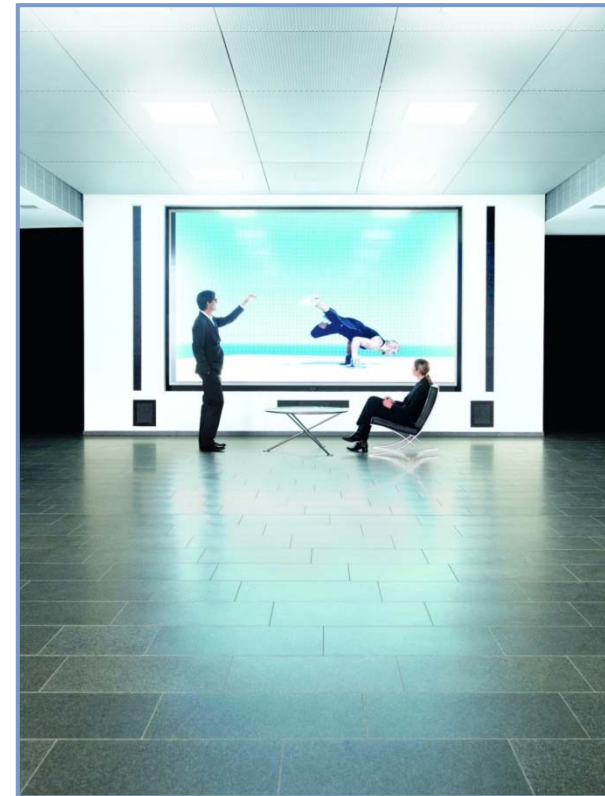
Patent protection



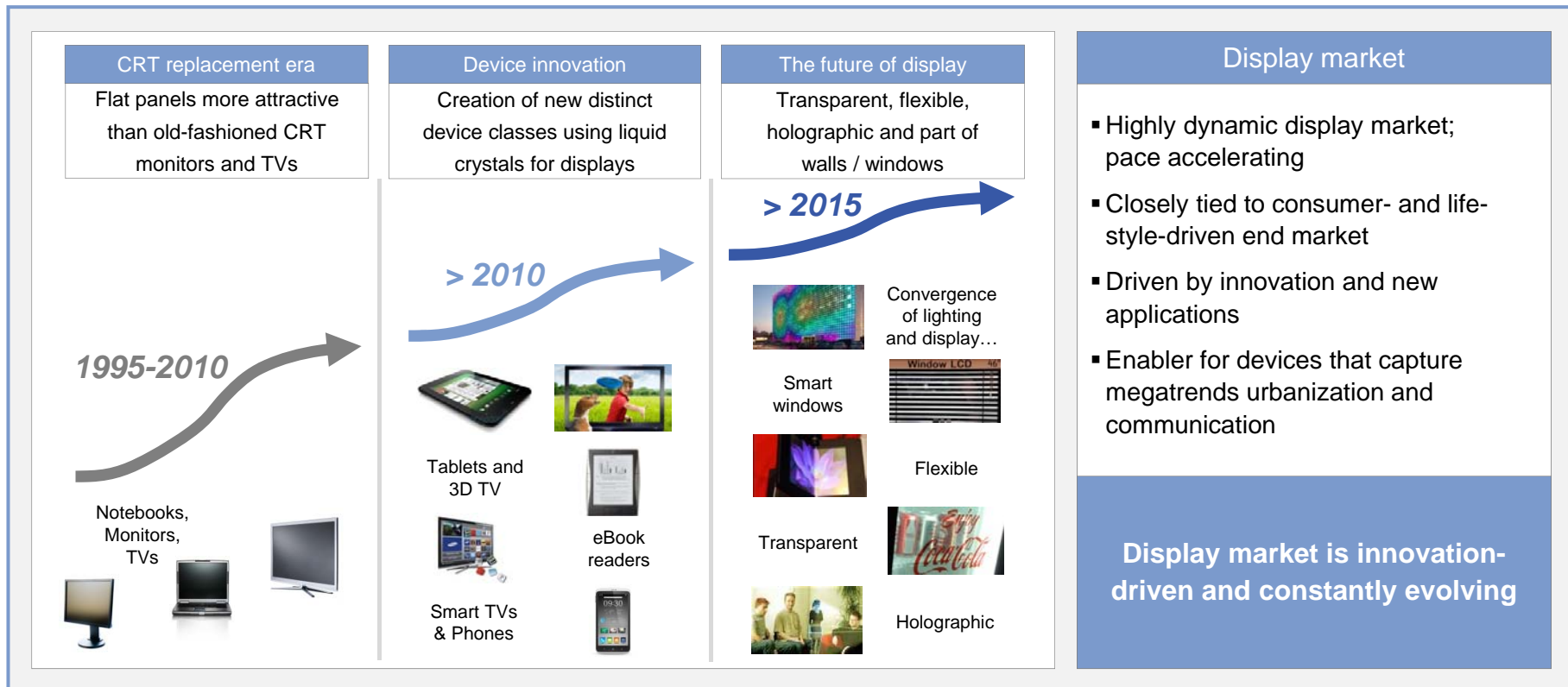
Customer intimacy



Application and  
production know-how

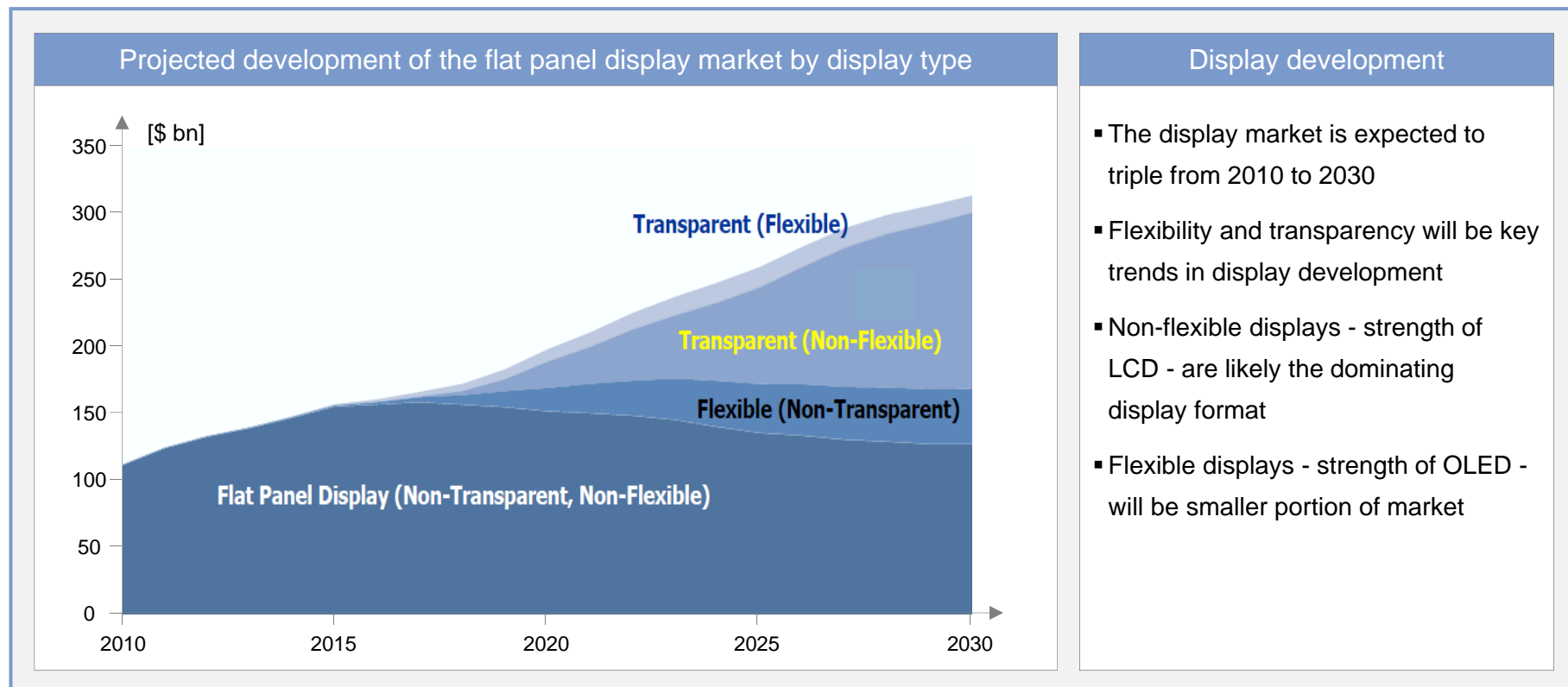


# Chemical molecules tend to find their applications – evolution and expansion of a new market









# Displays with new features will drive market growth and extend the current range of display types

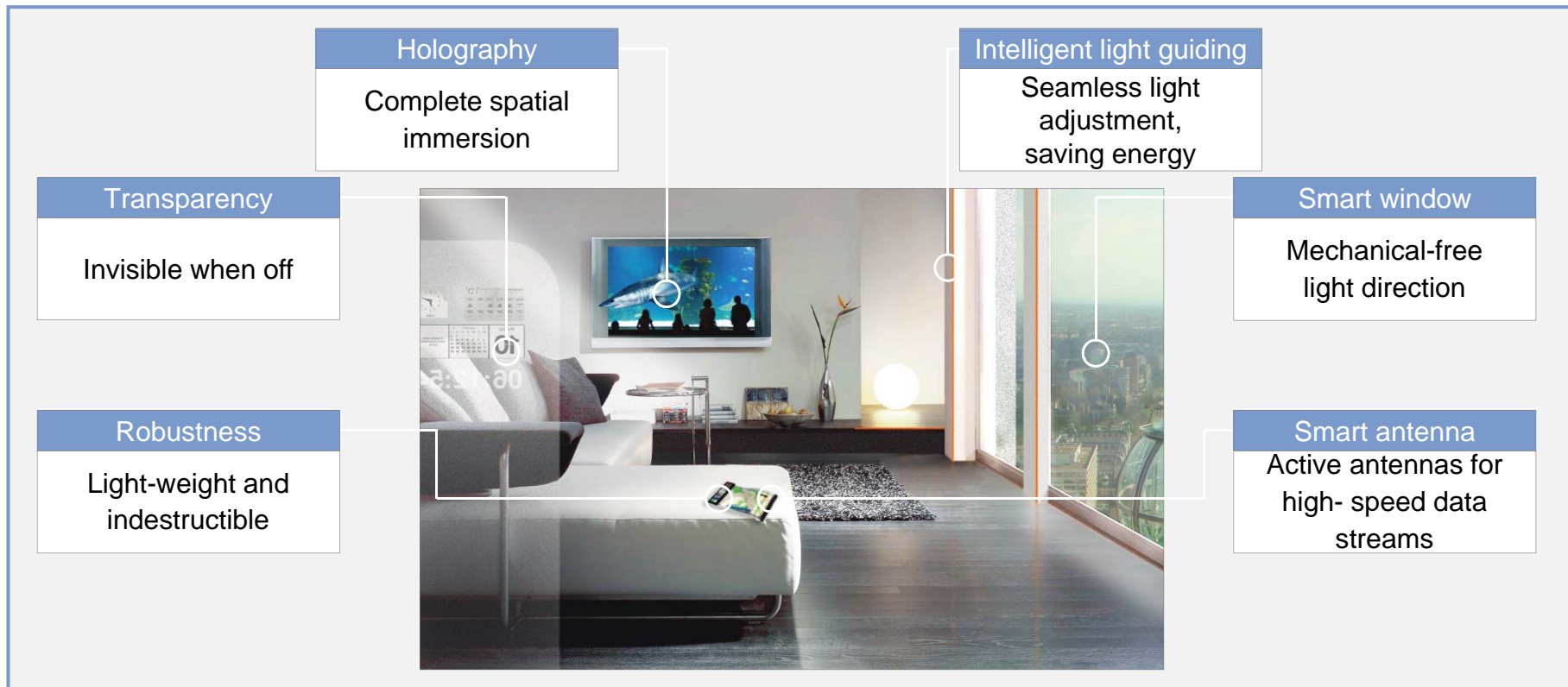


Source: "Transparent Display Technology and Market Forecast", Displaybank, Apr. 2011

# Current trends and customer needs continue to drive growth and innovation

Trend		Impact on the company
<b>3D TVs</b> 	<ul style="list-style-type: none"> <li>▪ Special display materials for cinema-type 3D experience</li> <li>▪ Replacement of older TVs</li> </ul>	<ul style="list-style-type: none"> <li>↳ Liquid crystal volumes</li> <li>↳ Reactive mesogens</li> </ul>
<b>Display resolution (4K2K/UHD)</b> 	<ul style="list-style-type: none"> <li>▪ Larger displays need higher amounts of liquid crystals, from &lt;40" to 80" to 110"</li> <li>▪ PS-VA for high-transmission liquid crystals</li> </ul>	<ul style="list-style-type: none"> <li>↳ Liquid crystal volumes</li> <li>↳ Especially PS-VA</li> </ul>
<b>Tablets, smart-phones</b> 	<ul style="list-style-type: none"> <li>▪ Strong end-consumer demand for new devices accelerating the replacement cycle</li> </ul>	<ul style="list-style-type: none"> <li>↳ Liquid crystal volumes</li> <li>↳ LCs for high resolution</li> </ul>
<b>Smart TVs</b> 	<ul style="list-style-type: none"> <li>▪ Replacement of older TV sets with internet connected devices offering more services and better human interfacing</li> </ul>	<ul style="list-style-type: none"> <li>↳ Liquid crystal volumes</li> </ul>

# The next innovation step – applications beyond displays



Picture source: Sign Kommunikation GmbH

# Liquid crystal-based smart window: A unique way to realize energy efficiency and aesthetic facades

## Smart windows

Window normal state



Window set to dark



## The idea

- Unique autonomous switchable window based on liquid crystals and dyes
- Fast switching capabilities from bright to dark
- Color tunable
- Increasing demand for energy saving through light control

Creation of a large area application using high quality liquid crystals

# Our leadership in Liquid Crystals is built on unique strengths

<b>Market position</b>	Leading market position in attractive high-margin market
<b>Future potential</b>	Consumer needs and consumer trends drive future demand
<b>Innovation</b>	We have a proven track record of innovation and commercialization
<b>Pipeline</b>	Broad and full pipeline of future technologies and applications



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