

The Decorative and Functional Finishing Possibilities of UV-Curable Powder Coatings



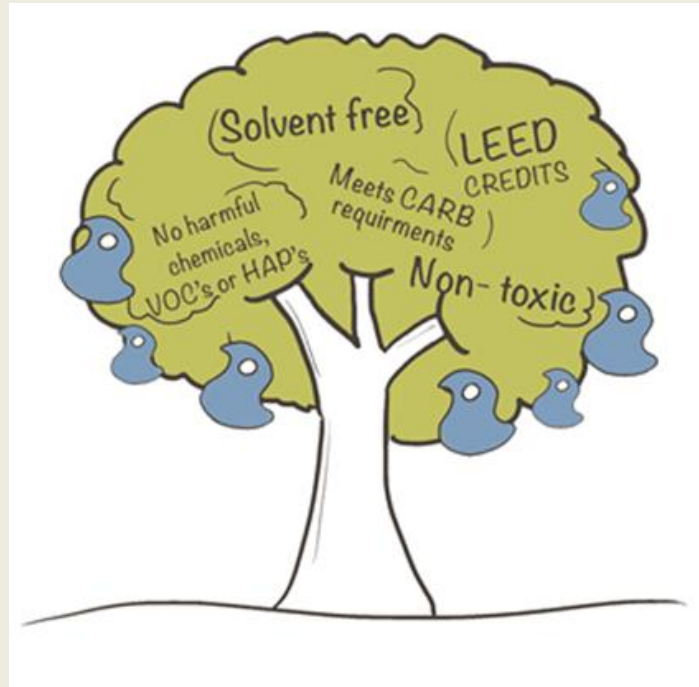
RADTECH 2014
ROSEMONT, IL

MICHAEL KNOBLAUCH
DVUV HOLDINGS, LLC
DVUV, LLC
KEYLAND POLYMER, LLC
DVUVSYSTEMS, LLC

UV-Cured Powder Coating

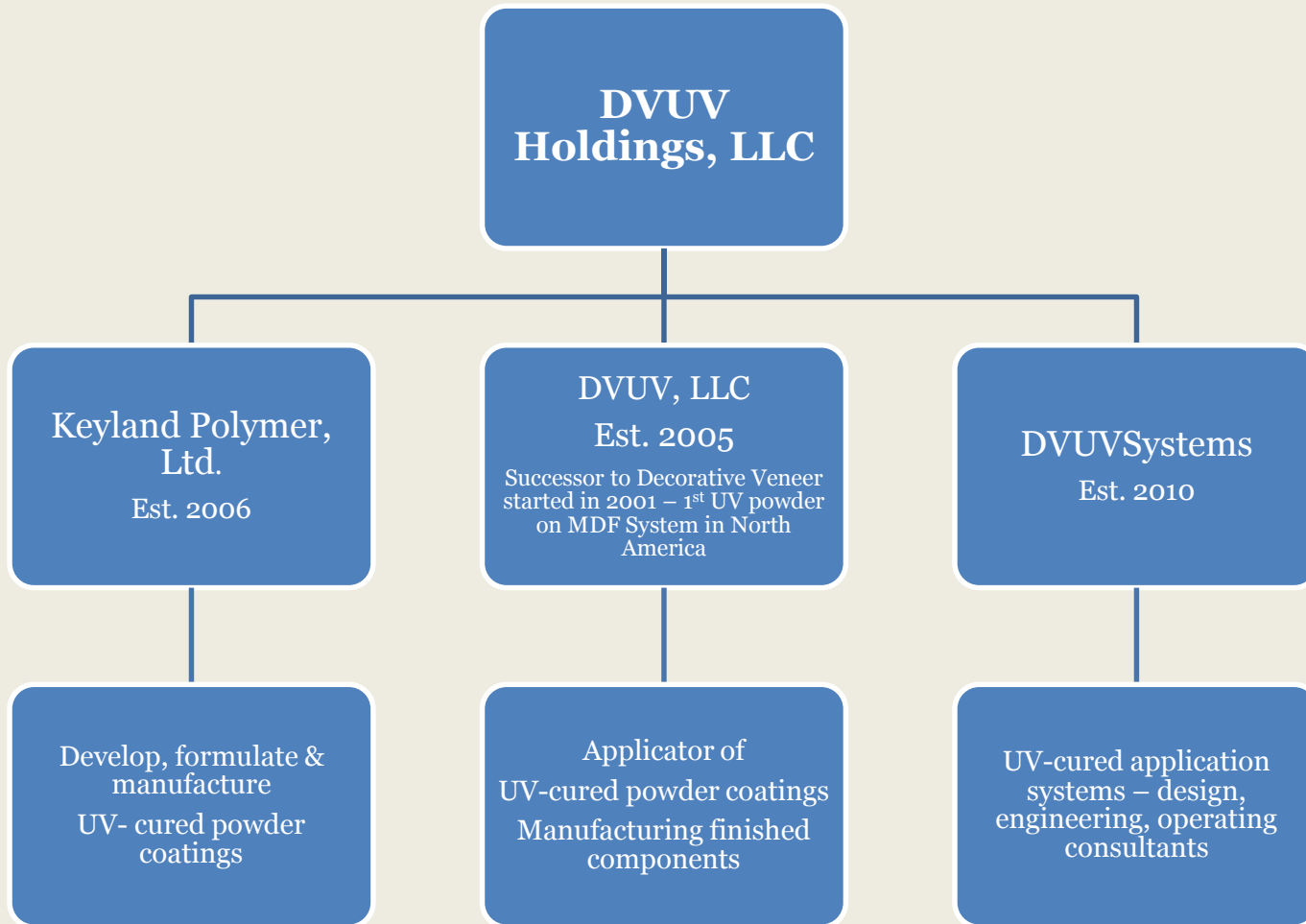
Clean

Fast



Green

DVUV Holdings, LLC



Presentation

Global Market & Industry Overview
Industrial Trends
About UV-Curable Powder Coating
Performance Characteristics
Operational Efficiencies & Cost Analysis
Sustainability
Future of UV Powder
Conclusion & Questions

UV-Curable Powder Coating



GLOBAL MARKET & INDUSTRY OVERVIEW

Global Market Perspective

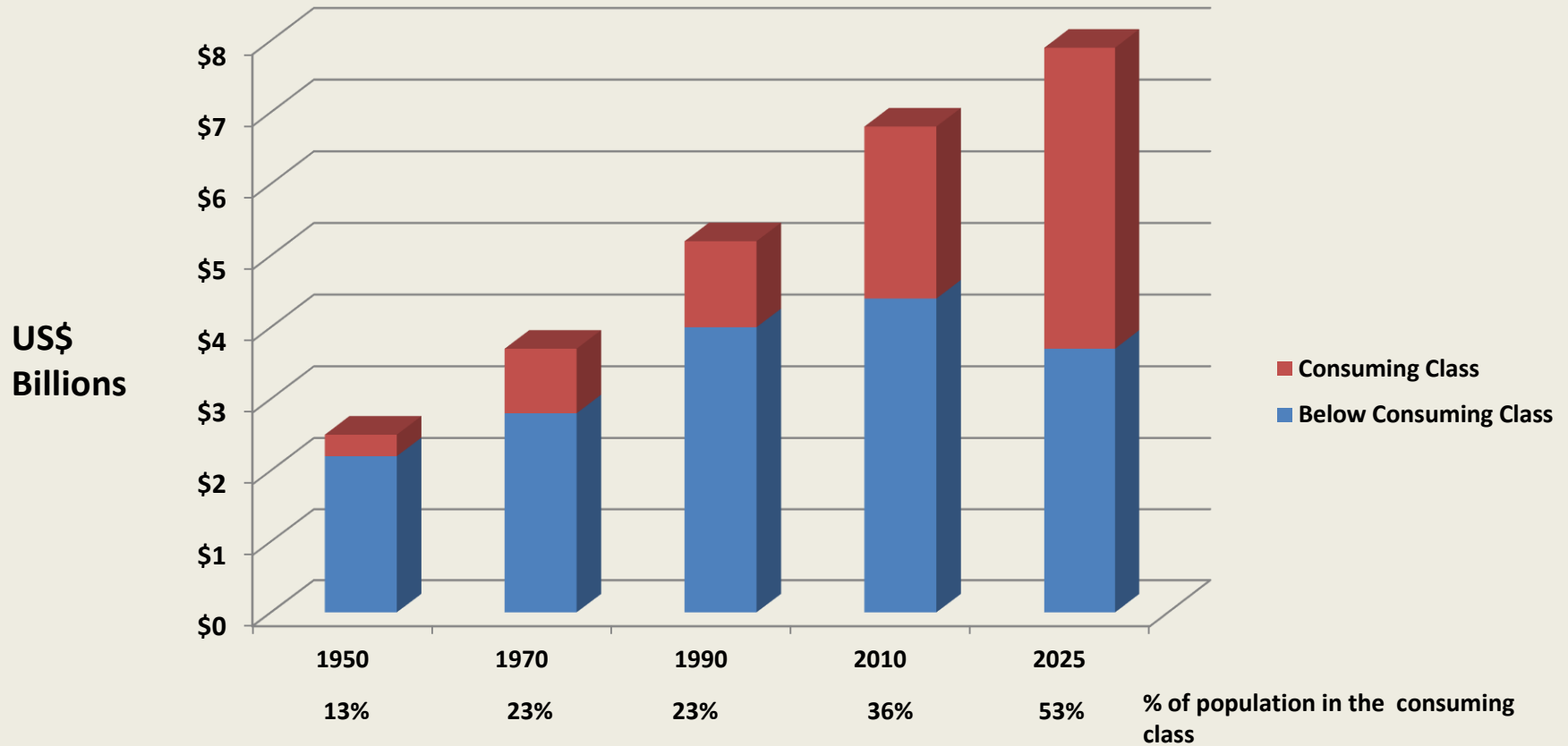
- Global population 2012 6 billion - 2030 7.4 billion¹
- 3 Billion more middle class consumers by 2030¹
- 2012 global motor vehicle production – 51.7 million units²
- 2030 estimated global motor vehicle production – 80.6 million units³
- Energy demand to increase by 420 quadrillion BTUs 2010 - 2030¹
- Convergence of sources and diversity of energy mix
fossil – biofuel – renewables – nuclear⁴

Global Market Perspective

- Global policies to reduce carbon emissions
 - By 2030 a 42% reduction of carbon as a % of GDP
 - By 2030 stabilizing carbon at 450ppm⁴
- Global growth 2012 – 2016 advanced economies – 1.1% to 3.0%⁵
- Global growth 2017 – 2025 advanced economies – 1.3% to 2.6%⁵
- Global growth 2012 – 2016 developing economies – 3.6% to 6.5%⁵
- Global growth 2017 – 2025 developing economies – 2.8% to 4.3%⁵

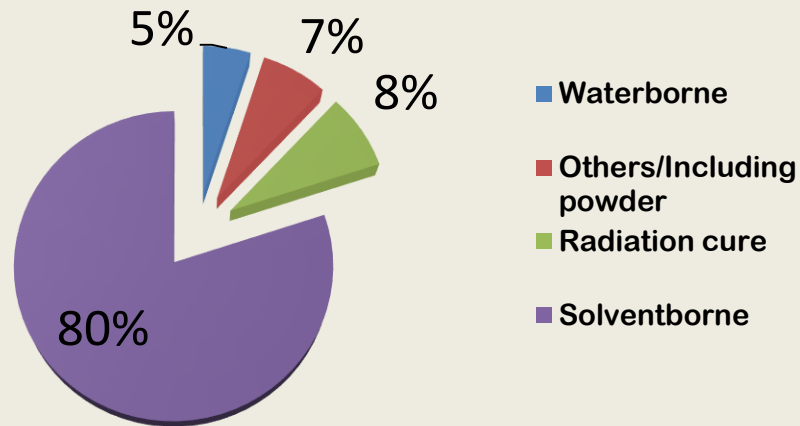
1. McKinsey Global Institute : Resource Revolution: Meeting the world's energy, materials, food and water needs. 2011
2. Robert W. Baird & Co.: Global Auto & Truck Markets – March 2012
3. Autelligence: Megatrends in the global auto industry to 2030: 2010
4. BP Energy Outlook 2030: 2011
5. www.conference-board.org/data/globaloutlook.cfm

Growth in Emerging Markets



McKinsey&Company

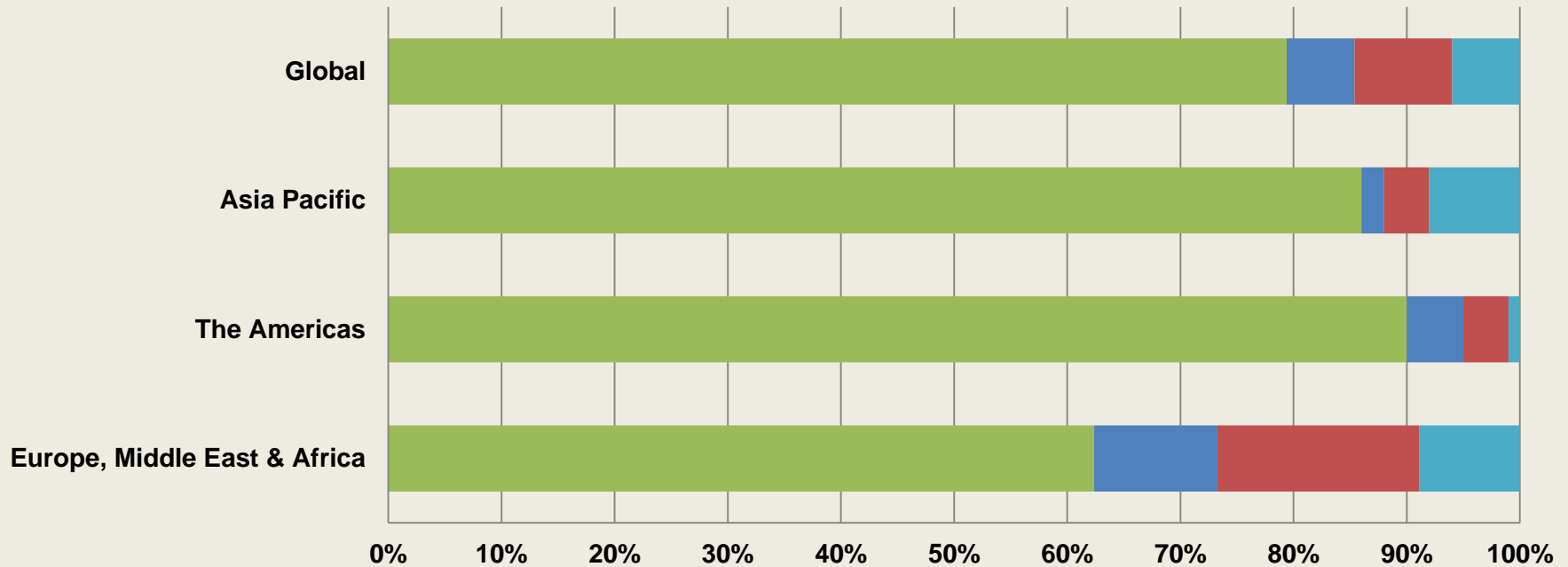
Coating Industry Today



- Paints and coatings market*
 - Global coatings market demand 80 billion pounds - US\$120 billion 2013 and will grow to 102 billion pounds – US\$150 billion in 2018
 - Solventborne & solvent containing liquid coatings 88% by value & 92.7% by volume 2013
 - Projected global growth rate of 5% through 2018
- UV-curable coating market as a segment of the global market*
 - 2.5% by value & 0.88% by volume - 2013
 - 2.73% by value & 0.83% by volume - 2018

* APCJ , April 2014

Global Market by Product



	Europe, Middle East & Africa	The Americas	Asia Pacific	Global
■ Solventborne	63%	90%	86%	80%
■ Waterborne	11%	5%	2%	6%
■ Radiation cure	18%	4%	4%	9%
■ Others	9%	1%	8%	6%

Coating Industry Tomorrow

UV-Curable coating technology is increasingly being seen as the future technology in the area of industrial coatings. The technology represents one of the rapidly growing segments in the coatings industry, and is arguably emerging as the answer to the rising environmental concerns and stringent regulations. Several application related advantages come to serve the technology that include absence of pot life issues, lower energy costs, fast cure speed, and reduced environmental impact.

As such, one-component UV-Curable coating ranks among the fastest coating chemistries available in the present context. Curing takes a few seconds to a few minutes, which makes it more ideal for use in applications that require faster turnaround time.

Industrial Trends



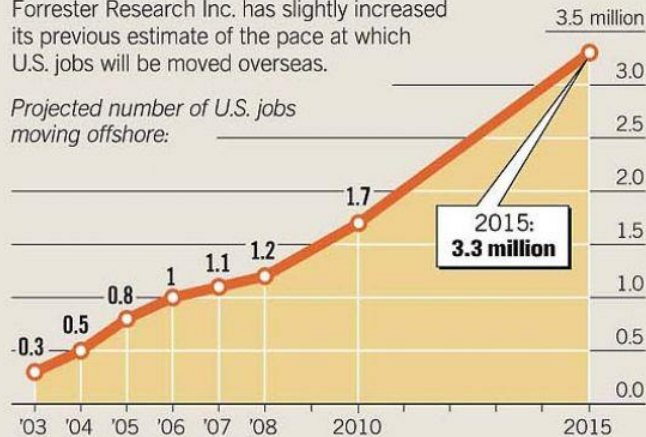
OFF-SHORING
RE-SHORING
NEAR-SHORING
NEXT-SHORING

Off-Shoring * Re-Shoring * Near-Shoring

Revised estimate of U.S. jobs offshored

Forrester Research Inc. has slightly increased its previous estimate of the pace at which U.S. jobs will be moved overseas.

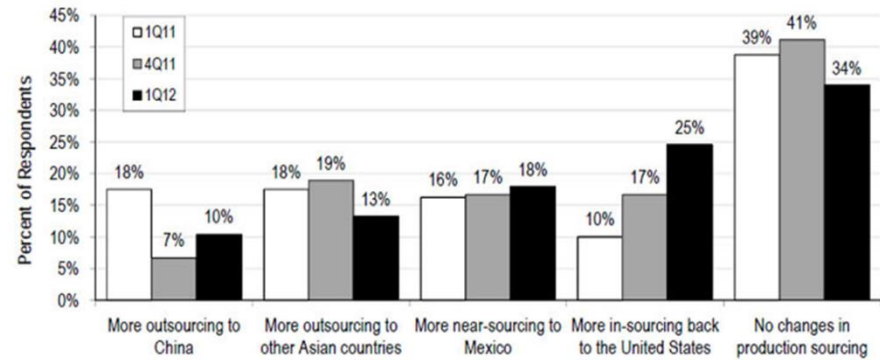
Projected number of U.S. jobs moving offshore:



Source: Bureau of Labor Statistics; Forrester Research Inc.

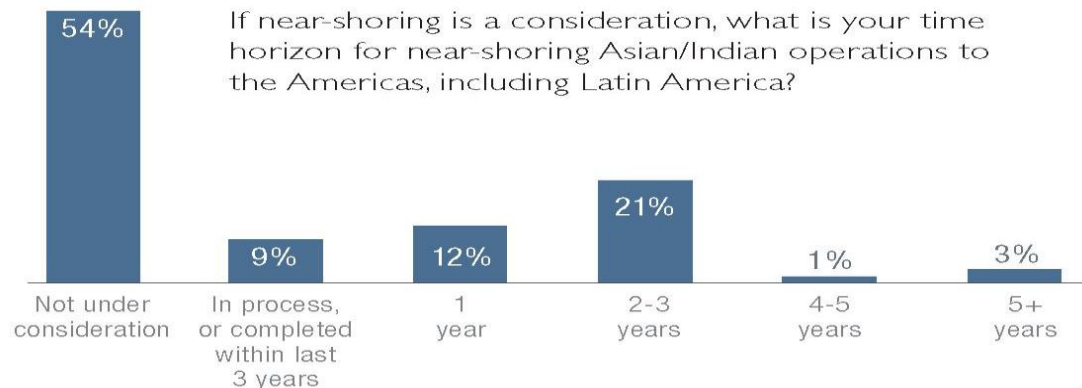
Chronicle Graphic

Exhibit 11. What Change in Production Sourcing Do You Expect for Your Company Over the Next Five Years?



Source: Wolfe Trahan & Co.

FIGURE I: Timelines for Near-Shoring Plans



If near-shoring is a consideration, what is your time horizon for near-shoring Asian/Indian operations to the Americas, including Latin America?

Next-Shoring

“A next-shoring perspective emphasizes proximity to demand and proximity to innovation. Both are crucial in a world where evolving demand from new markets places a premium on the ability to adapt products to different regions and where emerging technologies that could disrupt costs and processes are making new supply ecosystems a differentiator. Next-shoring strategies encompass elements such as a diverse and agile set of production locations, a rich network of innovation-oriented partnerships, and a strong focus on technical skills.”

Poll

- ***Where will manufacturing facilities be located five years from today?***
- About the same distance from customers 7%
- Further away 10%
- ***Closer to customers 83%***

McKinsey&Company

UV-Curable Powder Coating



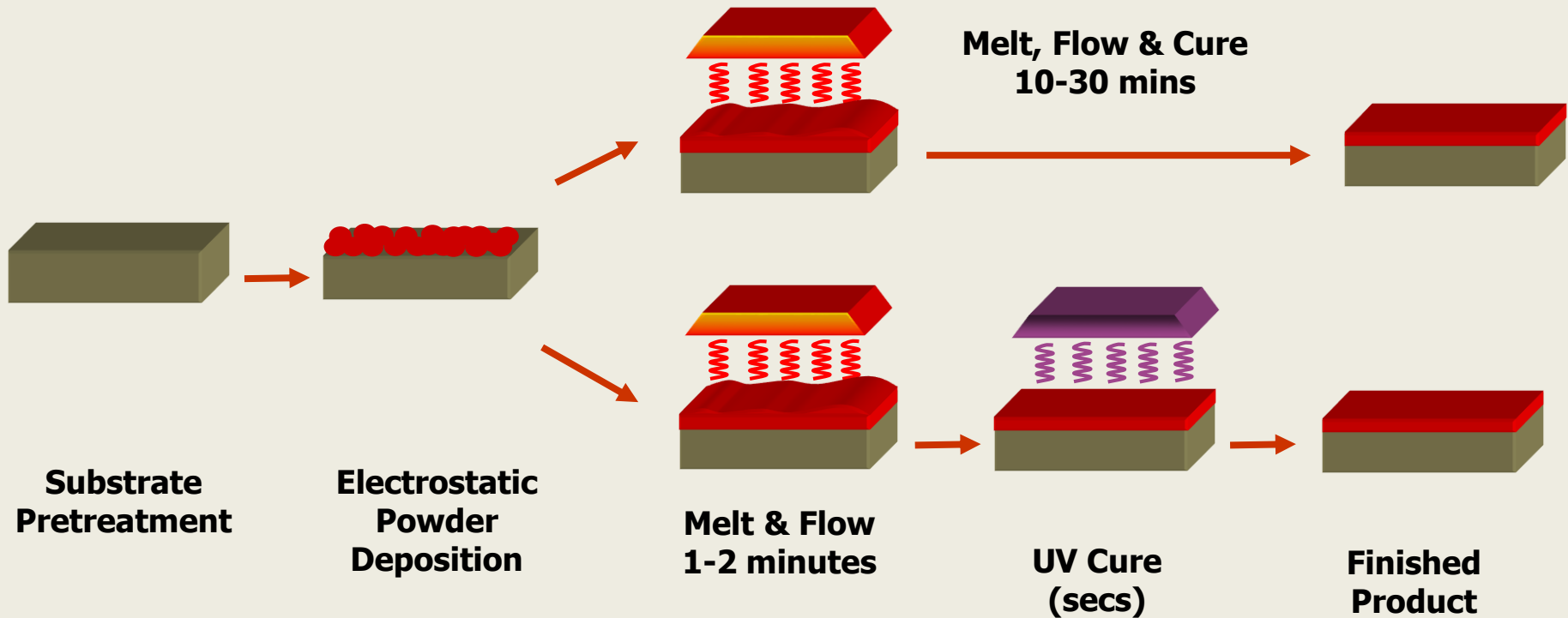
ABOUT UV-CURABLE POWDER COATING

Powder Coating

- Thermoset or thermally cured powder coatings were developed in the 1960s as functional coatings and have been adapted and developed for a variety of applications
 - Powder coatings give superior wear resistance, barrier properties, and cost effectiveness
 - Products include home appliances, industrial equipment, automotive primer, top coat
 - Powder coatings have no volatile organic compounds (VOCs), or hazardous air particulates (HAPs).
 - Metal substrates are ideal for electrostatic powder application
 - Thermal cure cycle for powder coating ranges from 20 to 60 minutes depending on chemistry and part geometry

UV Powder Coating

- The differentiating characteristic of UV-curable powder coating is the separation of melt & flow from cure



UV-Curable Powder Coating

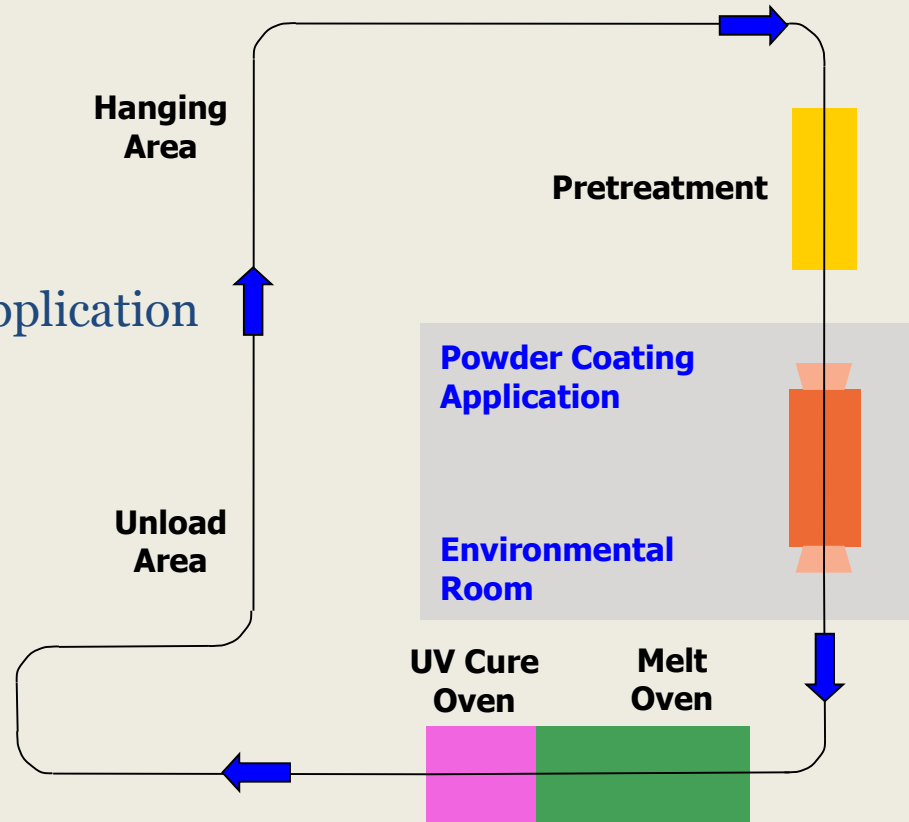
- 1998 – 2000s: 1st commercial applications in U.S.
 - Automotive radiator
 - Industrial motor
- 2001: Decorative Veneer built the 1st UV-curable powder coating facility for MDF in Plainwell, MI USA, followed by RADEX in London, Ontario Canada
- 2005: DVUV formed > 1 million square meters of finished product in global market
 - Key markets: Retail – Healthcare – Education & Office furniture – specialty applications
- 2006: Keyland Polymer, Ltd. formed to develop, formulate, and manufacture UV-curable powder coatings for DVUV and other customers
- Other UV-cured powder systems
 - Ecofia-Surfatech, Montpellier, France
 - Silap, Vimercate, Italy

Small Manufacturing Footprint

- UV-Powder system

1. Hanging
2. Pretreatment
3. Electrostatic powder application
4. Flow/Melt oven
5. UV Cure oven
6. Unload & inspect

200 foot line – cycle 20 minutes
2400 square feet of plant floor



Video

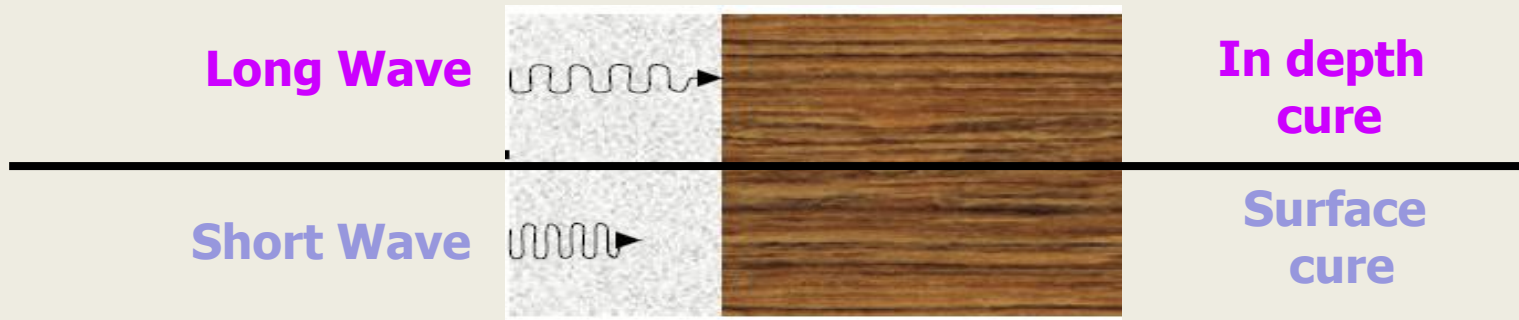


UV Powder Chemical Composition

Resin – Unsaturated	60 – 95 wt %
Photo Initiator	0.5 – 3.0 wt %
Surface and Depth	
Flow Control Agent	0.5 – 2.0 wt %
Degassing	0.5 – 4.0 wt %
Pigments	0.1 – 20 wt %
Filler/Extender	0 – 35 wt %
Additives	0.25 – 1 wt %

UV Curing Parameters

- **Intensity** - Power or density of UV energy
 - Typical 1000 - 3000 mW/cm² UV V
 - Ideal conditions - high intensity over short time
- **Exposure** - Total energy received at coating surface
 - Typical 1000 - 3000 mJ/cm² UV V
 - Intensity (mW/cm²) X time (secs) = Exposure (mJ/cm²)
- **UV Spectrum** required for different applications
 - Clear/Tints -Mercury
 - Opaque - Iron additive and Gallium additive Mercury



LED Curing



Application Process Advantages

- Powder Coating Advantages
 - Easier to blend, process and control during application
 - Easy to clean up with an industrial vacuum
- Powder coatings can be reclaimed and re-sprayed yielding up to 98% material utilization or sprayed to waste
- Color changes do not require any purging materials or solvents and can be accomplished in minutes



Finishes and Color Matching



Multi- Component



Metallic



**RAL – Pantone – PMS
systems**



Heavy Pigment Load

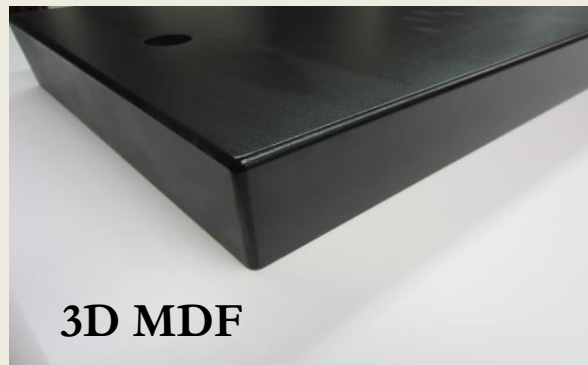
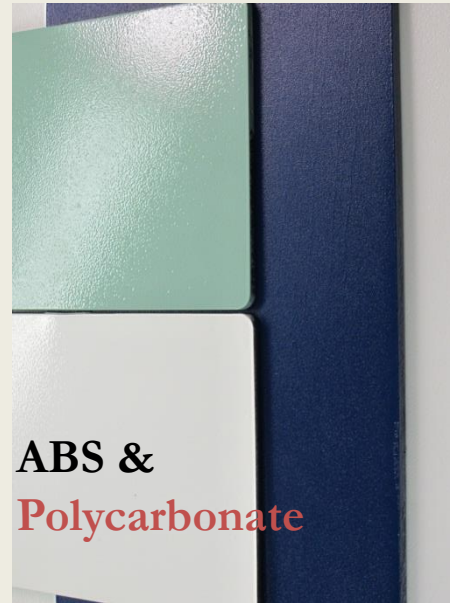
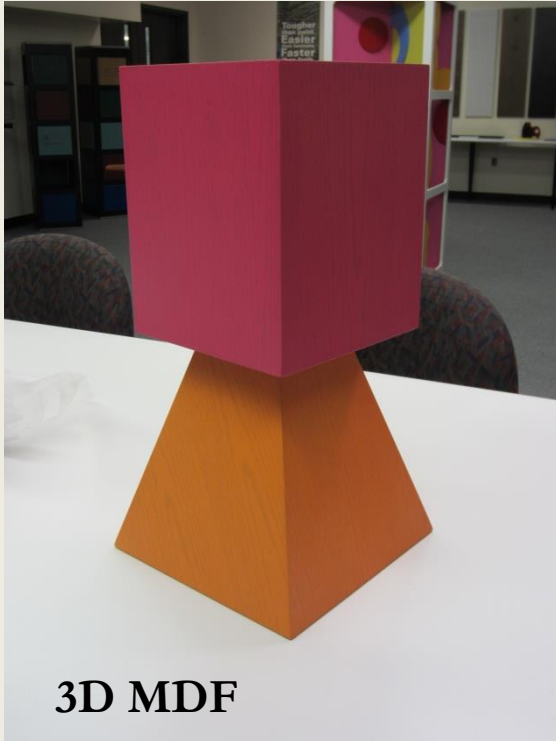


Opaque

Application on Various Substrates



Application on Various Substrates



Finished Products

Educational Lectern



POP Display



Interactive Retail Display



Healthcare Component



Architectural Element

UV-Curable Powder Coating



PERFORMANCE CHARACTERISTICS

Performance Results

Test	Standard	Results	Test	Standard	Results												
Adhesion (rating code)	BS 3662-6 UNE 11019-6	4	Oils and fats resistance (rating code)	BS 3962-5 UNE 11019-5	5												
Scratch resistance Scratch point Appearance of the substrate	BS 3662-6 UNE 11019-6	4 5	Cold Check resistance	ASTM 1211 UNE 48025	No defects												
Impact resistance (rating code)	BS 3662-6 UNE 11019-6	5	Light fastness	UNE EN ISO 11341	5												
Dry heat resistance (rating code) 85°C 100°C	EN 12 722	5 5	Wear resistance Number of cycles	EN 438-2	250												
Wet heat resistance (rating code) 55°C 70°C 85°C	EN 12 722	5 5 5	Thickness (microns)	95±5													
Cold liquid resistance (rating code) Acetone Butyl acetate Cleansing solution Ethanol 48% Tea Coffee Bleach Ammonia solution 10%	EN 12 702	1 1 5 5 5 5 5 5	Assessment guidelines														
			<table border="1"> <thead> <tr> <th>Description</th> <th>Assessment</th> </tr> </thead> <tbody> <tr> <td>No change</td> <td>5</td> </tr> <tr> <td>Change slight</td> <td>4</td> </tr> <tr> <td>Moderate change</td> <td>3</td> </tr> <tr> <td>Significant change</td> <td>2</td> </tr> <tr> <td>Strong change</td> <td>1</td> </tr> </tbody> </table>			Description	Assessment	No change	5	Change slight	4	Moderate change	3	Significant change	2	Strong change	1
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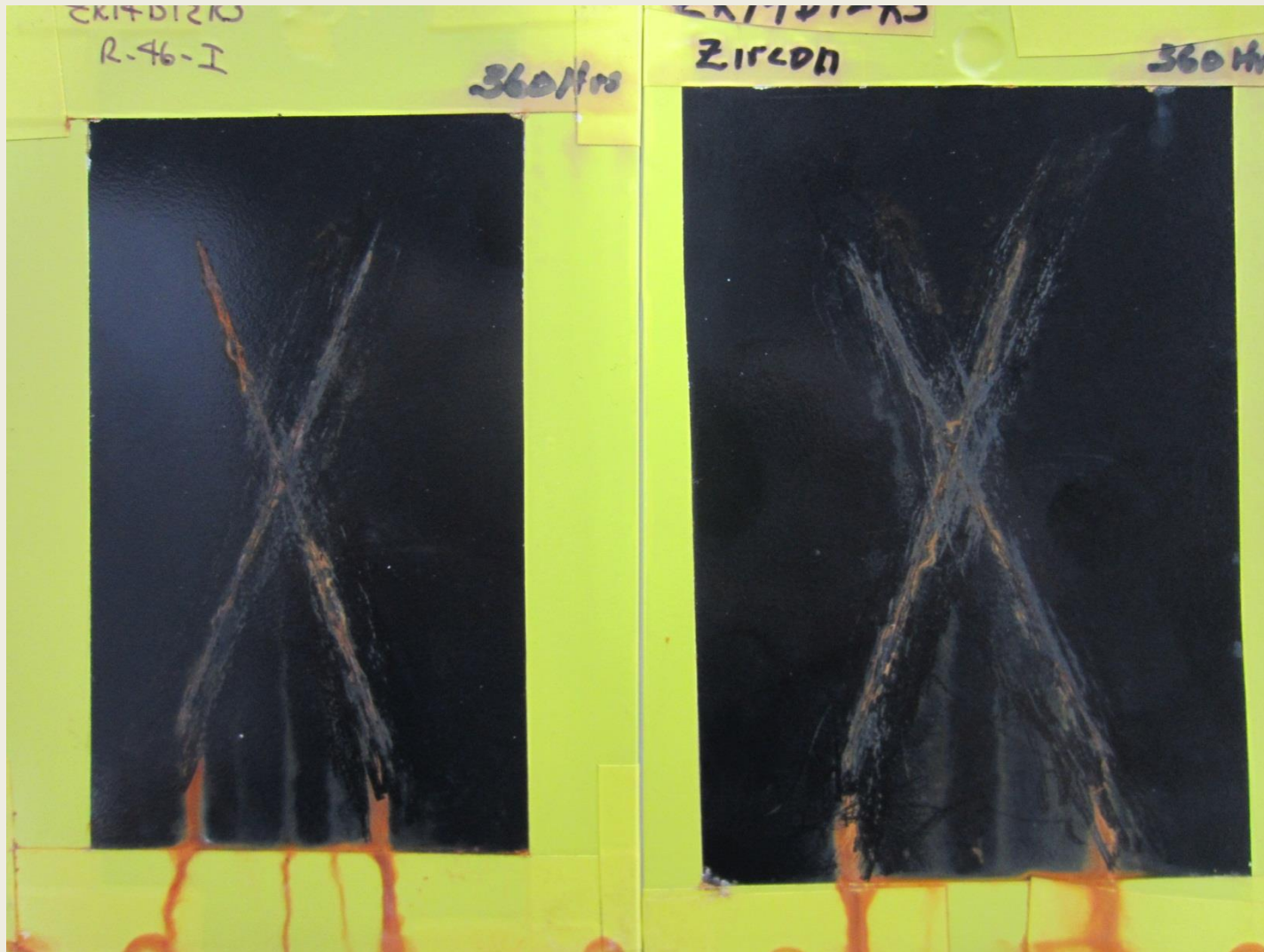
AIDIMA, Instituto Tecnológico del Mueble, Valencia, Spain

Testing Assessment

- Testing assessment – According to the results obtained, the tested finishing system fulfils the specifications laid down in:
 - The standards UNE 11022/1 and UNE 11023/1
 - The document “FIRA Standard 6250”
- For interior GENERAL use in:
 - “HORIZONTAL SURFACES, excluding kitchen worktops”
 - “OTHER SURFACES” (like front and side parts of furniture, vertical wall panels,...)
- And for interior SEVERE use, except for acetone and butyl acetate resistance in:
 - “HORIZONTAL SURFACES, excluding kitchen worktops”
 - “OTHER SURFACES” (like front and side parts of furniture, vertical wall panels,...)

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Corrosion Resistance

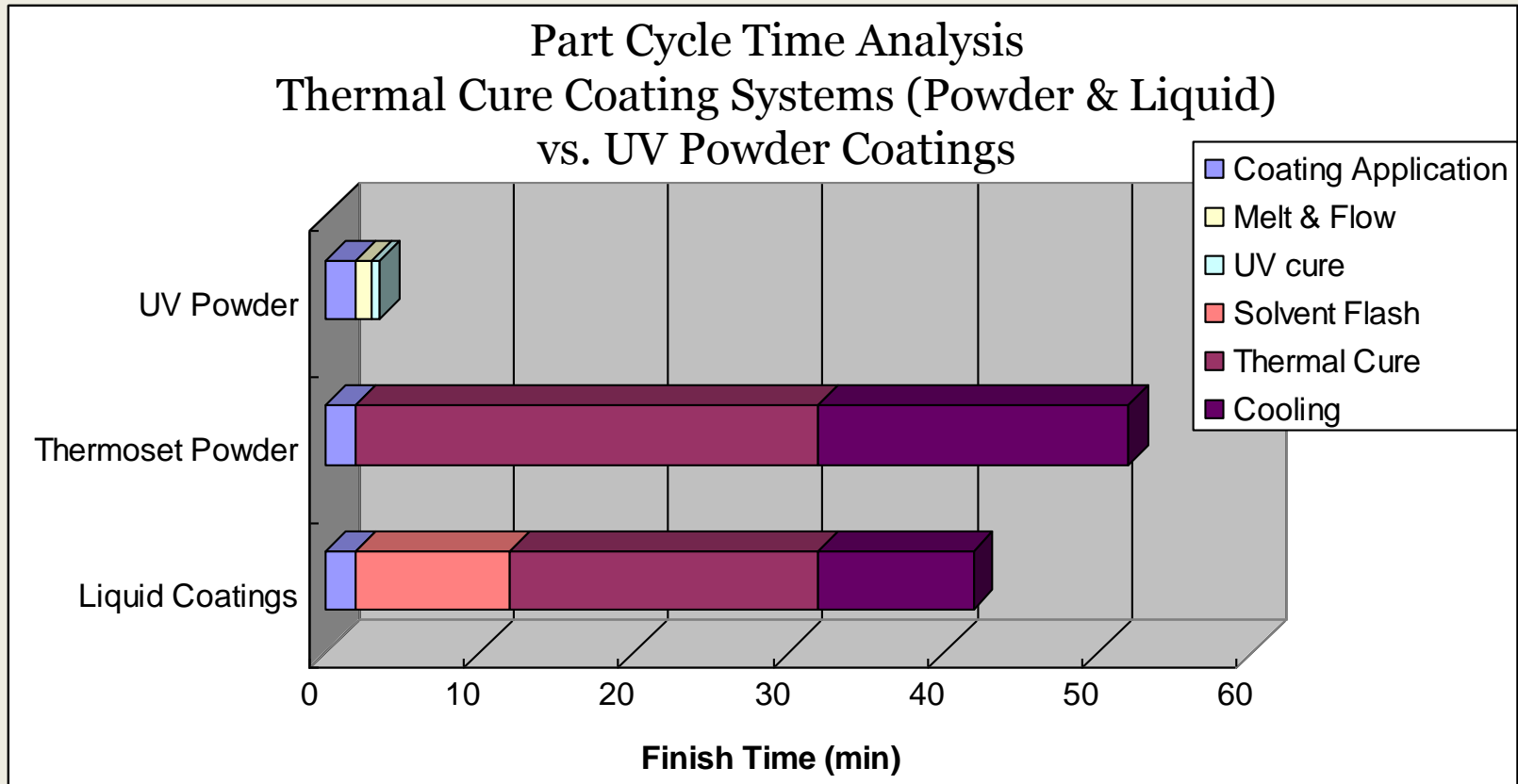


UV-Curable Powder Coating



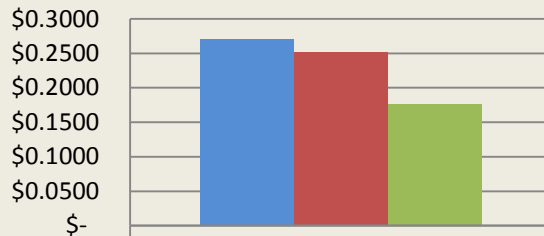
OPERATIONAL EFFICIENCIES & COST ANALYSIS

Operational Efficiencies



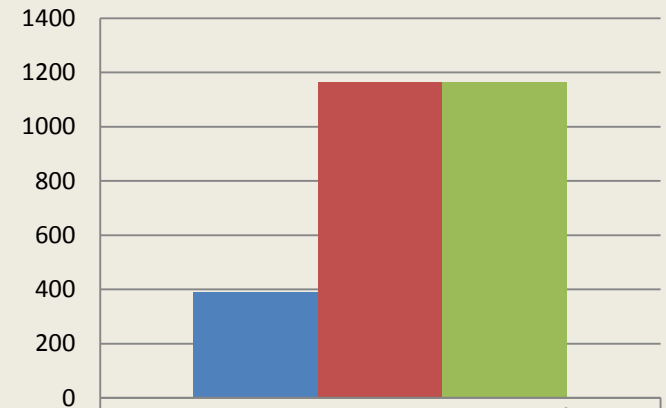
Material Cost & Productivity

Material Cost per Square Foot of Surface Finished



Material cost comparison \$/square foot - Liquid and UV cured powder	
■ Liquid 2 coat low VOC	\$0.2712
■ UV powder spray to waste	\$0.2520
■ UV powder spray to reclaim	\$0.1768

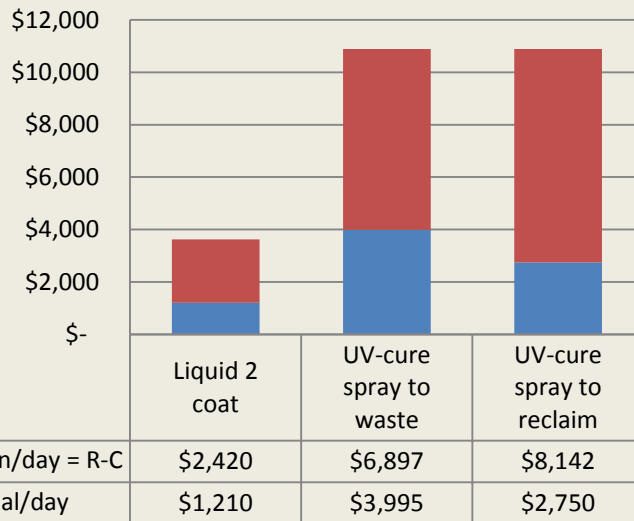
Parts Produced per Day



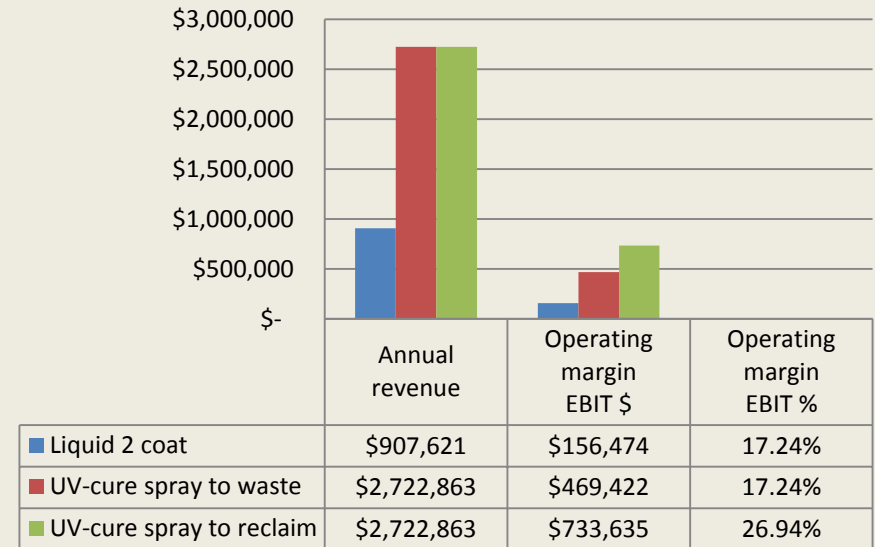
Parts Produced per Day 8 hour Shift	
■ Liquid 2 coat low VOC	388
■ UV-cure powder spray to waste	1164
■ UV-cure powder spray to reclaim	1164

Revenue and Operating Margin

Daily Revenue, Material and Gross Margin



Revenue & Operating Margin



Operating margin data from www.nyu.stern.edu

UV-Cured Powder – Solvent Liquid

Assumptions:	Average value of unpainted part	\$	7.95		
	Terminal supplier annual capacity		1,500,000		
	Turn around time in days		3		
	Daily supplier production capacity		7,500		
Example #1					
	UV Powder 15.6 parts/minute	Solvent Liquid Coating			
Cost of UV-powder	\$ 0.0231 /part	Vendor Supplied	\$ 0.2500 /part		
Indirect cost	\$ 0.0802 /part	Vendor Indirect	\$ 0.1251 /part		
	Total		Total	\$ 0.3751 /part	
Annual cost	\$ 154,988	Annual cost	\$ 562,700		
		Working capital WIP	\$ 178,875		
			\$ 741,575		
Cost savings Yr 1	\$ 407,713				
CAPEX	\$ 500,000				
Example #2					
	Optimizing UV-powder capacity @ 30 parts/minute 2,880,000/year				
	UV Powder				
Cost of UV-powder	\$ 0.0231 /part				
Indirect cost	\$ 0.0486 /part				
	Total				
	\$ 0.0717 /part				
Annual cost	\$ 107,588				
CAPEX	\$ 500,000				

UV-Cured Powder Coating Compared to Two Thermal Cured Powder Systems

Example #1 - 7MM parts per year

	UV Powder	Thermal 1	Thermal 2
Total Energy Cost / Part	\$0.0046	\$0.0407	\$0.0275
Total Material Cost / Part	\$0.0625	\$0.0217	\$0.0217
Total Labor Cost / Part	\$0.0058	\$0.0613	\$0.0300
Total	\$0.0728	\$0.1237	\$0.0792

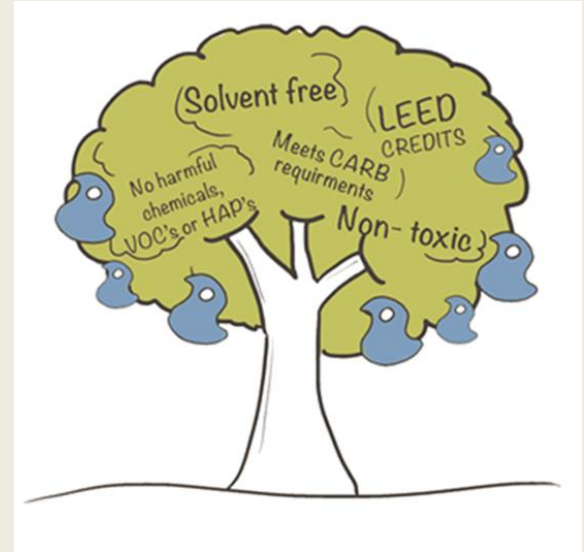
Example #2 - 320M parts per year

Total Energy Cost / Part	\$0.0046	\$0.0407	\$0.0275
Total Material Cost / Part	\$0.0625	\$0.0217	\$0.0217
Total Labor Cost / Part	\$0.0263	\$0.2800	\$0.1371
Total	\$0.0934	\$0.3424	\$0.1864

System Production Capacity 50 week year 24/5	19,440,000	1,080,000	1,987,200
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UV Powder Finishing Advantages

- **Fast**
 - Instant cure
 - Completed parts in 20 minutes or less
 - One coat
- **Clean**
 - No harmful chemicals, monomers or additives
 - Safe to use – no special safety gear
 - Easy material handling and clean up
- **Green**
 - Smallest carbon footprint of any coating material
 - No VOC's
 - Waste recycling or repurposing
 - No operating permits



UV-Curable Powder Coating

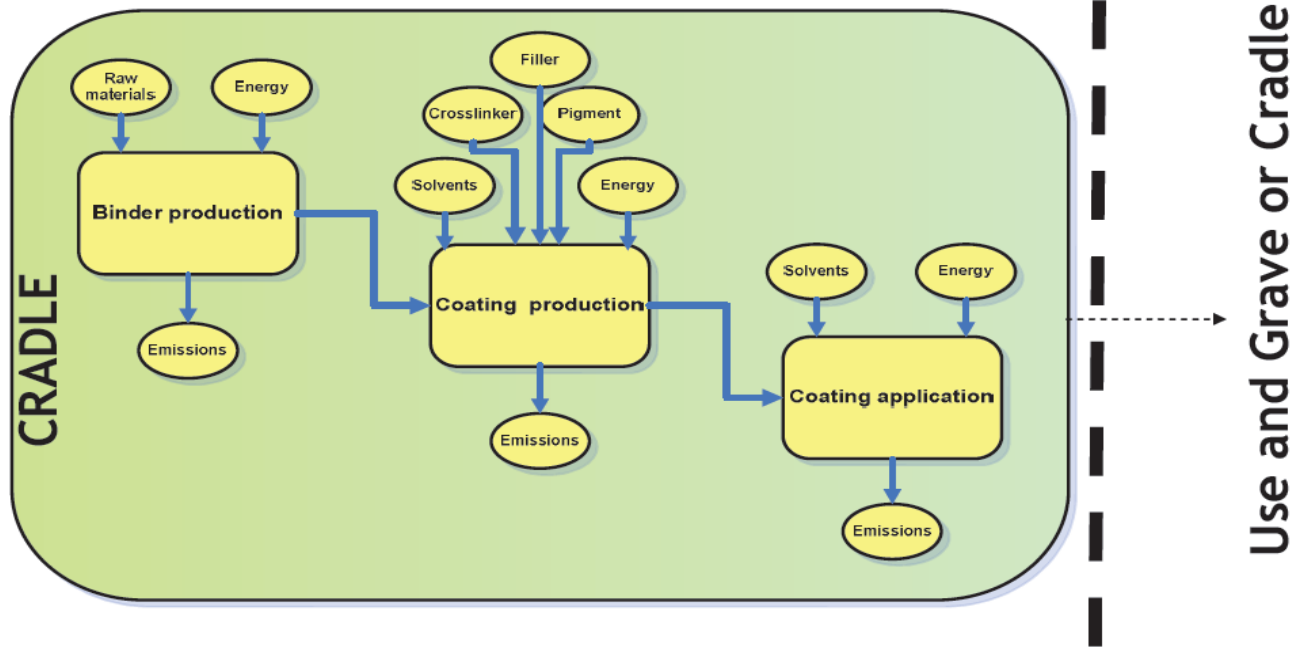


SUSTAINABILITY

Sustainability

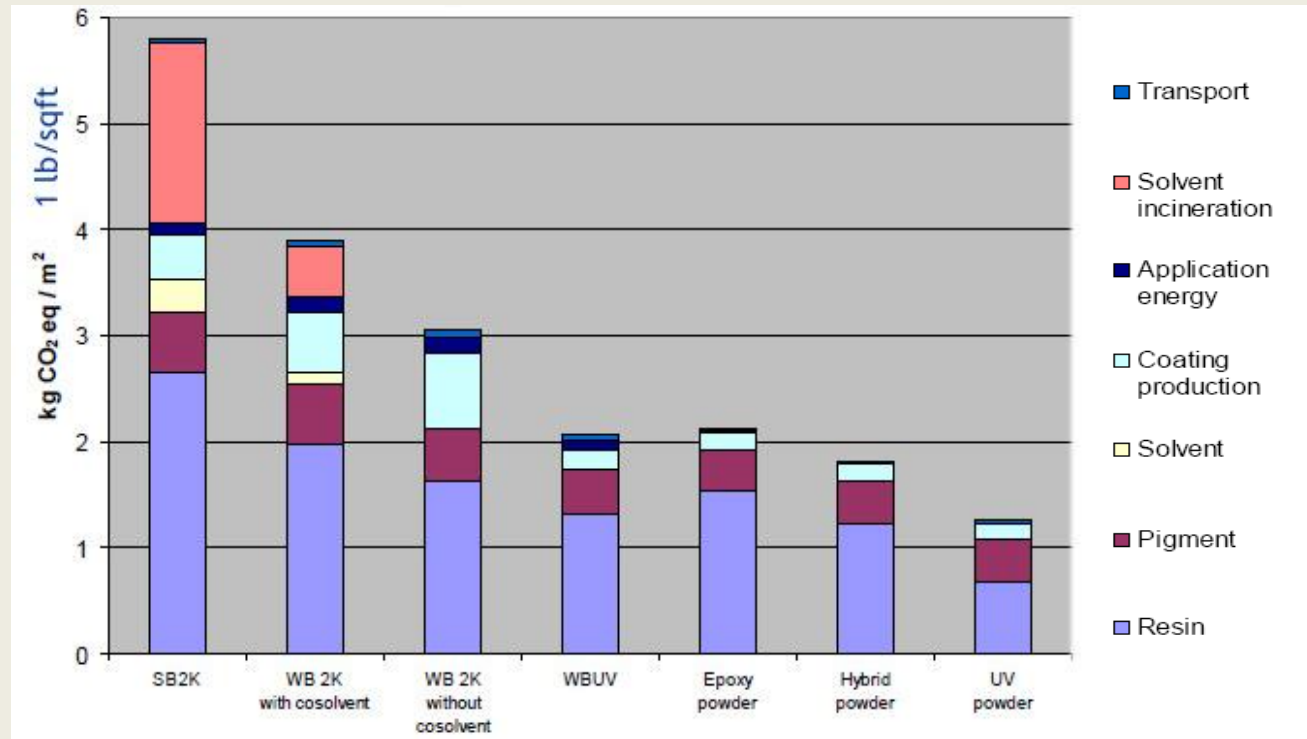
Scope of LCA: Cradle to Gate

GATE



Sustainability

- Coatings Life Cycle Assessment



Assumptions

Substrate : MDF 0.75" Thick Coating both sides Surface area – 5.4 sq ft	Solid Content	100% all powders 50% for all 2-k systems 40% for waterborne UV	Utilization % (Transfer Efficiency)	95% Powder 90% Waterborne UV 60% 2k solvent and waterborne
Pigment/Resin/Filler 20/60/20 for all (avg) TiO ₂				

Sustainability – Findings

- Solvent-based coatings have the highest environmental footprint
 - High CFP to produce and dispose solvents
- Waterborne paints (conventional and UV 100% solids) have lower environmental impact
- UV-curable powder coatings have the lowest environmental impact of coating materials

Coating Technology Impact on Carbon Footprint

	Solventborne-2K	Waterborne-UV	UV Powder
Carbon Dioxide, CO ₂ (kg/m ²)	0.96 / mil of coating	0.35 / mil of coating	0.21 / mil of coating
Typical Coating Thickness	5 mils	2 mils	2 mils
Coating Carbon Footprint (CO ₂)	4.8 kg/m ²	0.7 kg/m ²	0.41 kg/m ²

10 x More



UV-Curable Powder Coating



**FUTURE OF
UV POWDER**

Future of UV-Curable Powder Coating

- Convergence of the macro market forces creates greater opportunity for UV-curable powder coating
 - Population growth and growth of the consuming class
 - Higher growth rates in emerging economies
 - Increased consumer awareness and demand for sustainable chemistries
 - Reduction of carbon consumption as a % of GDP & establishment of carbon targets
 - Continuing growth of transportation other industrial products sectors
 - Increase in regulatory constraints on solvent based chemistries
- UV-curable powder coating opportunities
 - Innovative chemistries and application technologies deliver more value at lower cost
 - New curing technologies - LED
 - Displacing existing finishing chemistries & application technologies
 - Develop and penetrate new markets and material applications
 - Ideal for Next-Shoring market and product innovation

Conclusion

- The coatings market will grow at or above aggregate global GDP.
 - *The market offers better than average GPM and ROI opportunities to firms that bring into the market innovative chemistries and coatings that meet market specific needs.*
 - Improved coating performance
 - Demonstrably sustainable, economically viable and have a reduced carbon footprint
 - Fast application time and fast cure response
 - Generate economic profits
- UV-Curable powder coatings are a nascent but viable finishing system.
 - The productive and economic capability UV-curable application technology is clearly demonstrable and generates greater than market GPMs and higher ROIs.
 - More resources need to be made available to take advantage of market opportunities.
 - UV-curable powder coating application technology and chemistry are poised to capture a significant and profitable marketshare of the Global Coatings Industry.
 - **Projected growth in Radcure market 2013-18 – 7% AGR***
 - **Projected growth in powder coating segment 2013-18 8% AGR***

UV-Curable Powder Coating



**THANK YOU
&
QUESTIONS**

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