POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# Reaching your Sustainability Goals and Targets with UV Cured Powder Coatings

Michael Knoblauch
President
Keyland Polymer Material Sciences, LLC

**Keyland Polymer Material Sciences** is a global innovation leader developing, manufacturing, and applying solid polymer coatings and materials cured by Ultraviolet Light (UV) and Electron Beam Energy (EB). Keyland develops and brings to market safe, sustainable, and lower-carbon polymer chemistries and application systems.

DVUV Wood Powder Coating

Since 2005, DVUV has produced commercial and industrial medium density fiberboard (MDF) products finished with UVMax® powder coatings. Customers include major retail stores, office and healthcare fixture firms.

KEYLAND POLYMER UV POWDER

In 2006 Keyland Polymer UV Powder began developing, formulating, and manufacturing UV cured powder coatings sold under the UVMax® brand.

KEYLAND POLYMER UV RESINS

Keyland started developing its proprietary resins in 2009 and the first production resin for commercial use was made in 2014.

KEYLAND POLYMER UV MATERIALS SPAIN

In 2017 Keyland established a resin R&D laboratory in Spain. Keyland Spain and has a manufacturing partnership for production of resins.

KEYLAND POLYMER UV APPLICATION TECHNOLOGY

Keyland offers system engineering, design, installation, and operating consulting assistance to firms building UV & EB cured powder and additive material application systems.

ER COATING
MMIT
MBER 8-9, 2022

**We believe in the environmental, economic, and technological benefits of UV/EB curing**
**We focus on the customer**
**We strive to be continuous innovators**
**We demonstrate consistent and reliable performance**

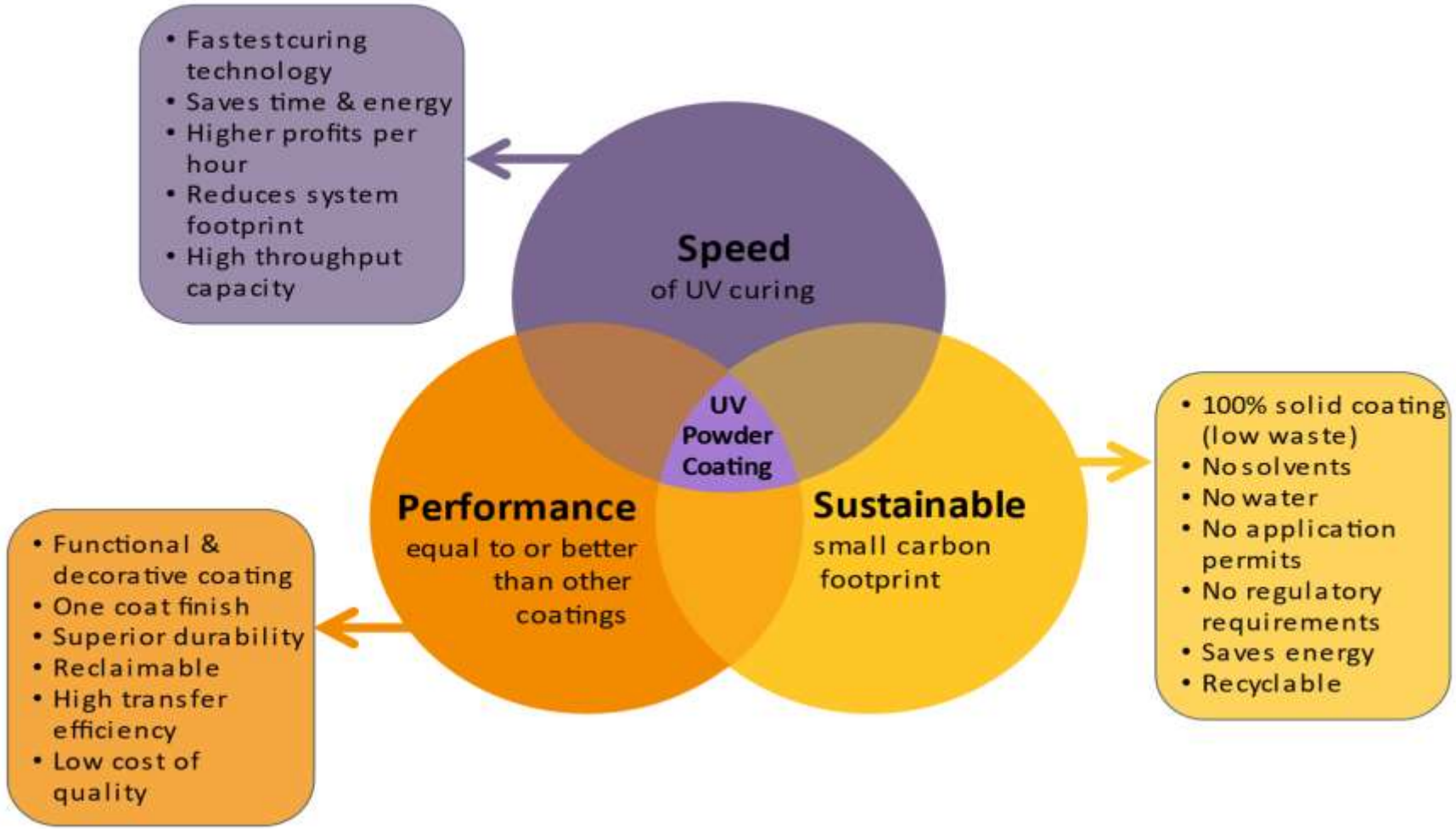
POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

- Introduction to Ultraviolet (UV) Powder Coatings
- Market Trends
- Climate Change and Water Scarcity
- Energy and UV Cured Powder Coatings
- Environmental, Sustainability, and Governance (ESG) Reporting
- Finishing Heat Sensitive Materials with UV Cured Powder Coatings

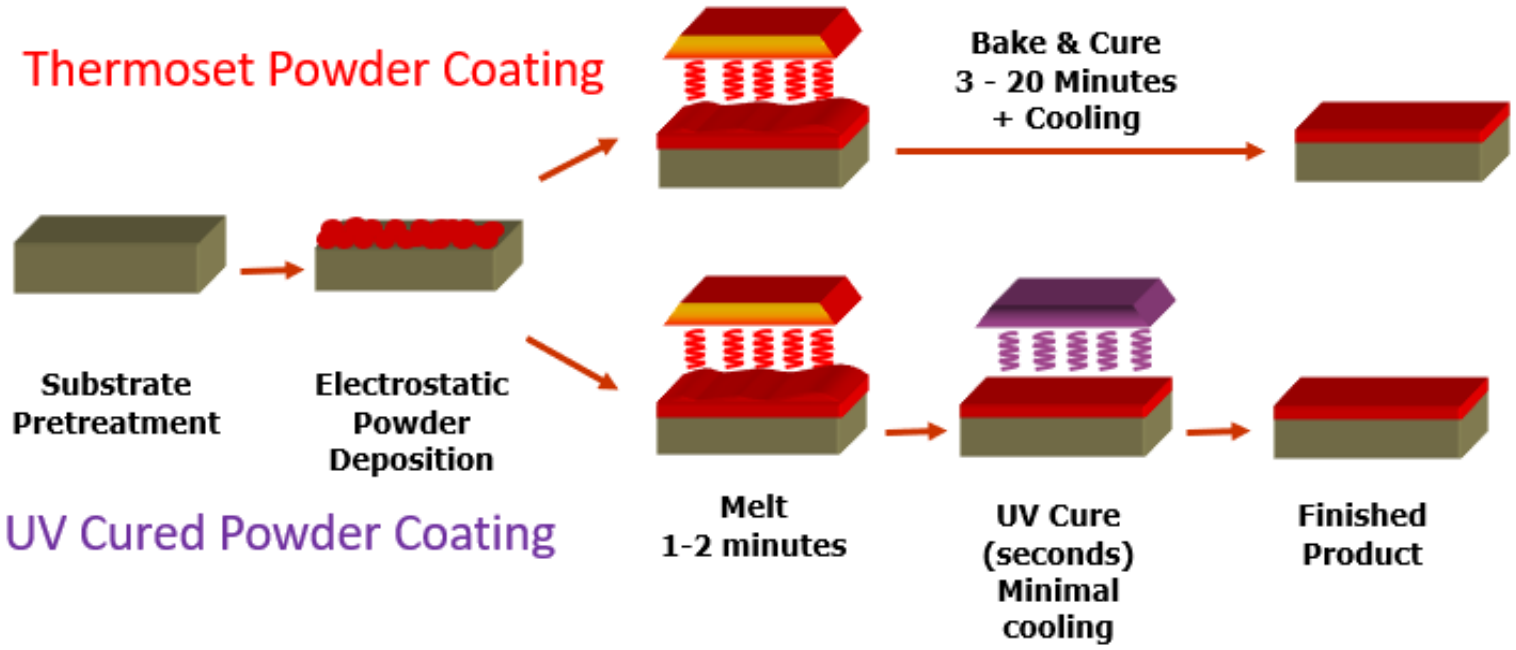
POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

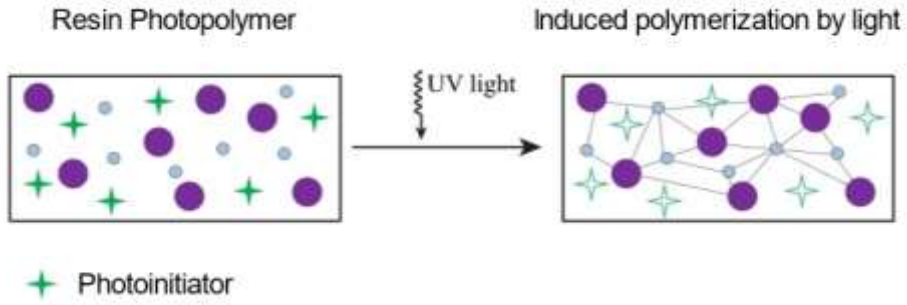
# Introduction to UV Powder Coatings

# UV Cured Powder Coating Value Proposition



UV cured powder eliminates the bake cycle of thermoset powder coatings.
UV cured powder is melted in a short heat cycle and then instantly cured with UV light



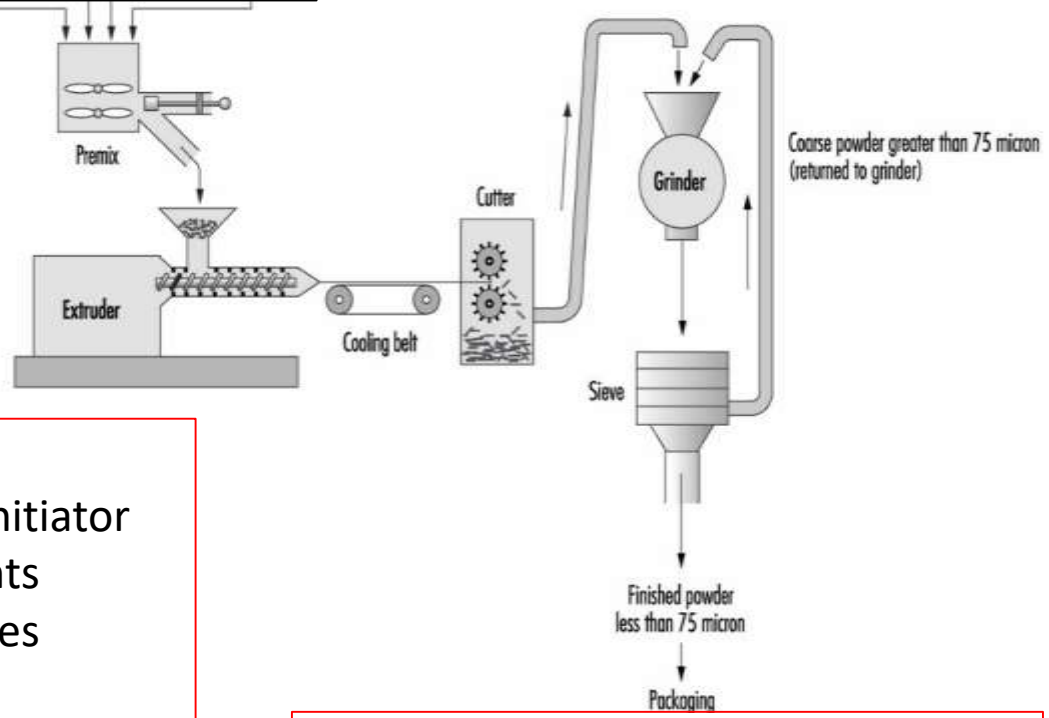



# UV Powder Manufacturing & Application

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

UV cured powder is made on the same equipment as thermoset powder

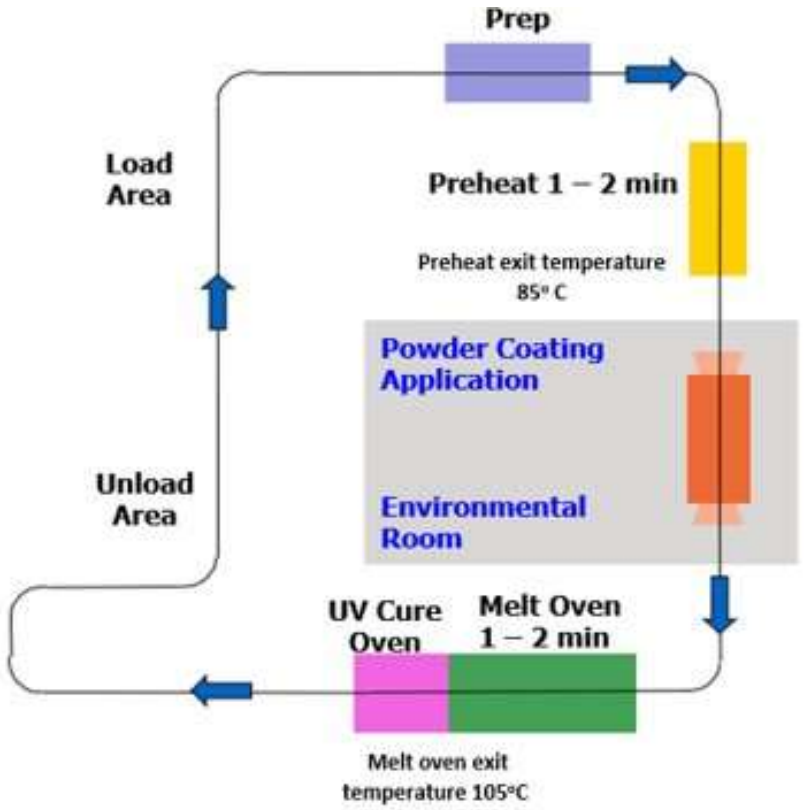
Raw Materials




Resin
Photoinitiator
Pigments
Additives
Filler

No special process control steps required during extrusion or milling

Example of a system layout for a UV cured powder coating line for MDF




200’ in length, 10’/min conveyor speed = 20 min to a finished component

# Benefits of UV Cured Powder Coatings

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

- 5% – 20% More Profits Per Hour
- 25% – 90% Less Energy Consumption
- > 60% Carbon Reduction
- 110°C – 130°C Surface Temperature at Cure
- 3.5x – 10x Faster Production
- No Solvents or Water

**A smaller carbon footprint & higher productivity than other curing processes**

**Customer Testimonial: "What used to take 4 days with liquid paint, now takes 4 hours with UV cured powder!"**

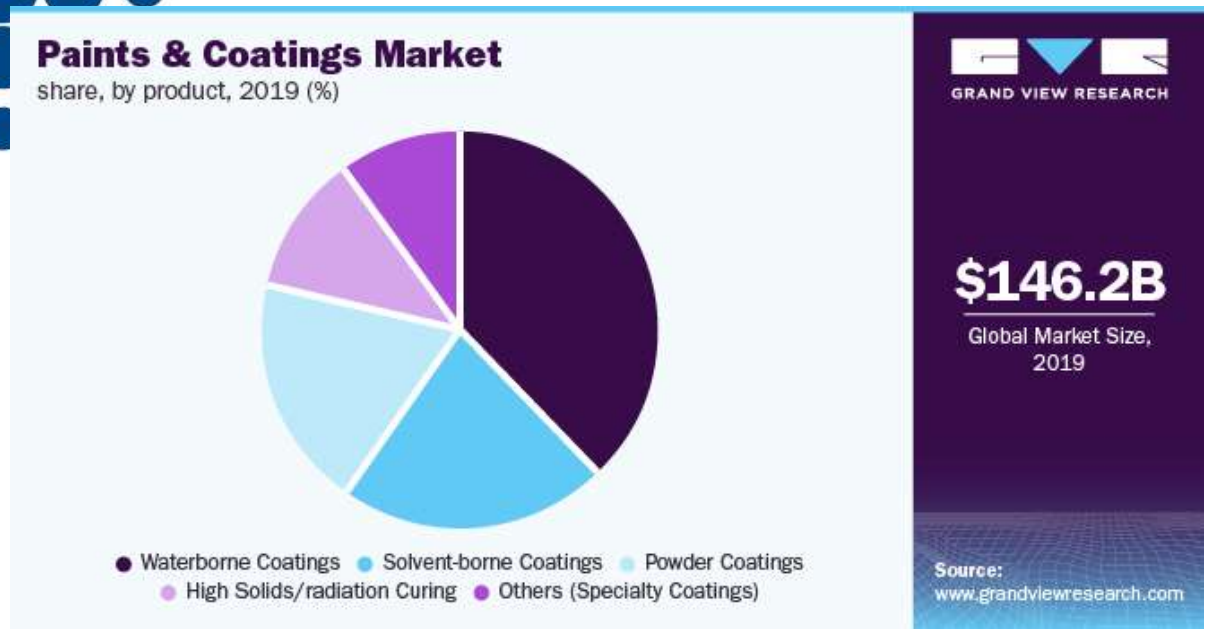
# Environmental Benefits of Powder Coatings

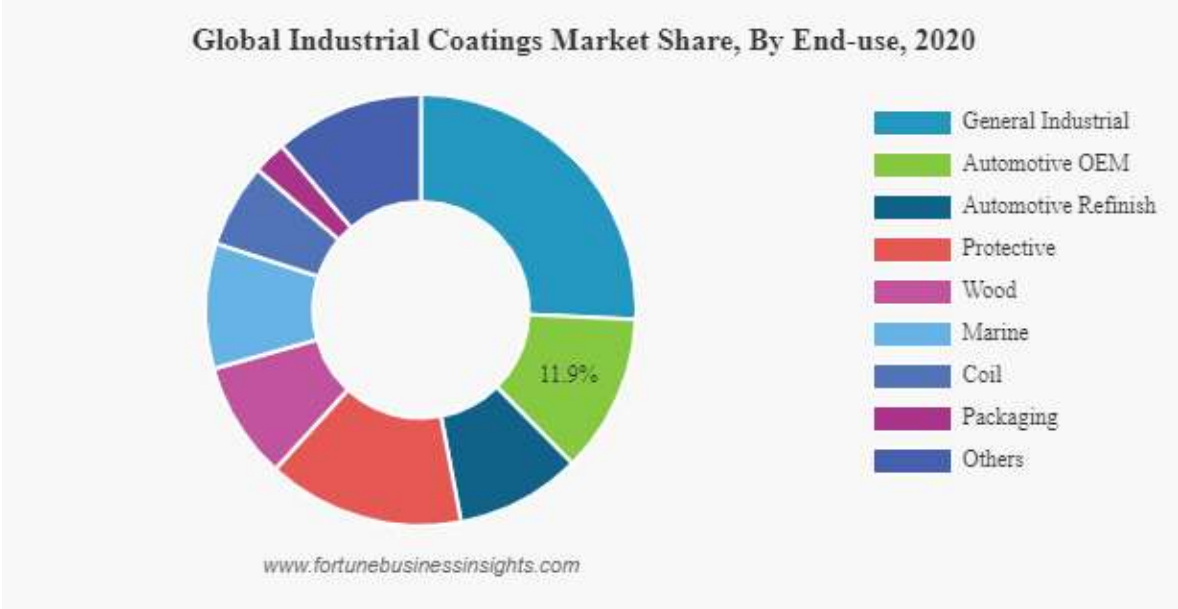

- Up to >95% material utilization rate
- Use what you ship
- No permits required to make or apply
- No solvent containment or management
- No water use conflicts

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# Coating Market Trends

# Coatings Market & Trends




Global Paints and Coatings Market Report: Insights, Trends and Forecast (2019-2023)

The global paints and coatings market value is forecasted to reach US$204.83 billion in 2023, growing at a CAGR of 4.92%, for the period spanning from 2018 to 2023.

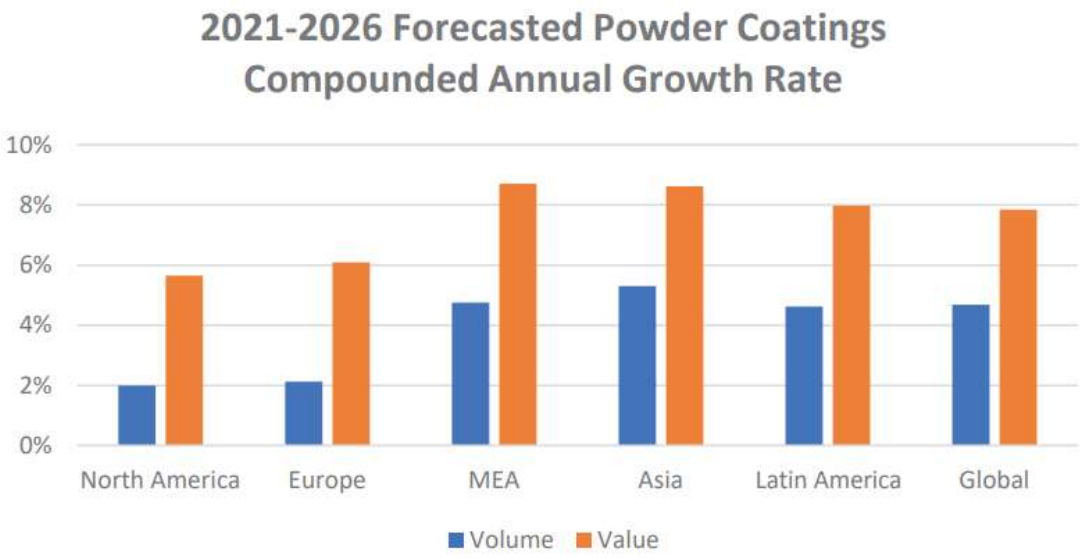
Source: https://www.businesswire.com/news/home/20190828005645/en/Global-Paints-Coatings-Market-Report-Key-Insights

Global Powder Coating Market 2021

US$12,207 Billion by value and 2,832 Million KG by volume

Powder Coated Tough May-June 2022

# Powder Coating & UV/EB Market Trends




Powder Coated Tough, May-June 2022

UV & EB Cured


Ultraviolet (UV), UVLED, Electron beam (EB) coatings, and Powder Coatings
Projected above average growth rates – Powder Coatings 4.6% by volume and 7.9% by value - UV/EB material by volume >6.6%

UV Curing and Powder Coatings – ***the combination*** of the two fastest growth segments in the coatings industry.

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# Climate Change & Water Scarcity

# Temperature Changes Cleveland, OH

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

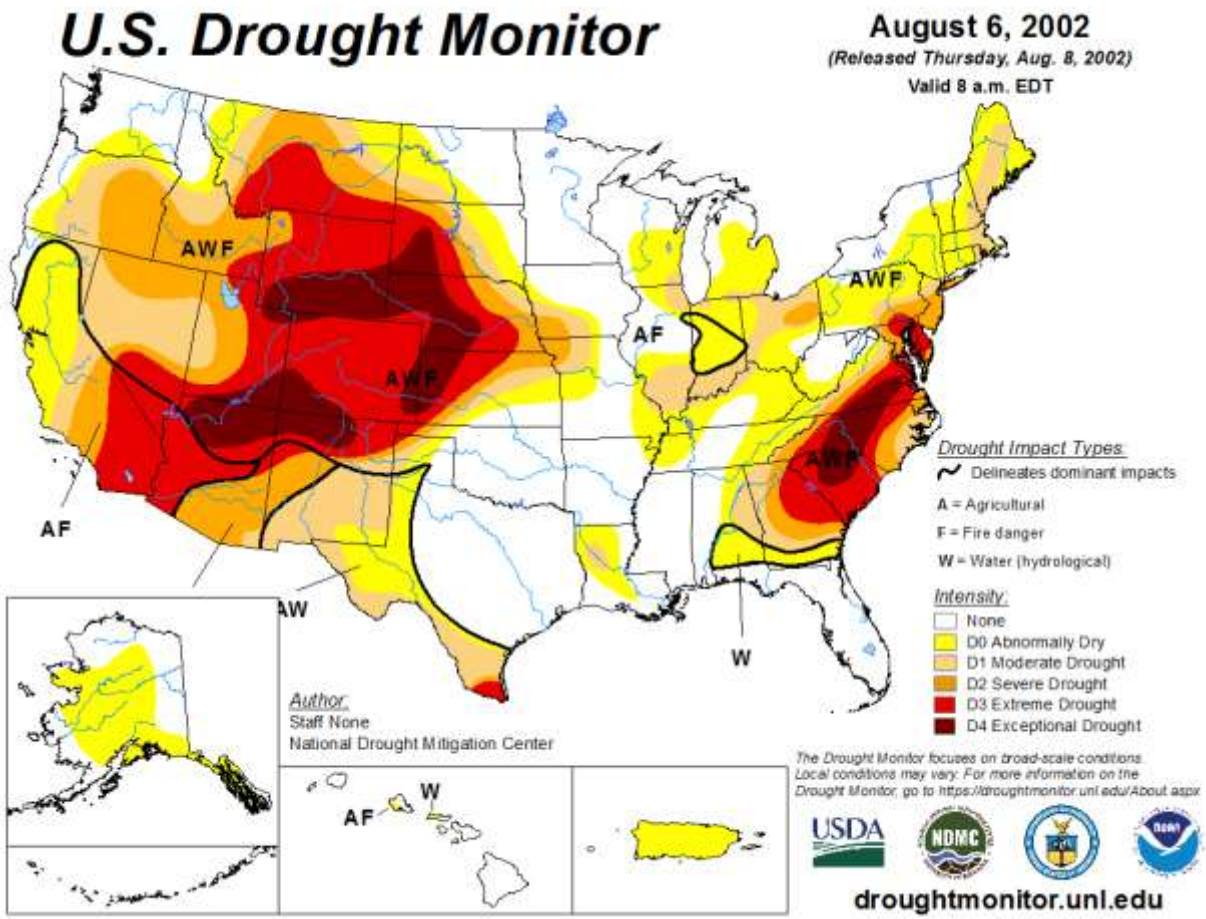
## Monthly Average Temperatures

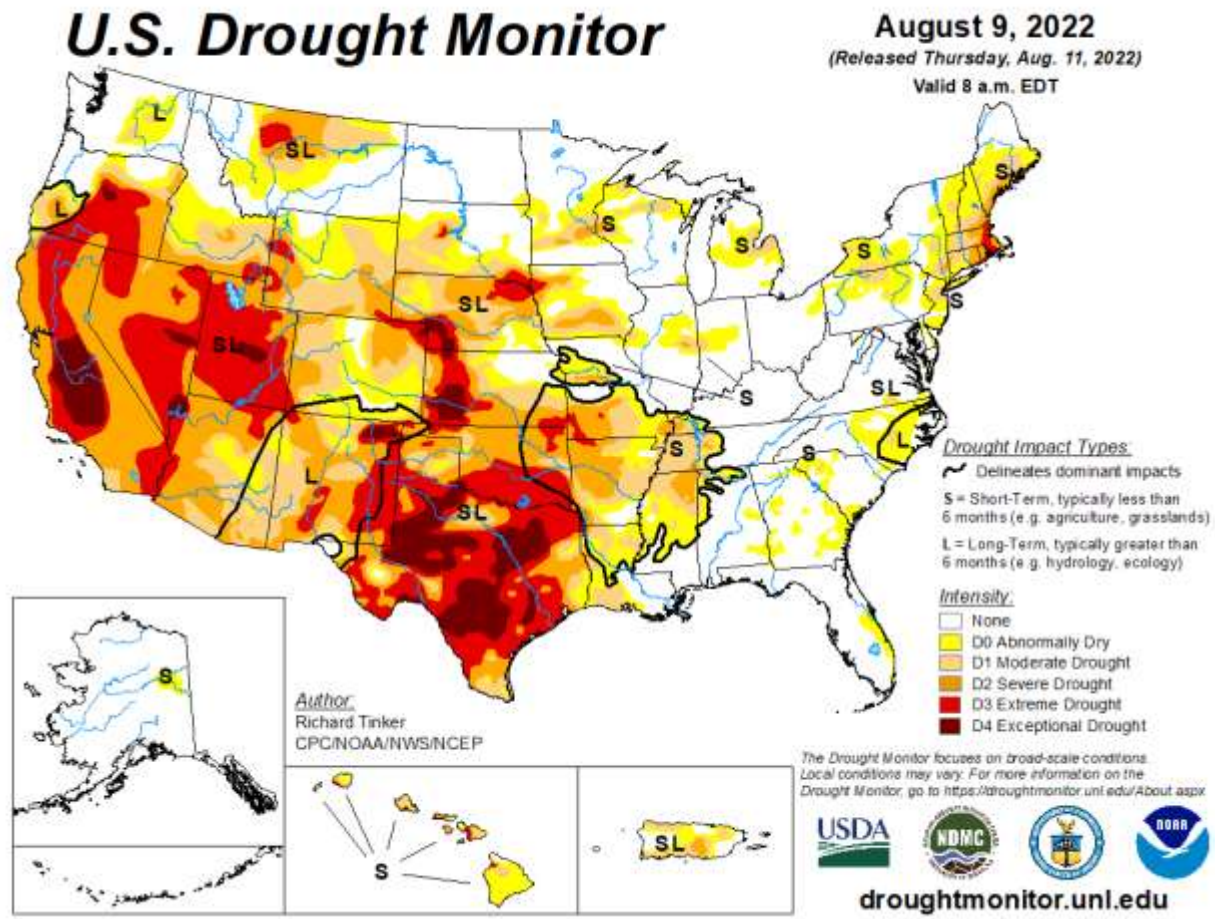
| | May | Jun | Jul | Aug | Sep | Average |
|---|---|---|---|---|---|---|
| 2000 - 2005 | 58.7 | 69 | 72.4 | 71.77 | 65 | 67.4 |
| 2006 - 2011 | 60.6 | 69.5 | 73.7 | 72.6 | 65.4 | 68.4 |
| 2012 - 2017 | 62.4 | 70.4 | 74.1 | 72.4 | 66.4 | 69.1 |
| 2018 - 2021 | 61.2 | 70.6 | 75.5 | 73.4 | 68.5 | 69.8 |
| Average | 60.7 | 69.9 | 73.9 | 72.5 | 66.3 | 68.7 |
| | | | | | | |
| 2000 - 2022* | Number of Days Over Temperature | | | | | |
| Mean # >80F | 7 | 15 | 22 | 30 | 9 | 16.6 |
| Mean # >85F | 3 | 8 | 13 | 10 | 4 | 7.6 |
| Mean # >90F | 0 | 3 | 5 | 3 | 2 | 2.6 |
| | | | | | | |
| 2016 - 2022* | Number of Days Over Temperature | | | | | |
| Mean # >80F | 8 | 17 | 25 | 24 | 13 | 17.4 |
| Mean # >85F | 4 | 9 | 16 | 13 | 7 | 9.8 |
| Mean # >90F | 1 | 2 | 6 | 4 | 2 | 3 |

*does not include 2022 August and September

Source: National Weather Service https://www.weather.gov/wrh/Climate?wfo=cle

# Water Scarcity – United States – 2002 - 2022



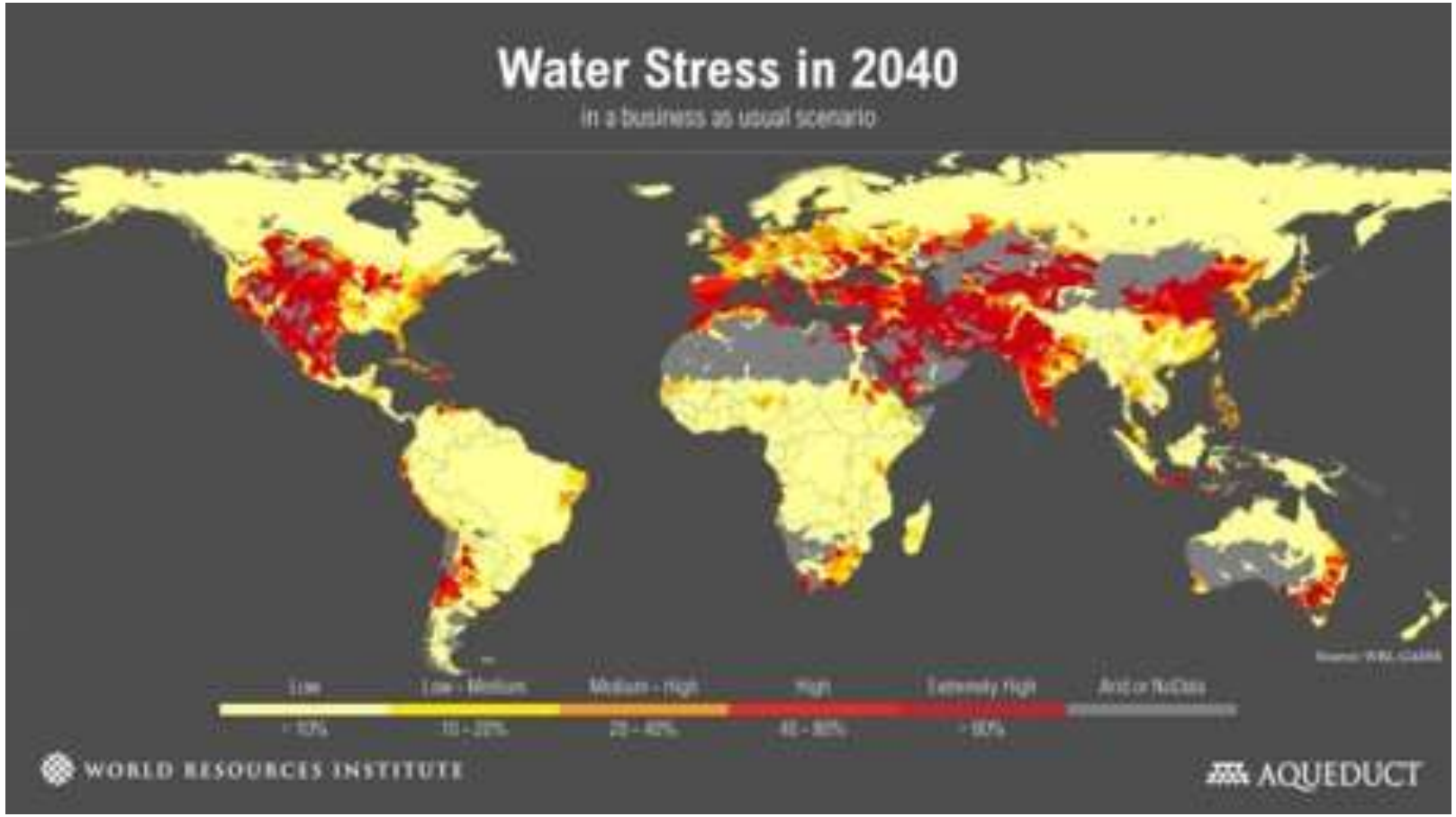
# Water Scarcity

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

**2019:** 50.3 billion pounds of waterborne coatings were produced* @ 70% water = 35.2 billion pounds of water = 4.22 billion gallons of water was used.

Estimating 5 years of waterborne coating production will consume enough water to supply the city of Chicago for **21 days.**

*Market Studies, PRA World Ltd, 2019

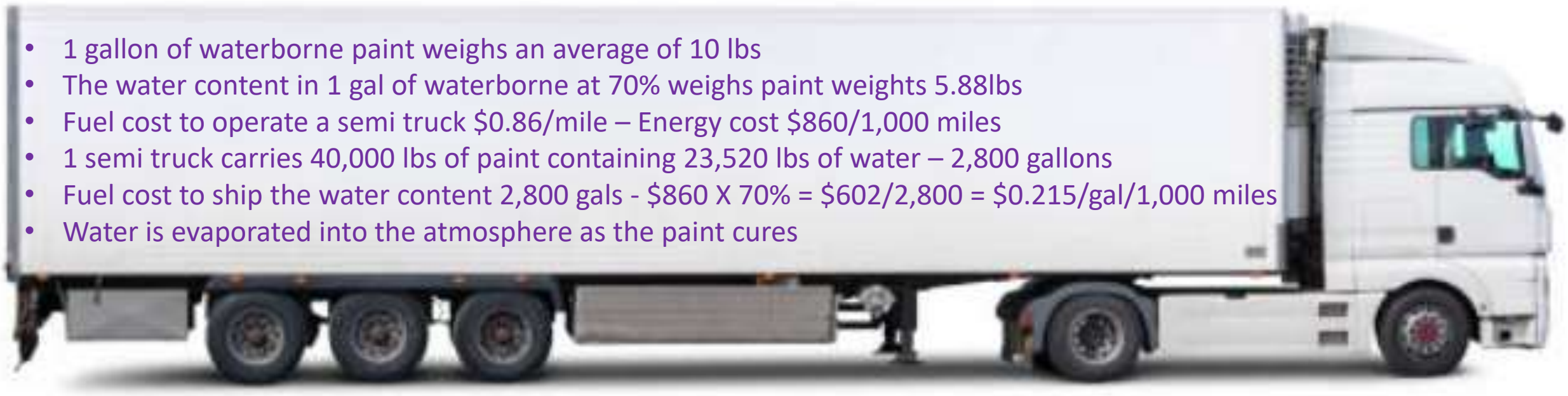


# Transportation (In)Efficiency

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

## The Cost to Ship the Water in a Gallon of Waterborne Paint

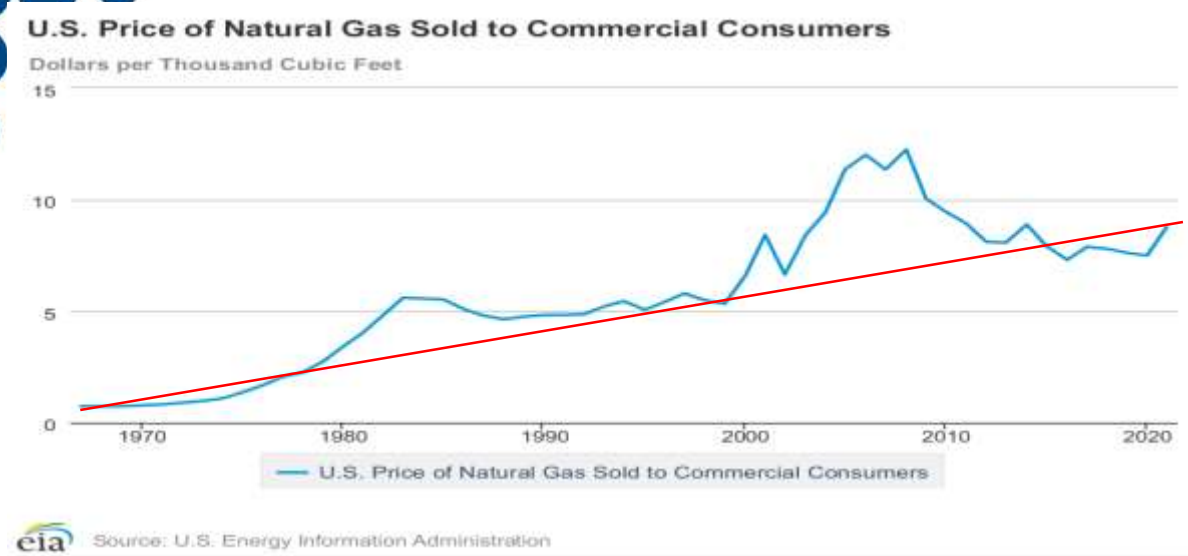
- 1 gallon of waterborne paint weighs an average of 10 lbs
- The water content in 1 gal of waterborne at 70% weighs paint weights 5.88lbs
- Fuel cost to operate a semi truck $0.86/mile – Energy cost $860/1,000 miles
- 1 semi truck carries 40,000 lbs of paint containing 23,520 lbs of water – 2,800 gallons
- Fuel cost to ship the water content 2,800 gals - $860 X 70% = $602/2,800 = $0.215/gal/1,000 miles
- Water is evaporated into the atmosphere as the paint cures

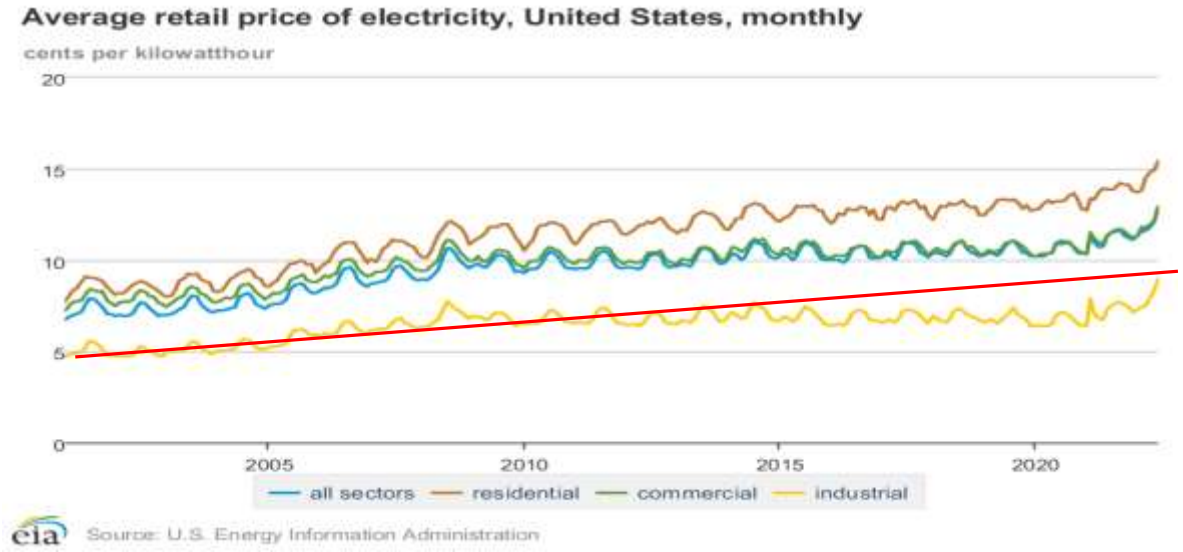


POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# Energy and UV Cured Powder Coatings

# Change in Energy Prices (U.S. & Europe)




# UV Curing Time & Energy Advantage

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

## Reduced Manufacturing Processing Time

**UV powder requires less heat and time compared thermoset powder.**

**UV powder requires less time than liquid coatings and does not have a solvent flash.**

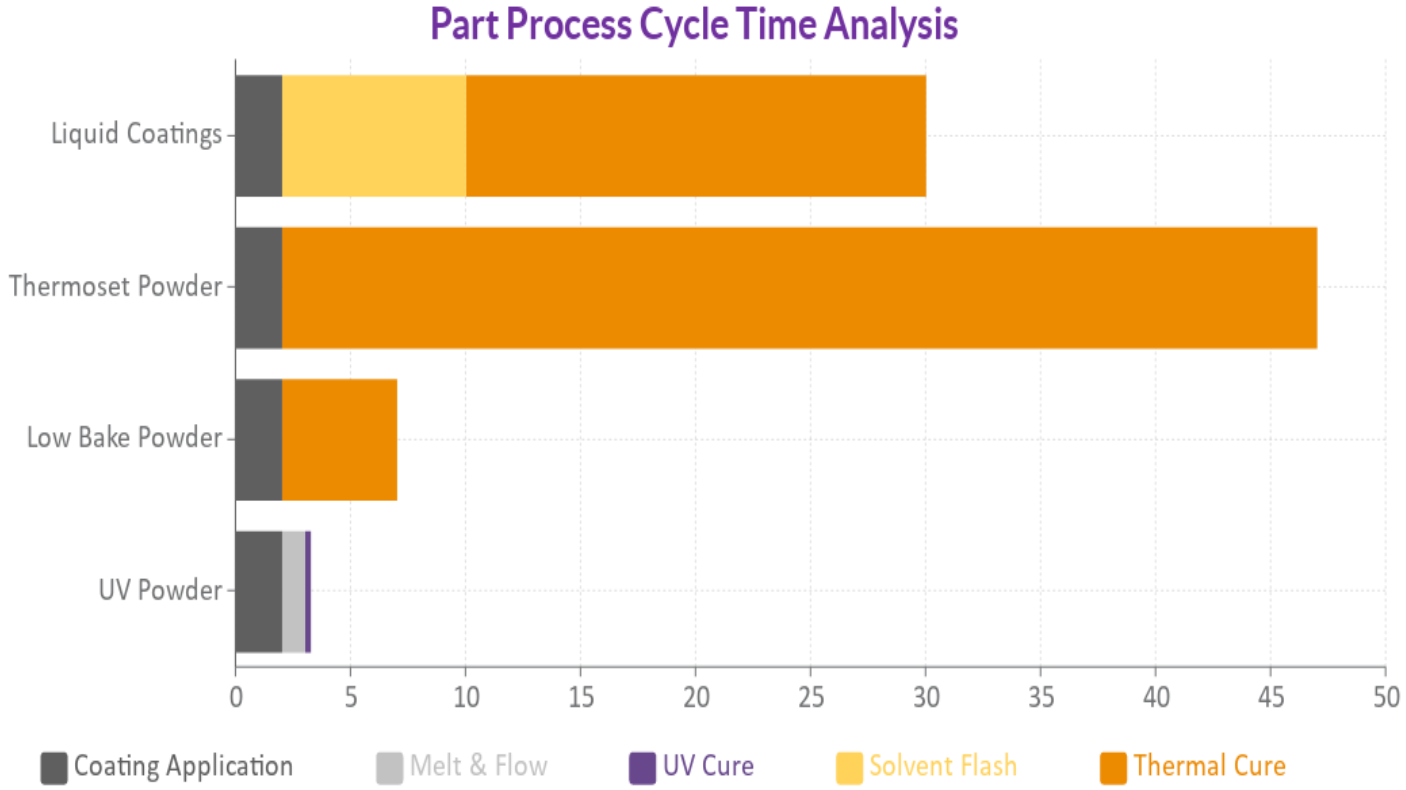
**Why does this matter?**

- More efficient/sustainable systems
- This fast and low temperature process can finish heat sensitive substrates and other materials that could not be finished with liquid paint or thermoset powder coatings

**MDF**

**Plastic**

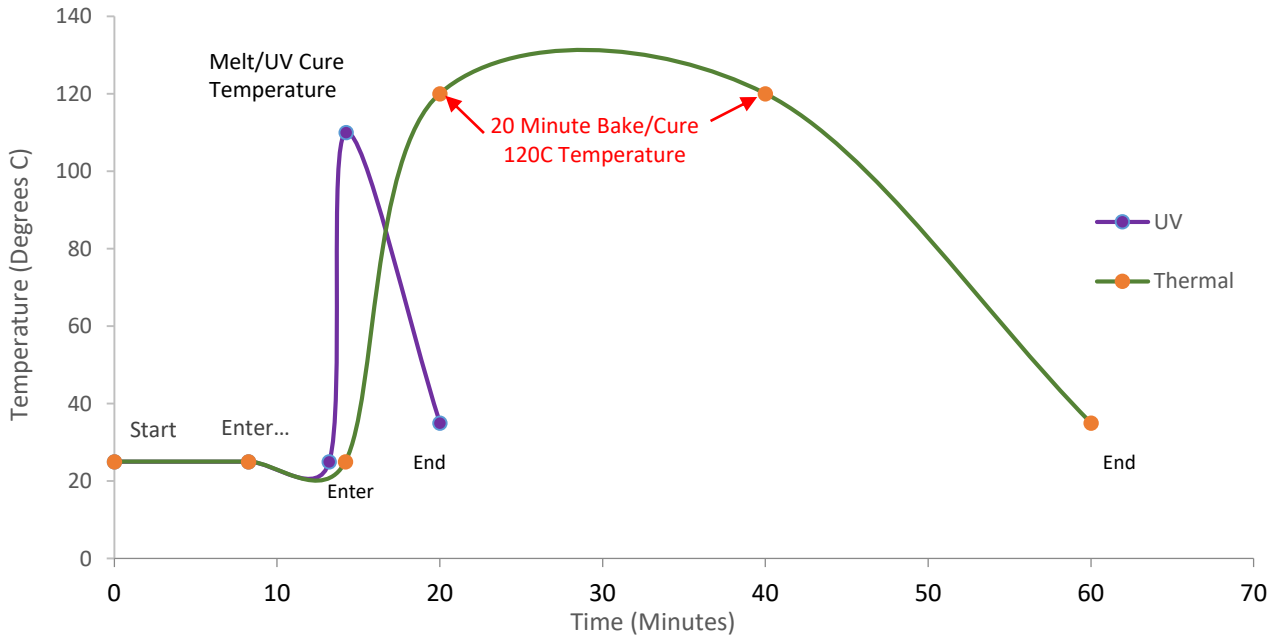
**Composite**



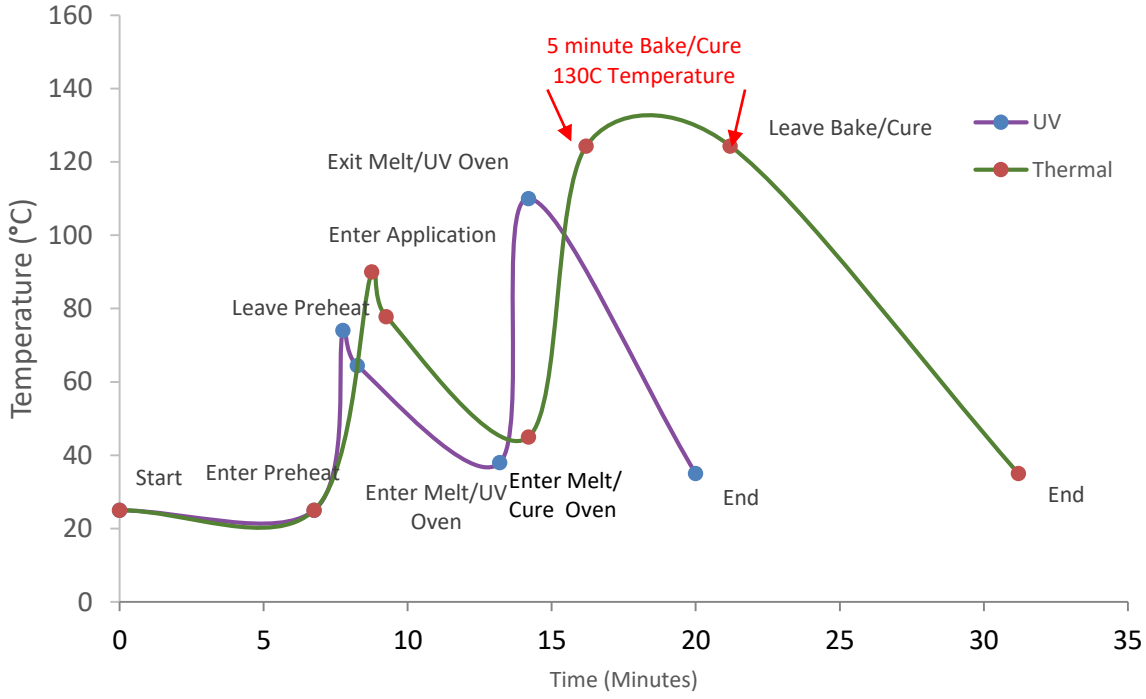
# Time & Temperature Comparisons

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

## UV Cured Powder & Thermal Powder Coating Process Time and Temperature Comparison for Metals/Plastics/Composites




## UV Cured Powder & Low Bake Thermal Powder Coating Process Time and Temperature Comparison for Wood and MDF



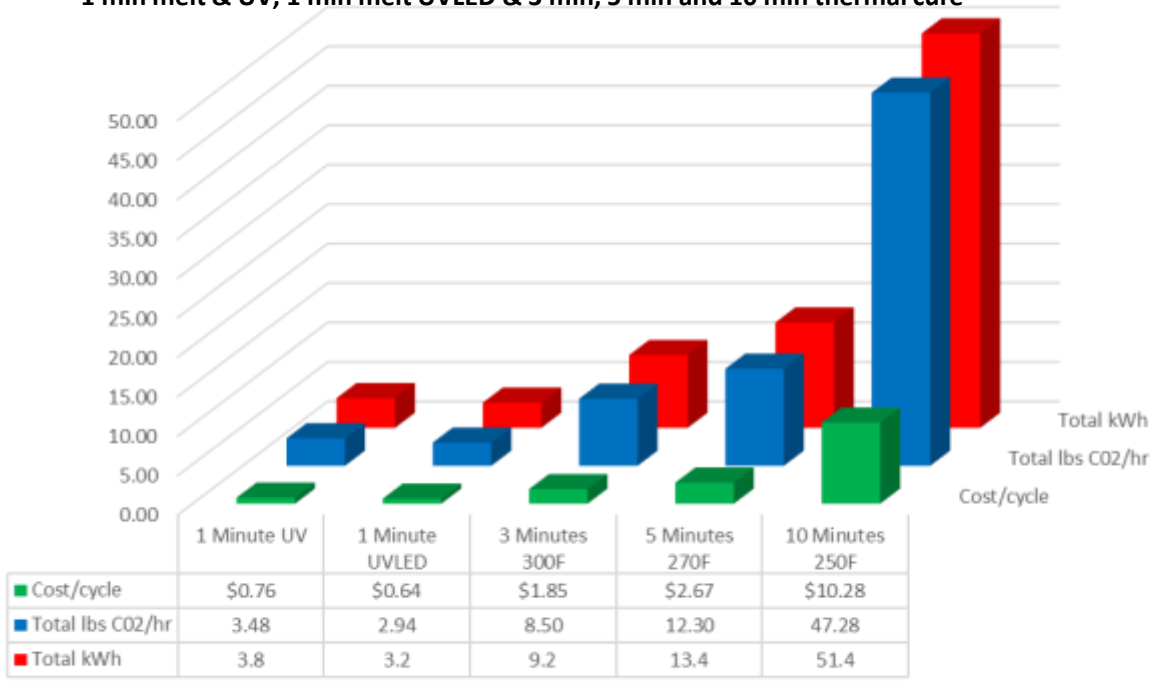
# Energy, Carbon Footprint & Energy Cost

| Process description * | Time for 1 oven cycle | Total kWh | Total $C0_2$/hr | Cost/cycle |
|---|---|---|---|---|
| 1 min melt @ 240F UV cure | 1 Minute UV | 3.8 | 3.48 | $ 0.76 |
| 1 min melt @ 240F UVLED UV cure | 1 Minute UVLED | 3.2 | 2.94 | $ 0.64 |
| 3 min 300F bake and cure | 3 Minutes 300F | 9.2 | 8.50 | $ 1.85 |
| 5 min 270F bake and cure | 5 Minutes 270F | 13.4 | 12.30 | $ 2.67 |
| 10 min 250F bake and cure | 10 Minutes 250F | 51.4 | 47.28 | $ 10.28 |

- Estimated using current energy costs, electricity and natural gas, and a standard oven configuration adjusted for increased time and output. Actual results will be different based upon oven design and energy costs.
- Increasing the 1 minute melt time to 2 minutes increases kWh consumption by 2.5kWh

**Real life example:**
Switching to UV cured powder eliminated baking the powder. Melting the powder prior to UV curing reduced the oven requirement by 75% and increased line speed (productivity) by >50% (from 13' per minute to 20' per minute).

**Energy, Carbon Footprint & Cost of Energy**
**1 min melt & UV, 1 min melt UVLED & 3 min, 5 min and 10 min thermal cure**




| | 1 Minute UV | 1 Minute UVLED | 3 Minutes 300F | 5 Minutes 270F | 10 Minutes 250F |
|---|---|---|---|---|---|
| Cost/cycle | $0.76 | $0.64 | $1.85 | $2.67 | $10.28 |
| Total lbs C02/hr | 3.48 | 2.94 | 8.50 | 12.30 | 47.28 |
| Total kWh | 3.8 | 3.2 | 9.2 | 13.4 | 51.4 |

1 min melt & UV cure – 600W medium pressure microwave lamp
1 min melt & UVLED cure – 16W 395 UVLED lamp

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

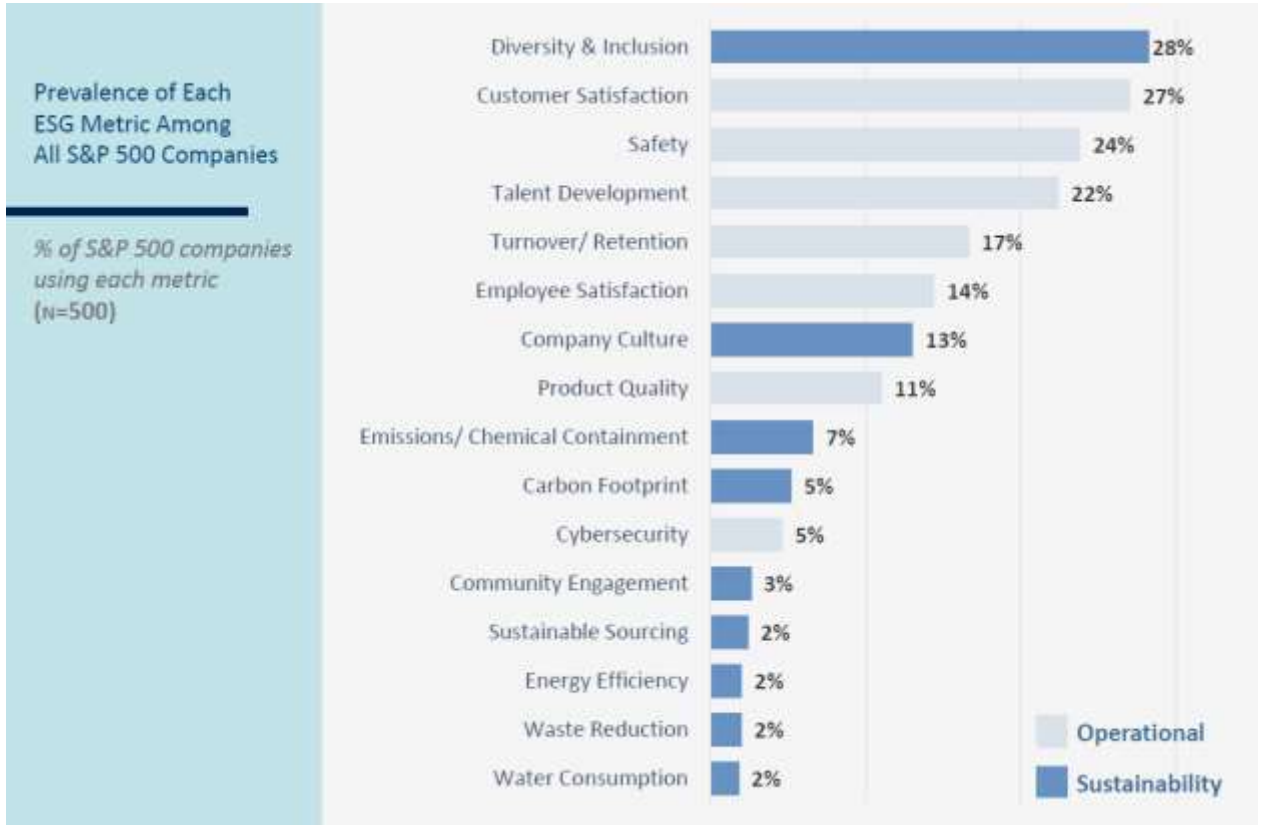
# Environmental, Sustainability, and Governance Reporting (ESG)

# Growth on ESG Reporting


S&P 500 Dataset

This year's study encompasses the full S&P 500. These companies range across all industries, with a median market cap of $30B and prominent representation from financials, industrials, and healthcare. The breadth of the dataset compared to last year's Fortune 200 study provides a more complete picture across industries and practices (including less prevalent ones) and extends the research to companies that aren't covered in the headlines. For this first issue, we've examined public disclosures filed between March 2020 and March 2021. We found that 57% of the S&P 500 include an ESG metric in either the annual or long-term incentive plan.

https://corpgov.law.harvard.edu/2021/07/08/2021-esg-incentives-report/




Reported on two publicly traded global paint companies ESG reports
Water from scarce resources >11% and >20%
Water use for industrial waterborne coatings does not include downstream water use for cleaning.

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# Finishing Heat Sensitive Substrates With UV Cured Powder Coatings

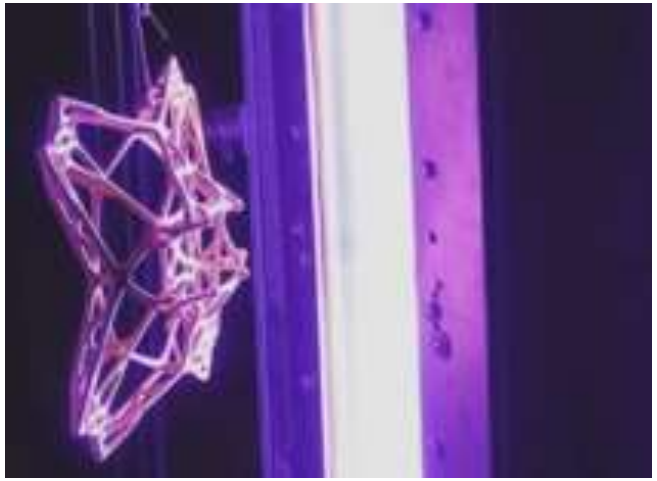
# Heat Sensitive Substrates

Foam core steel door

Carbon Fiber

MDF

Hollow core wood doors & MDF kitchen doors



Additive manufactured components

## GO Pro Video UV Cured Powder System

POWDER COATING SUMMIT
SEPTEMBER 8-9, 2022

# UV Cured Powder Coatings
For
# Heat Sensitive Substrates
Using
# Less energy, Faster, Small Carbon Footprint
For
# High-Performance, High-Quality Finishes
For
# Commercial, Industrial, and Consumer Products
Using
# A full Pallet of Colors - Textures - Gloss

# Thank You!

Michael Knoblauch
President
Keyland Polymer Material Sciences, LLC

mfk@keylandpolymer.com
www.keylandpolymer.com