

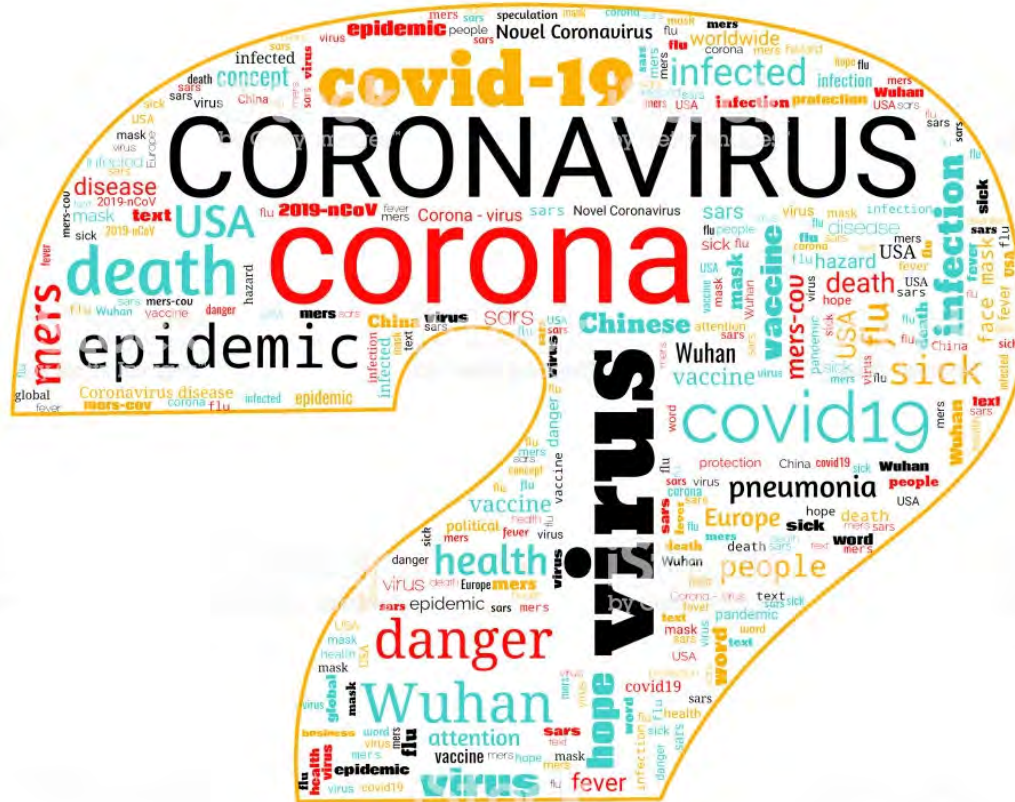
North American UV+EB Market Overview

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Economic Outlook

CBO's Economic Projections for 2020 and 2021

	2020				Annual	
	Q1	Q2	Q3	Q4	2020	2021
Real GDP (Percentage change from preceding quarter) ^a	-0.9	-11.8	5.4	2.5	n.a.	n.a.
Real GDP (Percentage change, annual rate) ^a	-3.5	-39.6	23.5	10.5	-5.6 ^b	2.8 ^b
GDP (Trillions of dollars)	21.6	19.1	20.1	20.7	20.4	21.3
Unemployment Rate (Percent)	3.8	14.0	16.0	11.7	11.4	10.1
Interest Rate on Three-Month Treasury Bills (Percent)	1.1	0.1	0.1	0.1	0.4	0.1
Interest Rate on Ten-Year Treasury Notes (Percent)	1.4	0.6	0.7	0.7	0.8	0.7

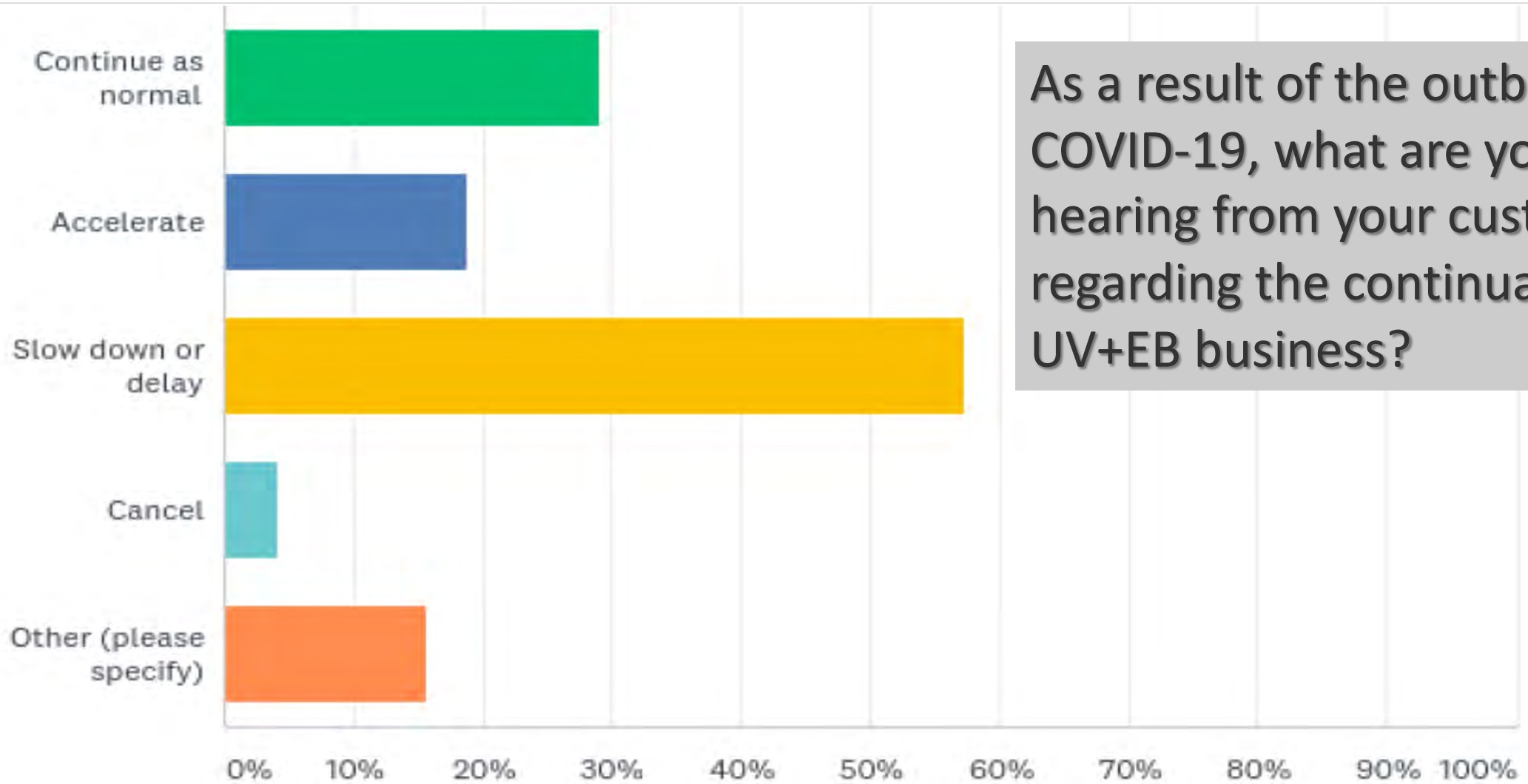
GDP = gross domestic product; n.a. = not applicable.

a. Real values are nominal values that have been adjusted to remove the effects of changes in prices.

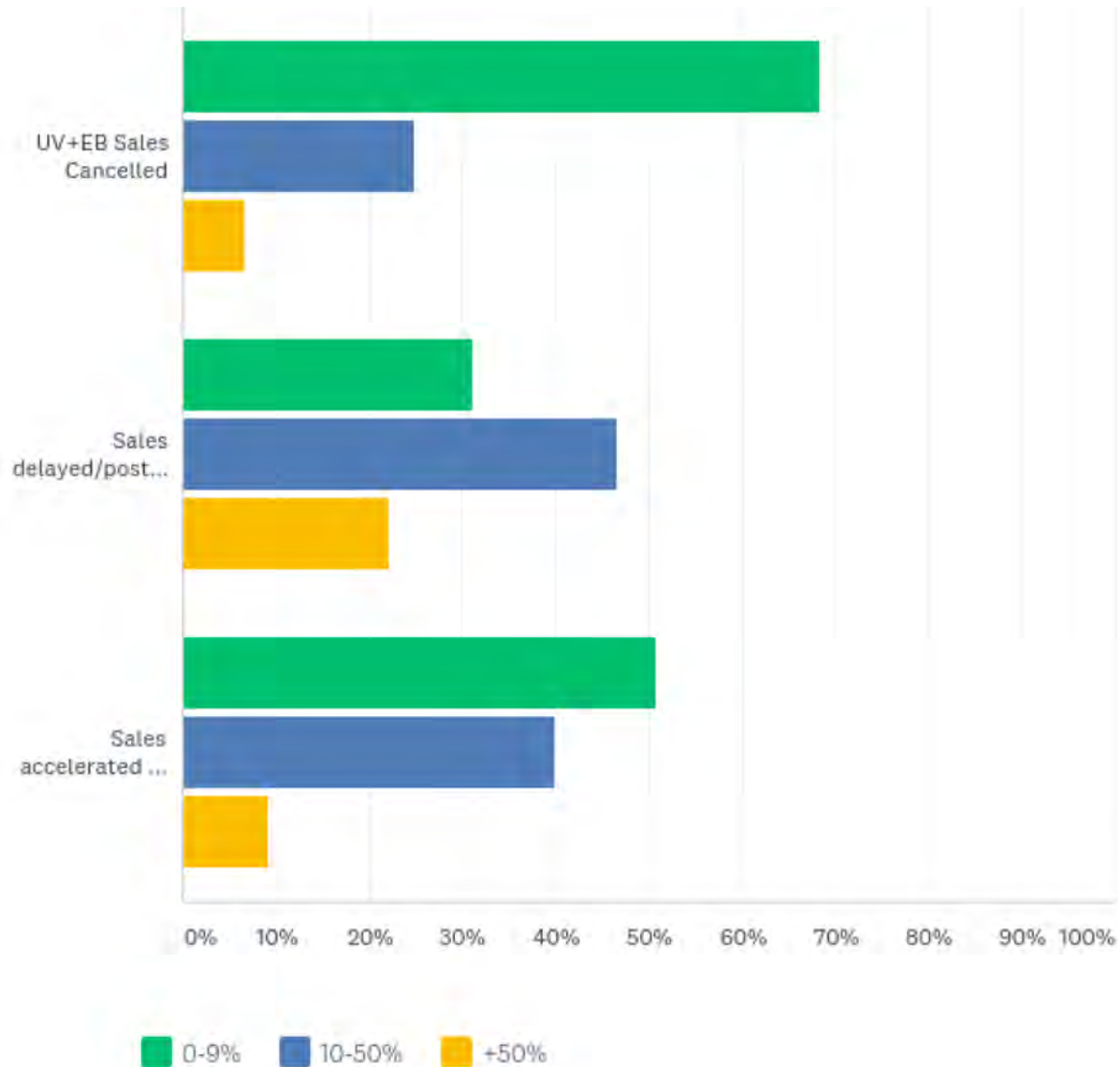
b. Data are shown on a fourth-quarter-to-fourth-quarter basis.

COVID-19--UV+EB Industry Impact Survey

Monday, April 27, 2020 – 97 responses



As a result of the outbreak of COVID-19, what are you hearing from your customers regarding the continuation of UV+EB business?

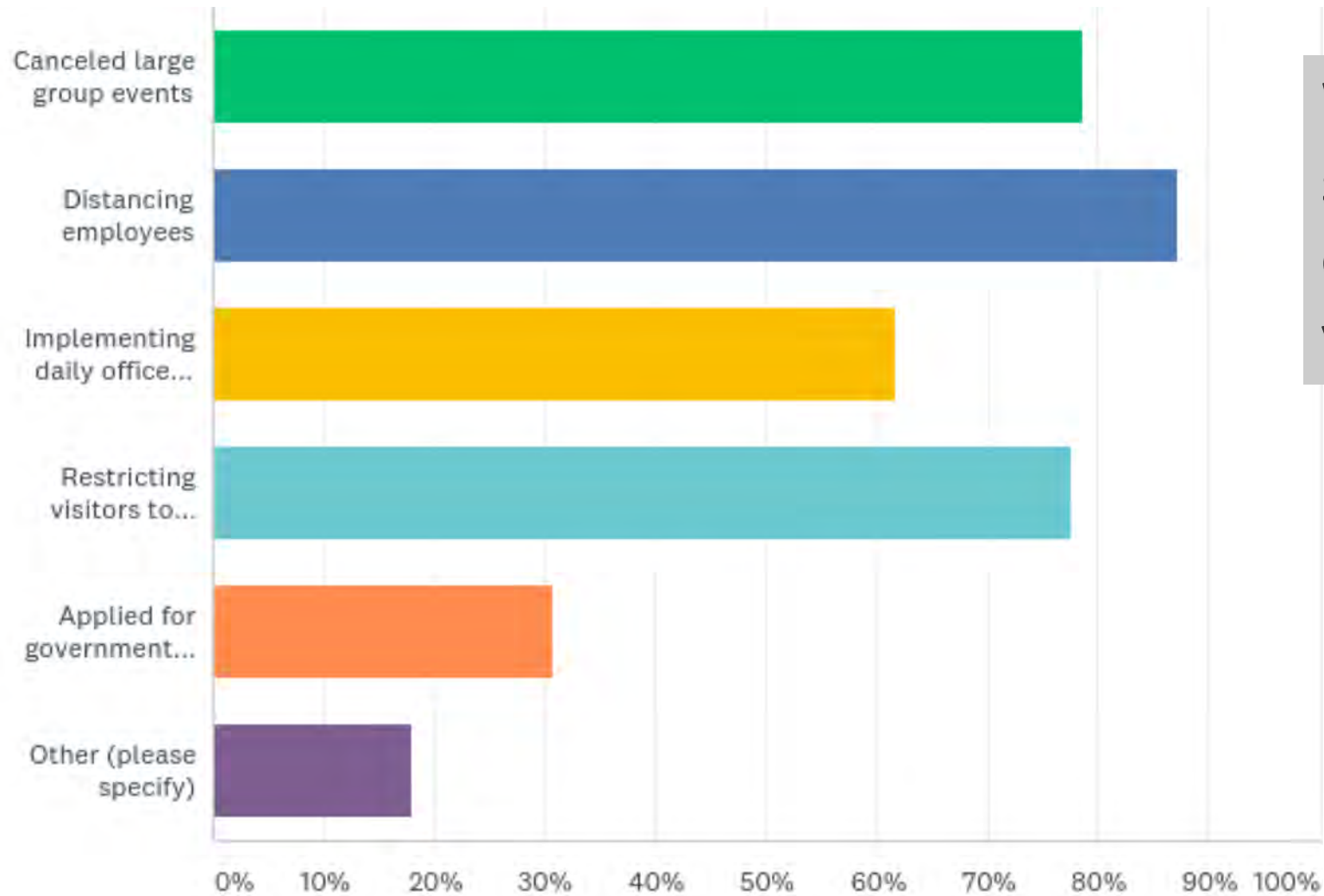


What percentage of your UV+EB business has been impacted compared with your expected (before COVID-19) business?

	<u>2020</u>	<u>2021</u>
Disinfection equipment	4.3	4.2
Medical devices	4.0	3.9
Food/consumer goods packaging	3.6	3.7
Labels	3.3	3.5
3D printing/additive manufacturing	3.0	3.5
Plastics	2.8	3.2
Electronics	2.6	3.2
Commercial printing	2.3	2.8
Wood and building products	2.3	2.7
Aerospace	1.9	2.8
Automotive	1.7	2.8

How will UV+EB demand be impacted in the following market segments as a result of COVID-19?

Ratings:
 1 = significant negative impact
 2 = some negative impact
 3 = no impact
 4 = some positive impact
 5 = significant positive impact



What are the most significant impacts of coronavirus and actions your company taken

Trends that may emerge out of current situation that may help demand for UV+EB

- Increased focus on **sustainability**
- Made in USA; need reliable suppliers
- Direct to consumer will continue strong
- UV disinfection
- Industries such as automotive/aerospace/medical will **become more innovative**
- **Antimicrobial** UV coatings
- **Less use of solvents** in formulations
- **3D Printing/Additive** manufacturing is showing its worth
- Development of **sustainable single use products**
- More **research into UV+EB** to meet new demands
- Smaller, more frequent orders
- **UVC LEDs** will become more cost effective
- Need for **faster, flexible production**
- The general public is becoming more **aware of UV**
- More consumer telecom, electronic devices for commerce and personal use/plastics demand for UV

New Initiatives that members are undertaking due to COVID-19

- Donating face masks to hospitals, communities and customers
- Making sanitizer
- Providing contributions to institutions that help seniors and people in need
- Designing UVC air sanitizing units.
- Providing health care products to vulnerable (people most in need/less privileged)
- Helping spread the correct news for use of UV
- More online troubleshooting and training
- Developing alcohol & chlorine free sanitization and hand washing solutions
- B2B contributions to local producers for sanitizers and cleaners
- Making hand sanitizer donations to local business and shops
- 3D printing PPE and testing equipment to support medical community
- Helping reengineer processes to 3d printing/additive manufacturing
- Increasing manufacturing of printing ink for food and medicine packaging
- Developing a UV Sanitizer for N95 Masks (a few like this)
- Donating hardware & expertise towards solutions to protect frontline healthcare workers
- Making EtOH for medical applications
- We are 3D printing face shields
- Increased production capabilities and hiring employees that have become available due to production plant closures at other companies.
- Accelerating development of UV-cured materials for medical products

RadTech Market Research 2020

UV+EB Emerging Applications

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Could this extra squishy new material mean safer bike helmets?



JOHNS HOPKINS APL'S
BREAKTHROUGH FLEXIBLE,
CUTTABLE LITHIUM-ION
BATTERY NOW WON'T
CATCH FIRE



MAJOR IKEA SUPPLIER IN
EUROPE USES UV LED
CURING IN FURNITURE
FINISHING



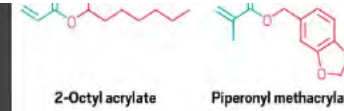
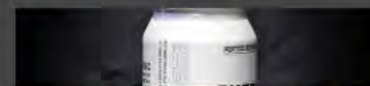
WASTE COOKING OIL
TURNED INTO 3D
PRINTING RESIN



NAIL ENAMEL GETS
GREENER



GETTING FLOORED FOR
ALL THE RIGHT REASONS



SELF-STICK ADHESIVE
MADE WITH BLACK PEPPER
DERIVATIVE ADJUSTS TO
MANY TASTES



WORKHOLDING
ADHESIVES FOR OPTICAL
AND CERAMIC
COMPONENTS



EVERYTHING THAT GOES
INTO MAKING A NEW
BALANCE SNEAKER

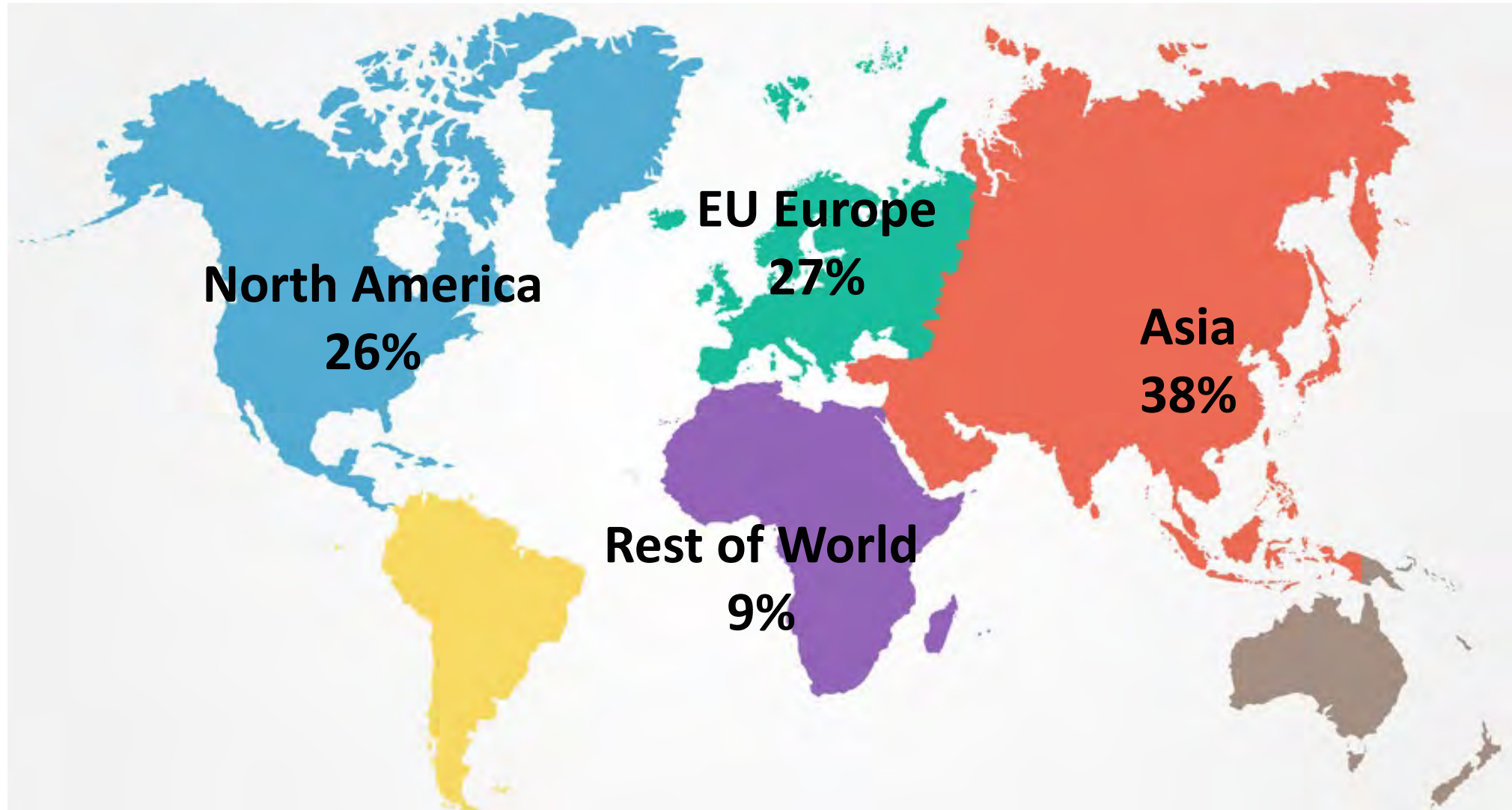


UV+EB Formulated Product Sales Growth in North America, by Volume (percent change from previous year)

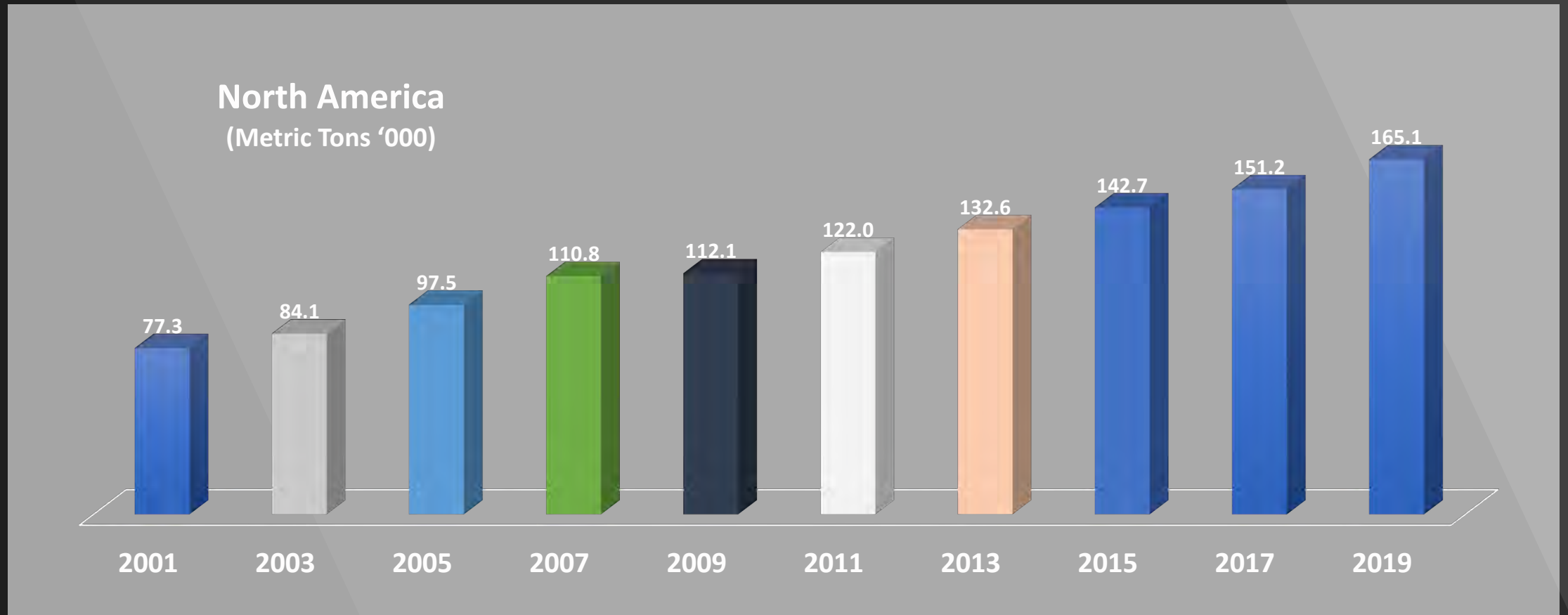
2019 (e)	3.7%
2020 (f)	4.6%
Next 3 year Annual Avg (f)	5.0%

Global Market for UV+EB

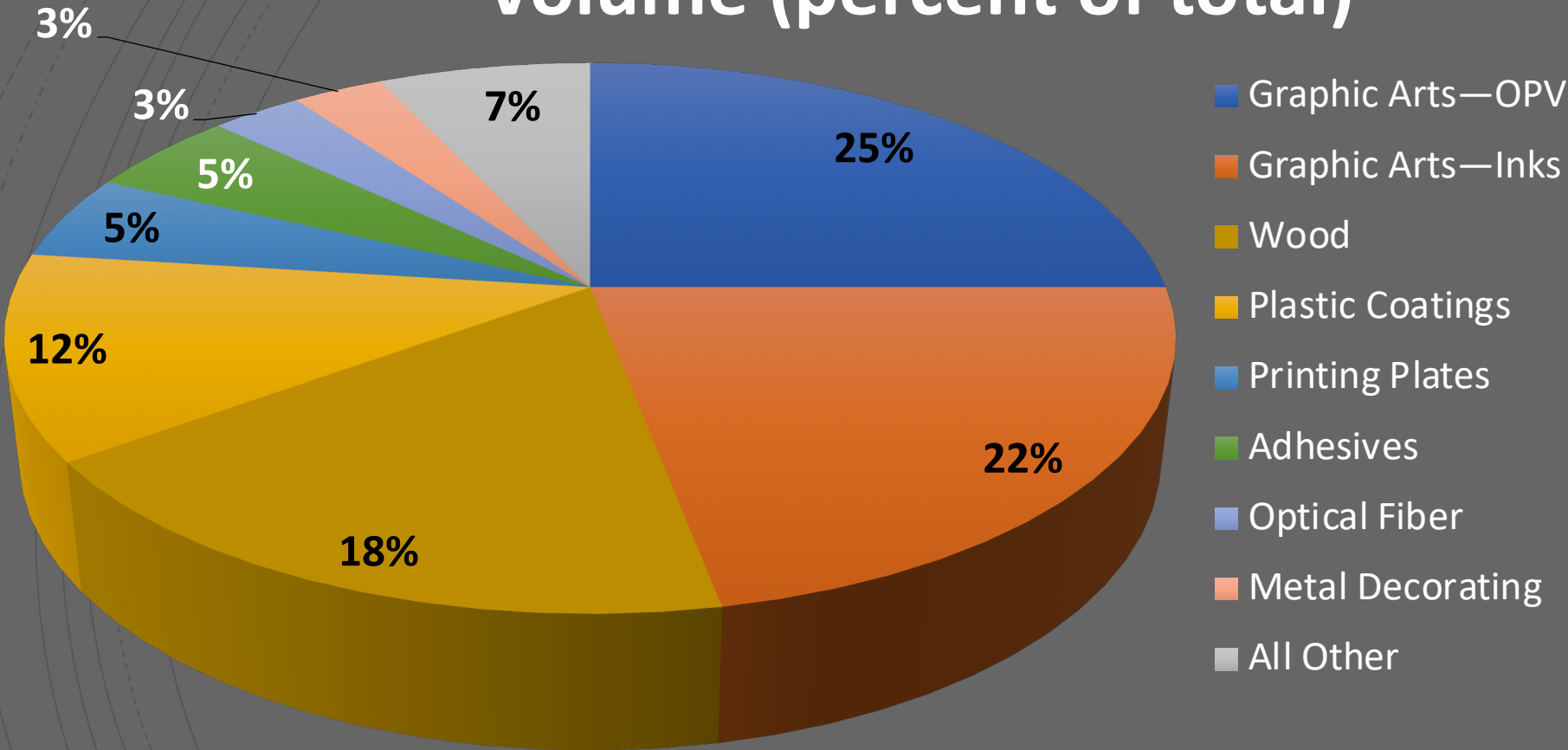
RadTech NA Survey 2020



UV+EB Formulated Product Usage 2019, By Volume

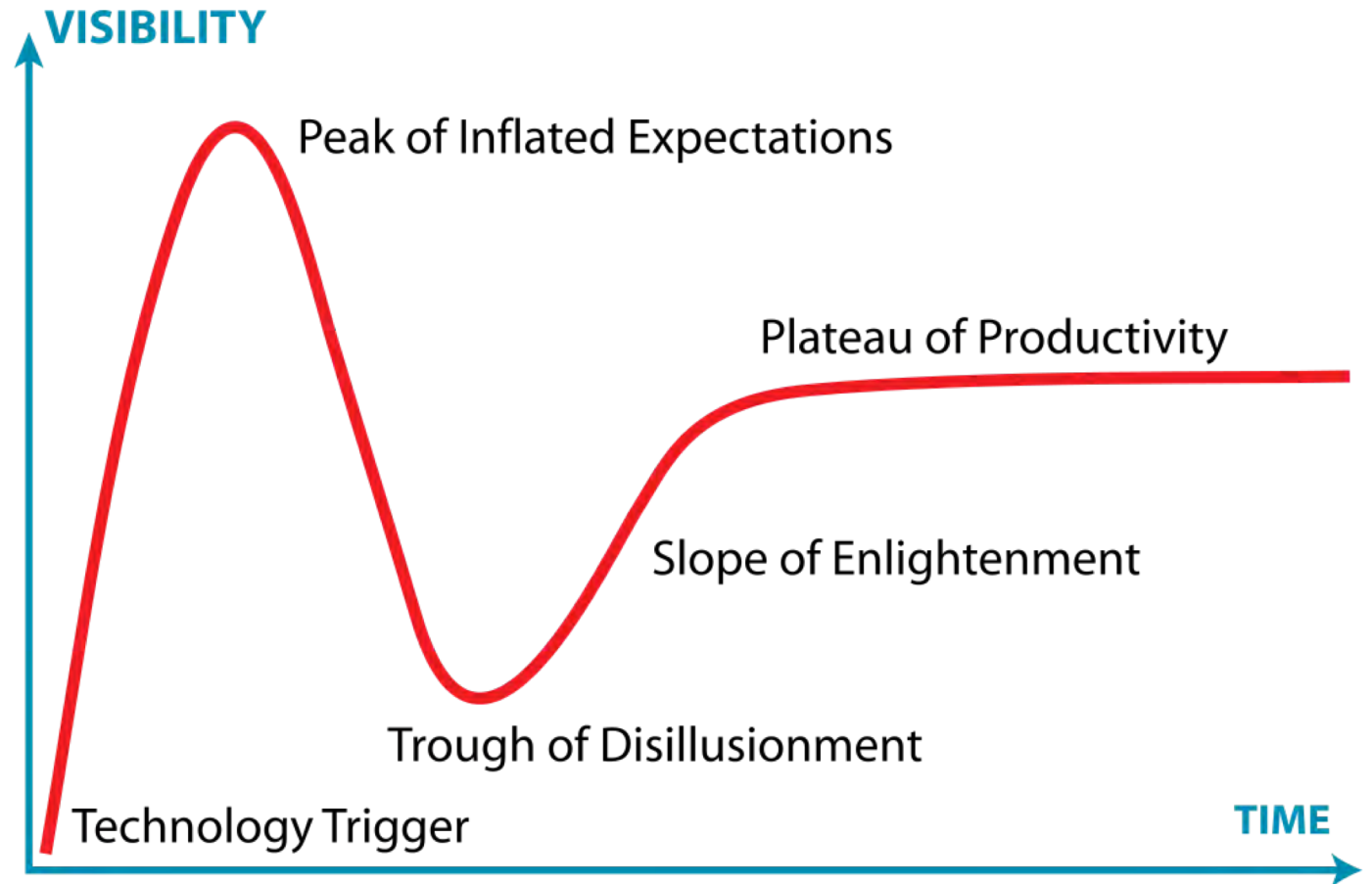


2019 UV+EB Formulated Product Usage by Volume (percent of total)



3D Printing?

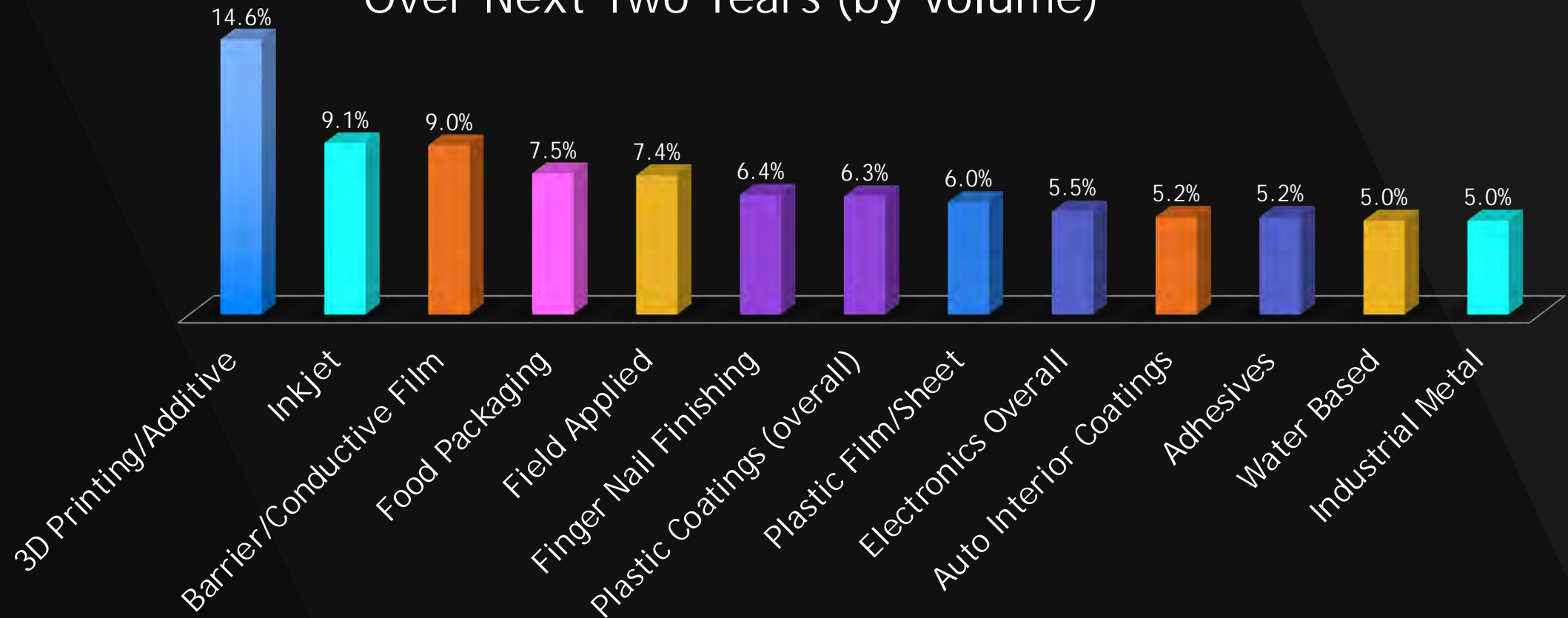
Gartner Hype
Curve



Next 2 Year Forecast

RadTech Biennial Survey 2020

UV+EB Products:
Average Annual Growth Rate
Over Next Two Years (by Volume)



UV+EB Formulated Product Usage by Volume

Other Categories We Track

- Graphic Arts Clear OPV
- Off-Set (Litho) Inks
- Screen Printing Inks
- Flexo Inks
- Letter Press Inks
- Inkjet Inks
- Wood Fillers
- Wood Stains and Sealers
- Wood Pigmented Coatings
- Wood Clear Finishes
- Wood Flooring (Prefinished)
- Metal Tubing & Pipe
- Metal Name Plate
- Metal Wire Coating
- Electronic Adhesives
- Electronic Photoresists
- Conformal Coatings
- Silicone Release Coatings
- Optical Fiber-Coating, inks, matrix
- Printing Plates (Flexo & Off Set)
- Stereolithography/Additive manuf.
- Dental Applications
- Medical Apparatus
- Plastic Film & Sheet (exclude Vinyl Flooring (Tile & Sheet)), incl. display film, auto film, optical film, window film etc.
- Vinyl Flooring (Tile & Sheet)
- Plastic Auto Lens & Reflectors
- Plastic Interior Trim
- Plastic Flooring (Prefinished)
- Adhesives--Optical
- Adhesives--Pressure Sensitive
- Adhesives--Laminating
- Can Coating Inks
- Can Coating OPV
- Can End Varnishes

UV+EB Formulated Product Curing Distribution by Equipment Type North America

Conventional UV	74%
UV LED	15%
Electron Beam	6%
Dual Cure/Hybrid Cure	5%

Motivations for using UV+EB

- Improve Physical Performance
- Increase Productivity
- Enabling/New
- Green Technology/Environmental Compliance

Advances

Most Important
In Last 2 Years

- UV LEDs
- Better UV Technology Overall
- Better Adhesion
- Sustainable Materials

Needs

To Address

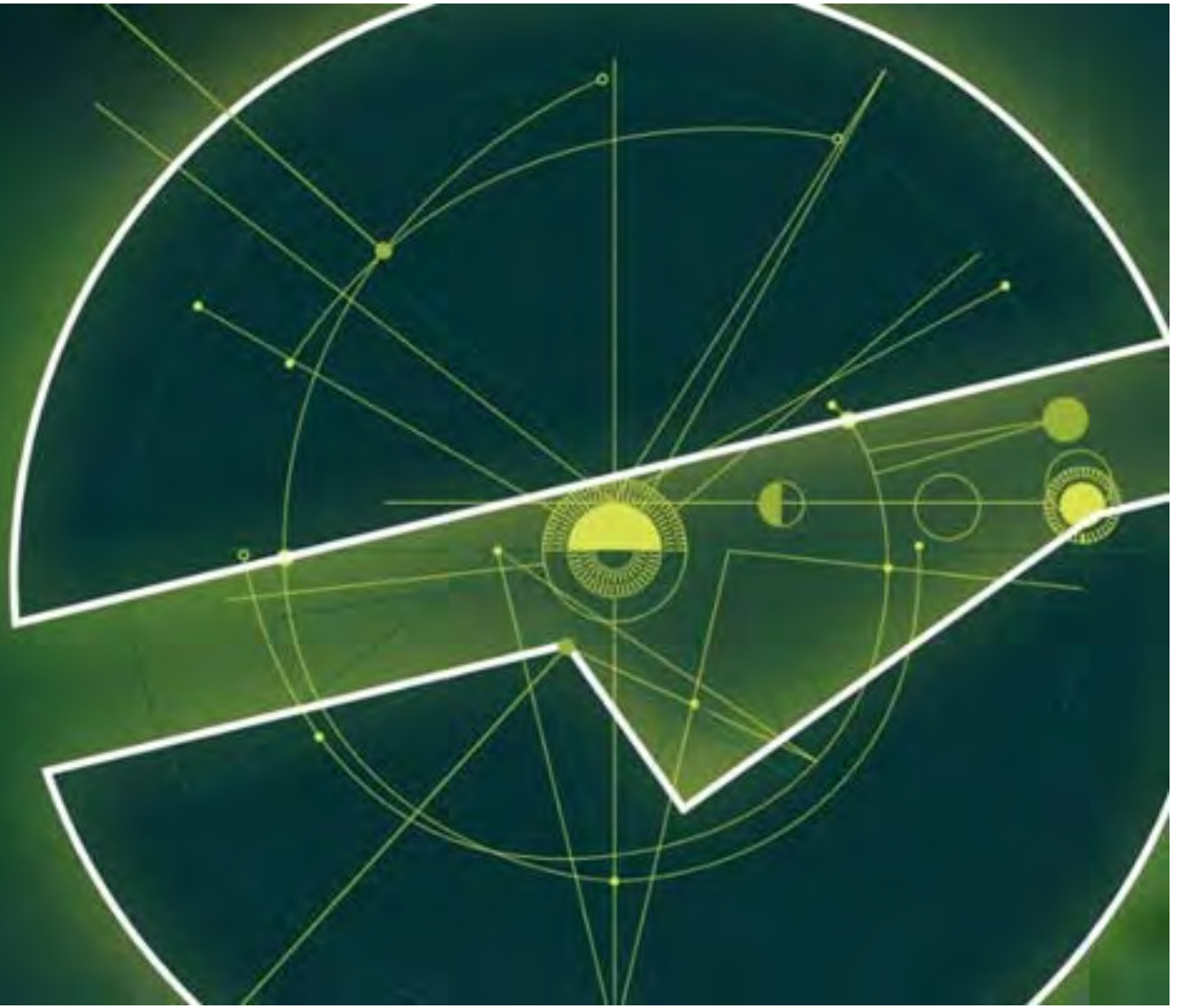
- PI for UV LEDs
- Regulations
- Improved weatherability
- Sustainability
- Concerns About migration
- Adhesion

RadLaunch 2020

Connecting Technology Start-Ups to UV+EB Industry Leaders

A Unique Idea Accelerator for UV+EB Start-ups, Students & Innovators





Thank you!

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