

When it comes to UV LED, most overlook the Big Ideas...

BIG

IDEAS

FOR UV+EB TECHNOLOGY



Eminence UV

SHINING LIGHT ON BIG IDEAS

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March 19, 2019

What are Big Ideas?

- Grant Wiggins (1950 – 2015)
- Ed.D. from Harvard University
- B.A. from St. John's College in Annapolis
- President of Authentic Education
- Specialist in educational reform
- Author of article *What is a Big Idea?* - June 2010
www.authenticeducation.org/ae_bigideas/article.lasso?artid=99
- All definitions, explanations, and examples of Big Ideas in this presentation are sourced to Wiggins's article



Grant Wiggins

What are Big Ideas?

- **Theories** that are concrete, useful, and allow us to make sense of confusing experiences and isolated facts
- **Inferences** that are insightful and meaningful enough to have real impact
- **Frameworks** that allow us to see better and work smarter
- **Rules of thumb** that help structure thought and remind us of universal principles

Ideas are not genuine unless they are tools in a reflective examination that solves a problem.

Source: John Dewey (1910) – *How We Think*.

Ideas are not Big unless they are Powerful.


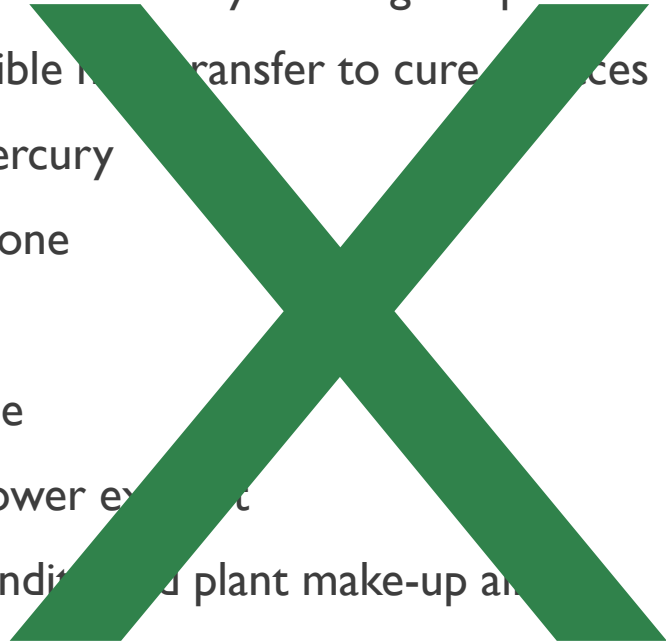
Source: Grant Wiggins (2010) - *What is a Big Idea?*

What are Big Ideas?

- They are the theories, not the details
- They are the lenses used for looking, not the objects seen
- They are the themes of a narrative, not the elements
- They are the overriding strategies in a game or business plan, not the individual plays, skills, tactics, or deliverables
- They are the easy to remember proverbs, without all the reasoning and experience that backs them up

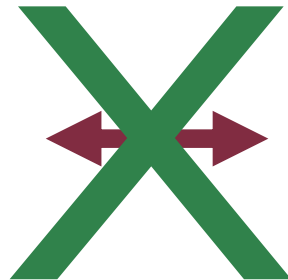


Big Ideas are not UV LED product features...

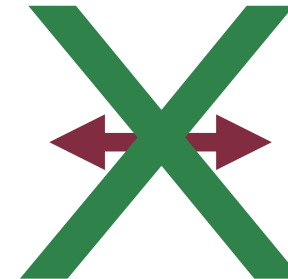
- Long life
 - High irradiance
 - Consistent output over time
 - Instant on/off
 - No warm-up/cool-down cycles
 - No shutters needed
 - Solid-state
 - Compact
 - Arc/LED compatible
 - Blended wavelengths
 - Energy efficient
- 
- Easy integration
 - Near-ambient array housing temperatures
 - Negligible heat transfer to cure surfaces
 - No mercury
 - No ozone
 - Quiet
 - Reliable
 - No blower exhaust
 - No conditioned plant make-up air
 - No radio frequency emissions
 - Air and water-cooled designs
- 

Big Ideas are not UV curing technology swaps...

Electrode UV



Microwave UV



UV LED



...for doing the exact same thing.

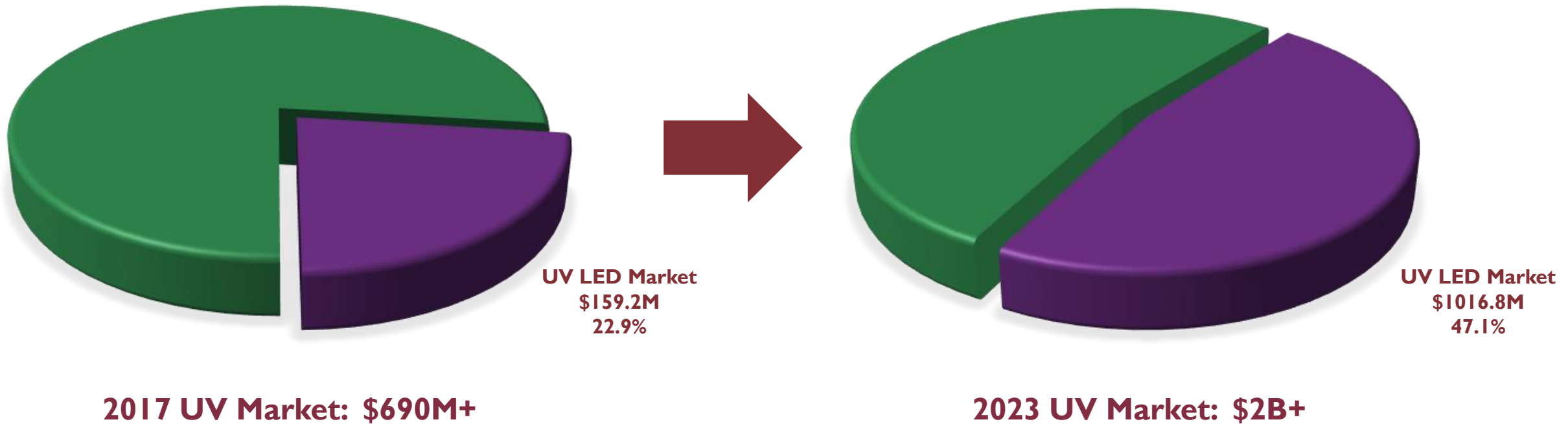
Most UV LED marketing strategies...

- Focus on capturing market share in conventional UV curing applications
- Focus on product features
- Fail to communicate true differences in technology
- Don't typically provide data backed justifications for solving problems
- Don't clearly communicate why a particular UV LED curing solution is best suited for an application
- Don't promote, leverage, or pursue the true Big Ideas



UV market share - LED vs mercury

Yole UV LED 2018 Report



*Yole data includes systems for water and air disinfection and sterilization, analytical instruments, medical phototherapy, photocatalytic purification, counterfeit detection, UV curing, and R&D.

A few Big Ideas for UV LED curing include...

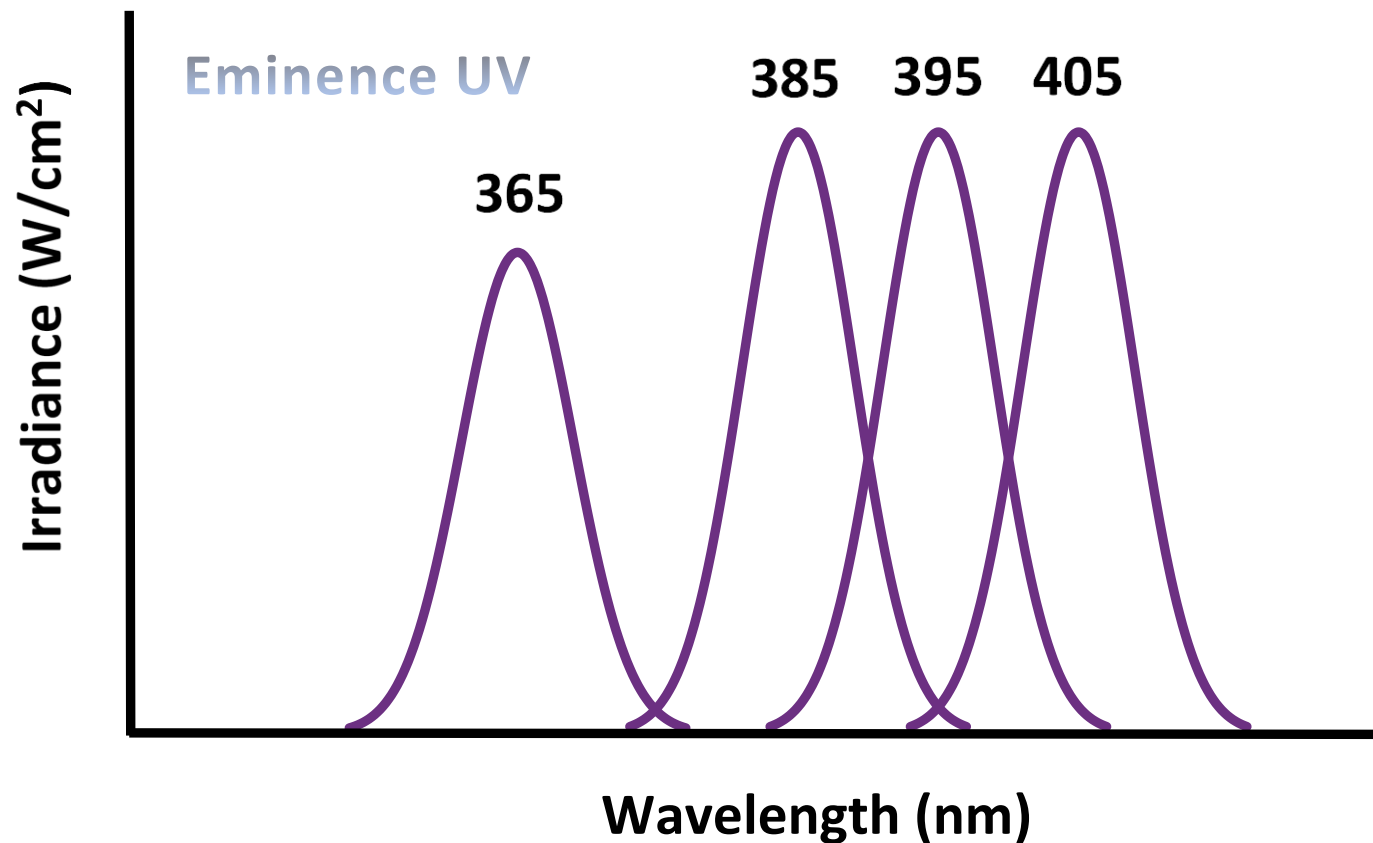
- **Theory:** UV LED enables new applications
- **Theory:** UV LED enables process optimization and manufacturing efficiencies & sustainability
- **Rule of Thumb:** define & maintain the UV LED process window to ensure application success
- **Theory:** UV LED enables food safe processes
- **Framework:** established guide for matching UV LED systems to a formulation and application (or reverse)
- **Rule of Thumb:** full cure at line speed is driven by energy density once the delivered UV is above the minimum irradiance threshold

Big Ideas activate thought, foster challenges, push boundaries, and spearhead testing of inferences that ultimately help users validate Big Ideas for their own unique set of product, manufacturing, and application conditions.

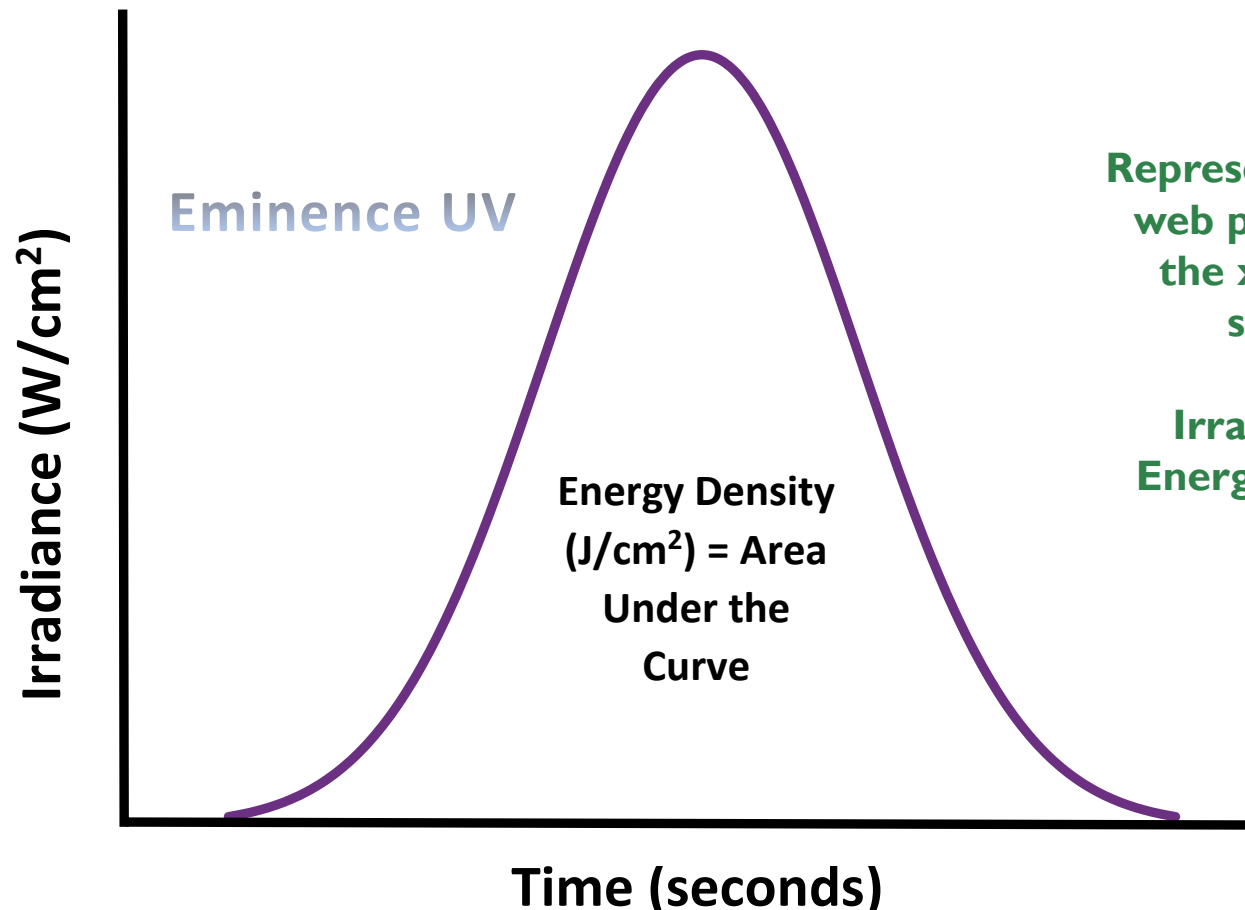
Focus on the Big Ideas and let UV LED technology follow as the solution

- UV LED is still a technology **Push**. It should be an application **Pull**.
- Put the needs of the application and manufacturing process first
 - Ask essential or Socratic questions that are built out of Big Ideas
 - Frame and re-frame
 - What is the current state?
 - What are the problems and challenges?
- How might UV LED be the answer to the manufacturing problem(s)?
- Suppliers should be skilled at constructing a proper understanding of UV LED and asking essential questions that foster engagement and reflection around Big Ideas
- Engaged end users and OEMs can then apply acquired and properly understood UV LED knowledge to 1) do something that couldn't be done before or 2) do something that is currently being done better
- When Big Ideas are pursued, supply chain collaboration quickens the process and improves the results

Set of available UV LED wavelengths is discrete



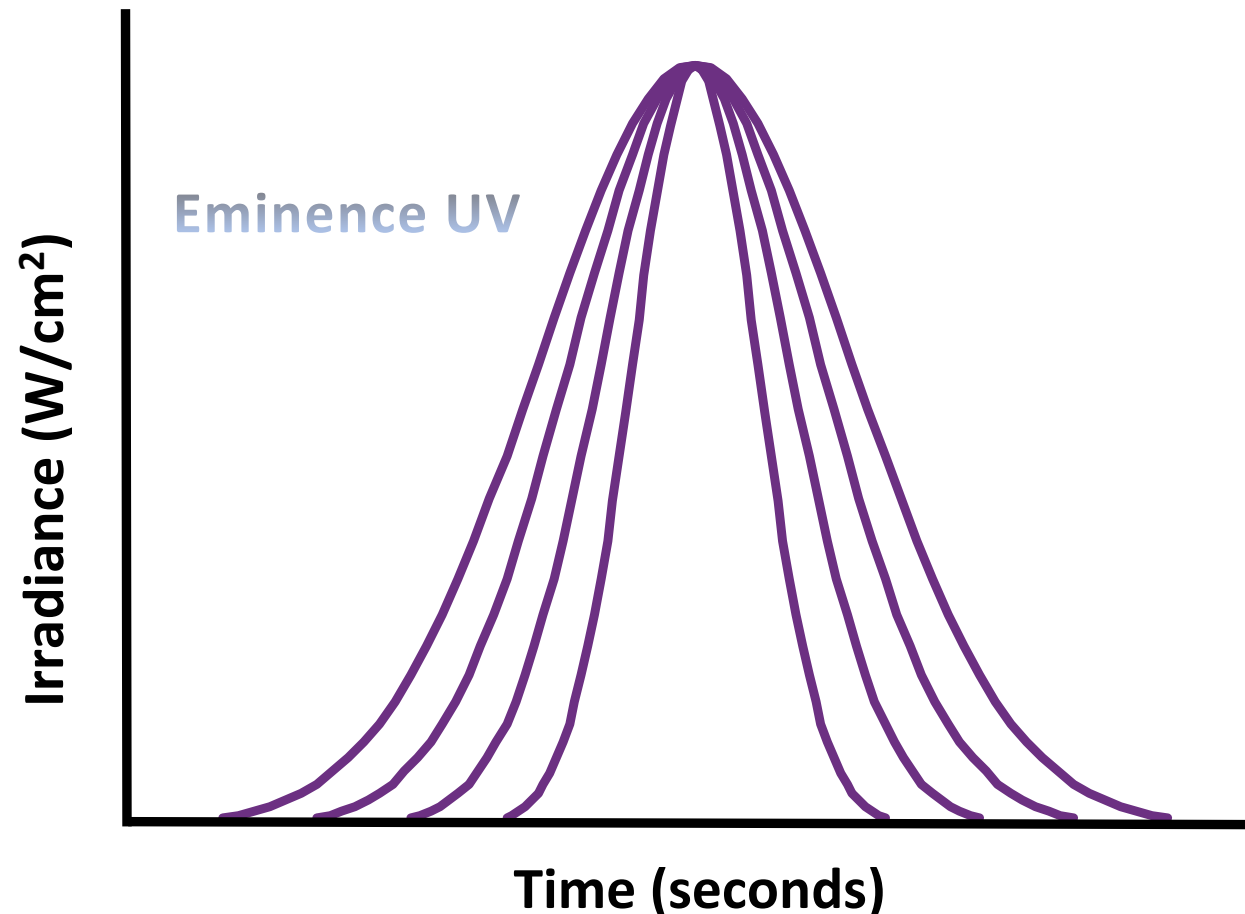
Energy density is the integral of irradiance over time



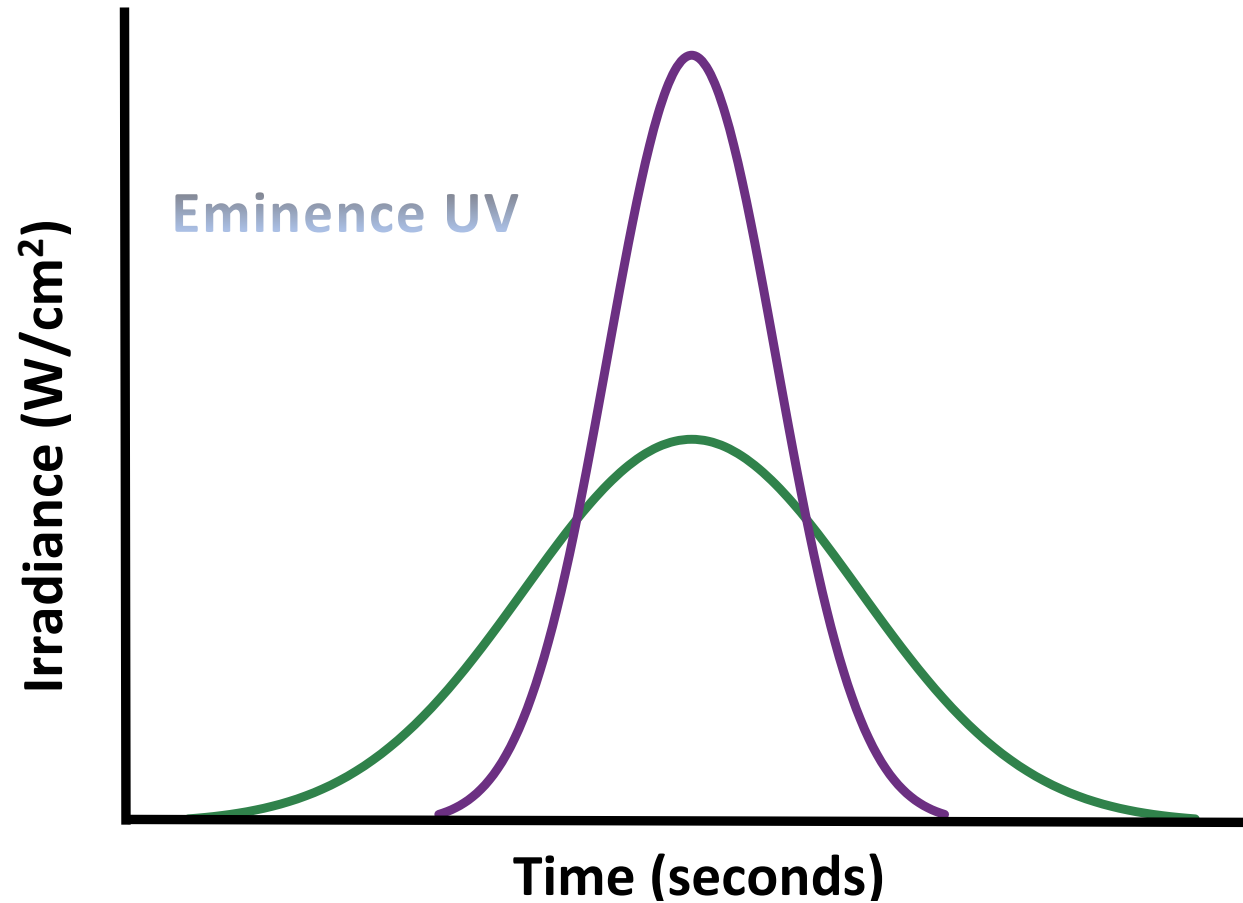
Representation of a part, sheet, or web passing horizontally (along the x-axis) and underneath a stationary UV source.

Irradiance is the power and Energy Density is the delivered energy.

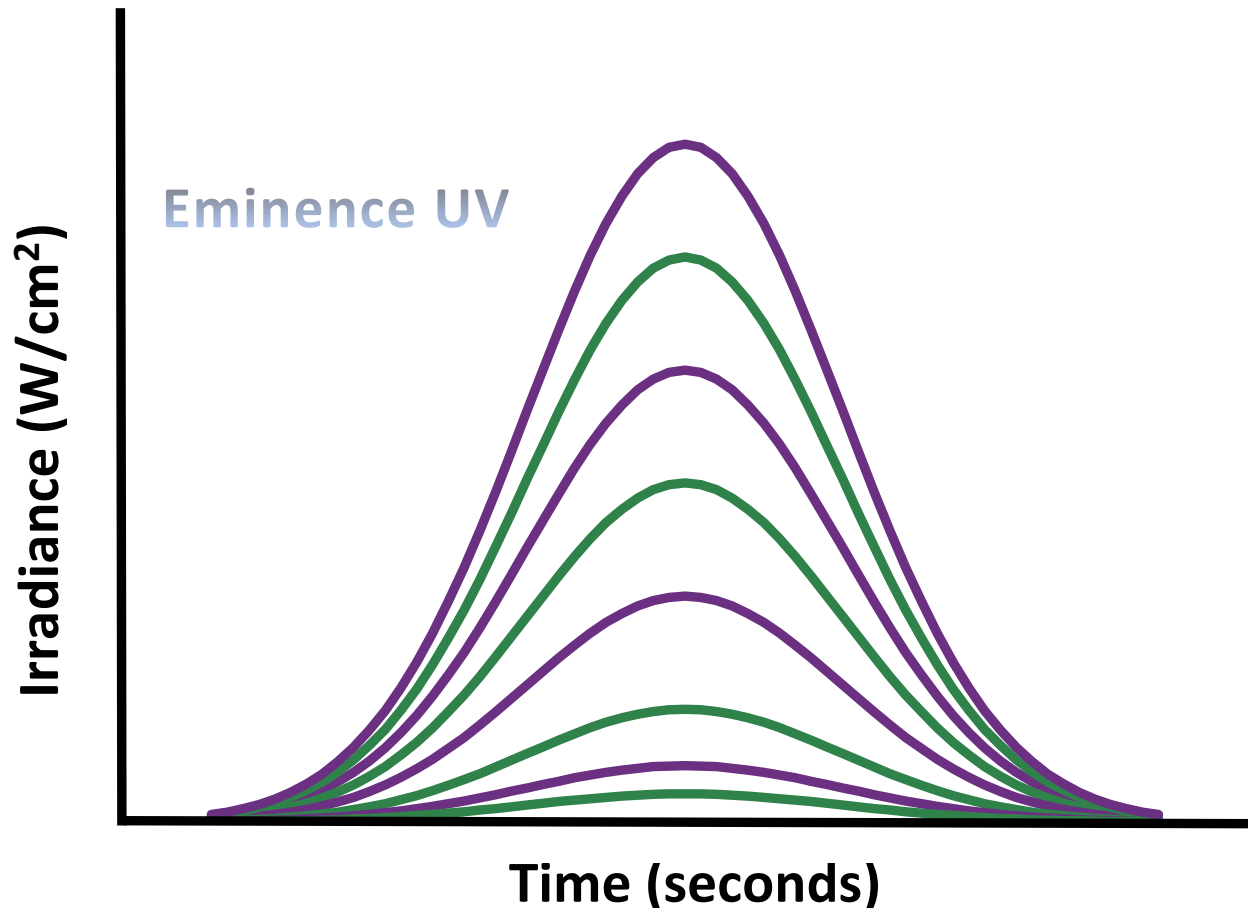
UV LED peak irradiance is an inadequate predictor of energy density



Unequal UV LED peak irradiances can produce equal energy densities



Understanding UV LED output is so much more than peak irradiance

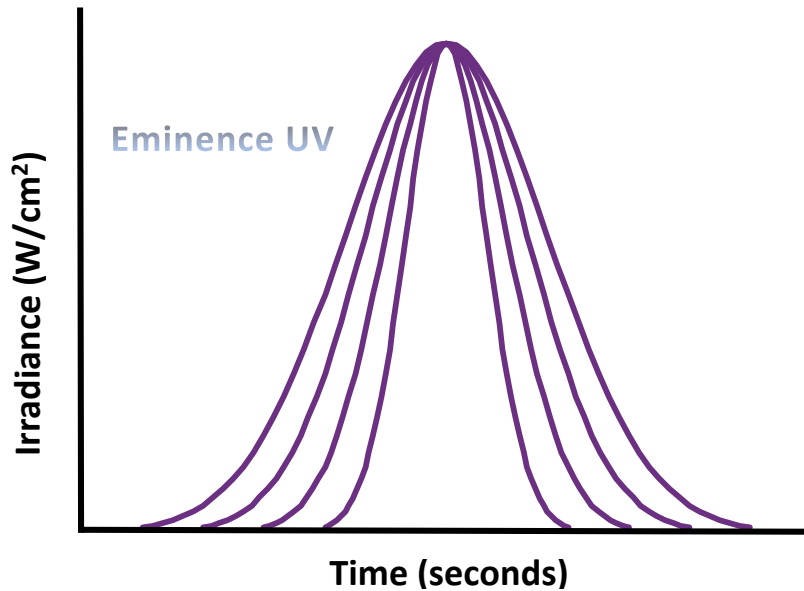


Device	Peak Irradiance (W/cm ²)
LED	0 – 50 plus
Microwave	1 - 5
Arc	1 - 3

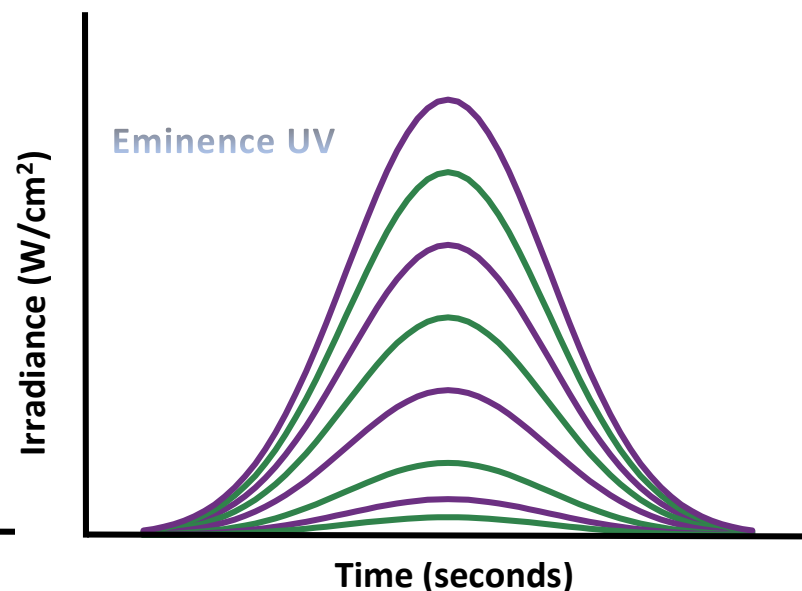
There is a lower and upper limit irradiance threshold with arc and microwave systems. There is no lower limit threshold with LED and a significantly higher upper limit.

There exist unlimited UV LED irradiance & energy density configurations

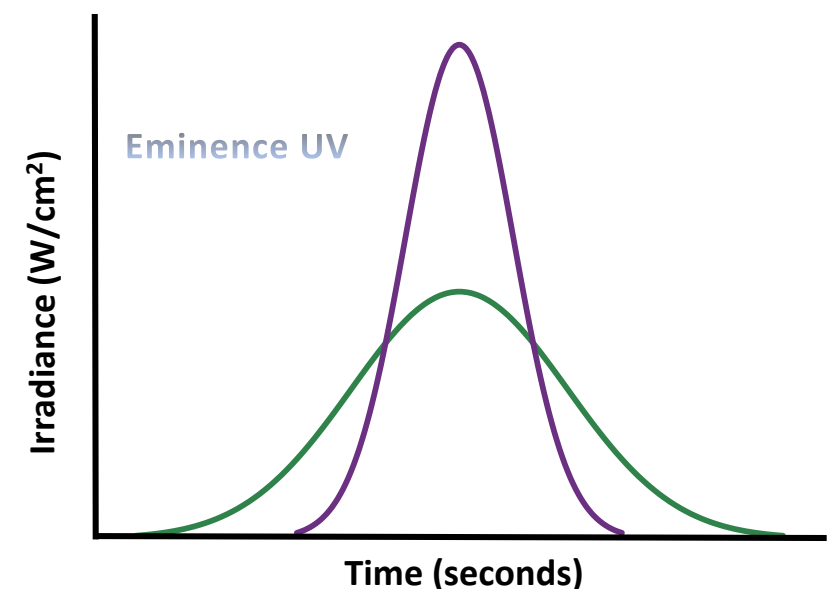
**Same Irradiance
Different Energy Density**



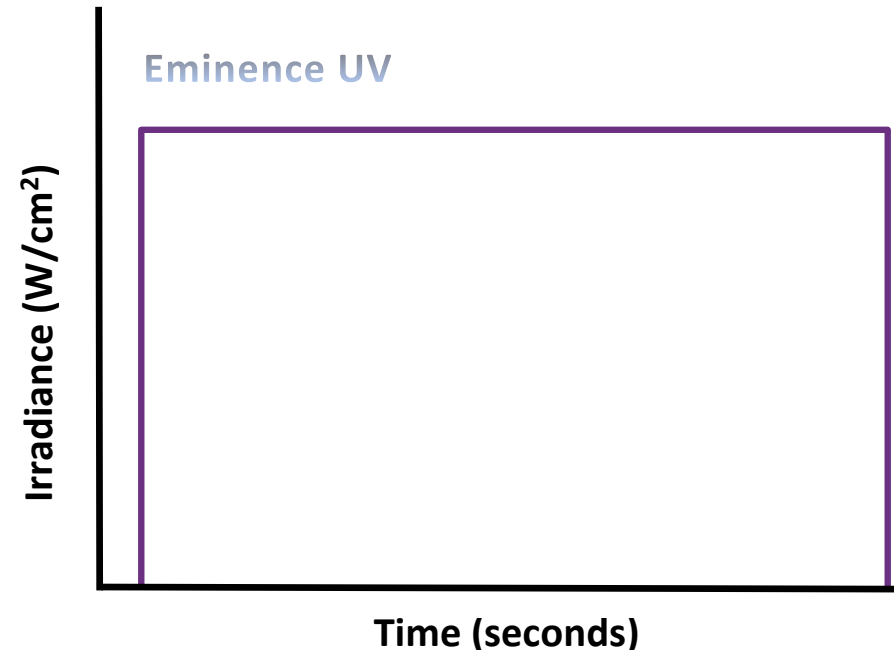
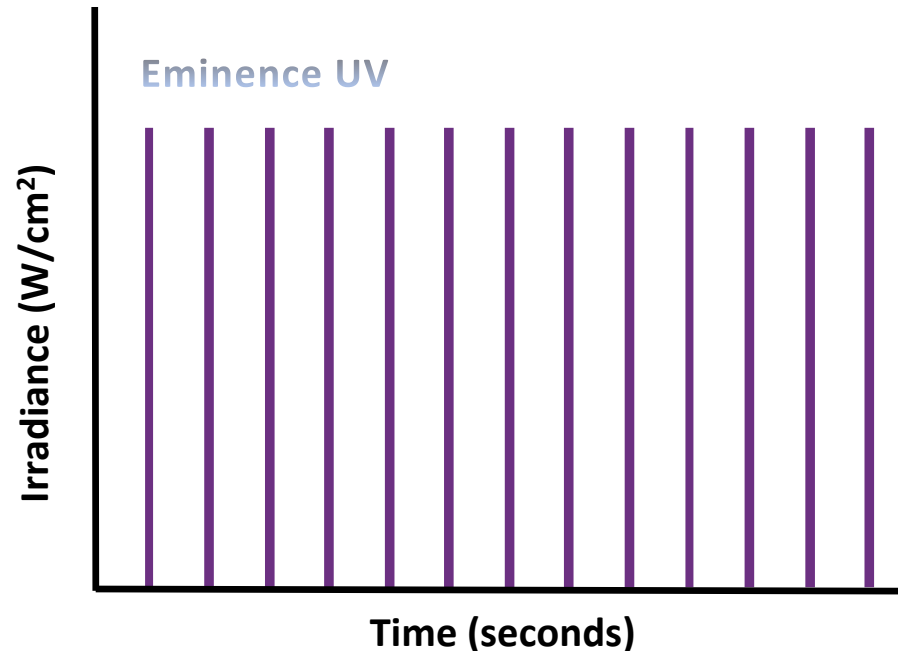
**Different Irradiance
Different Energy Density**



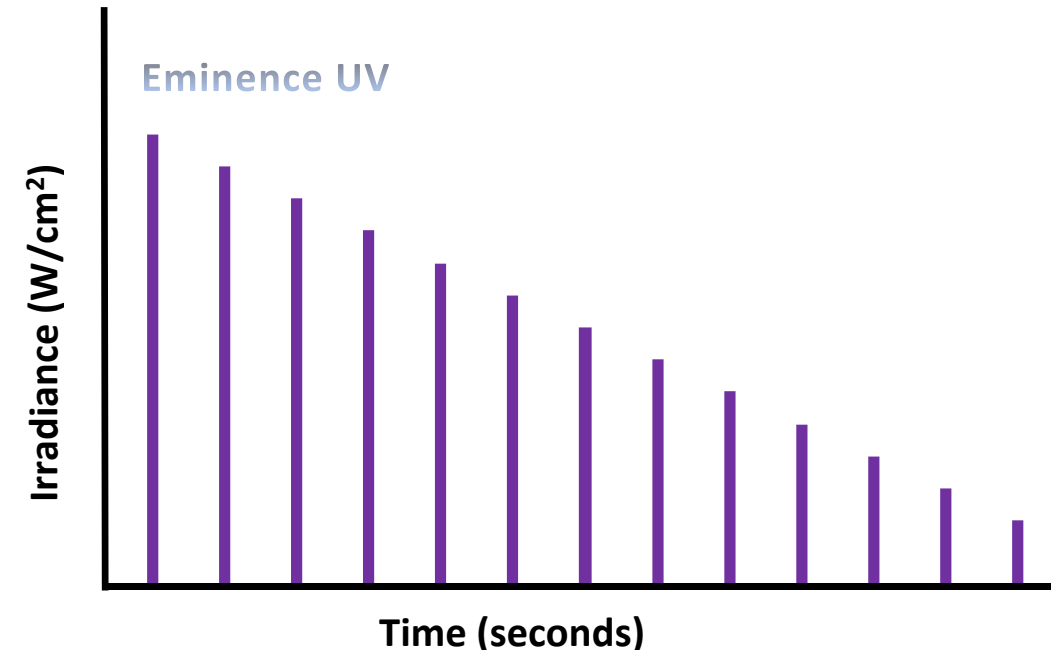
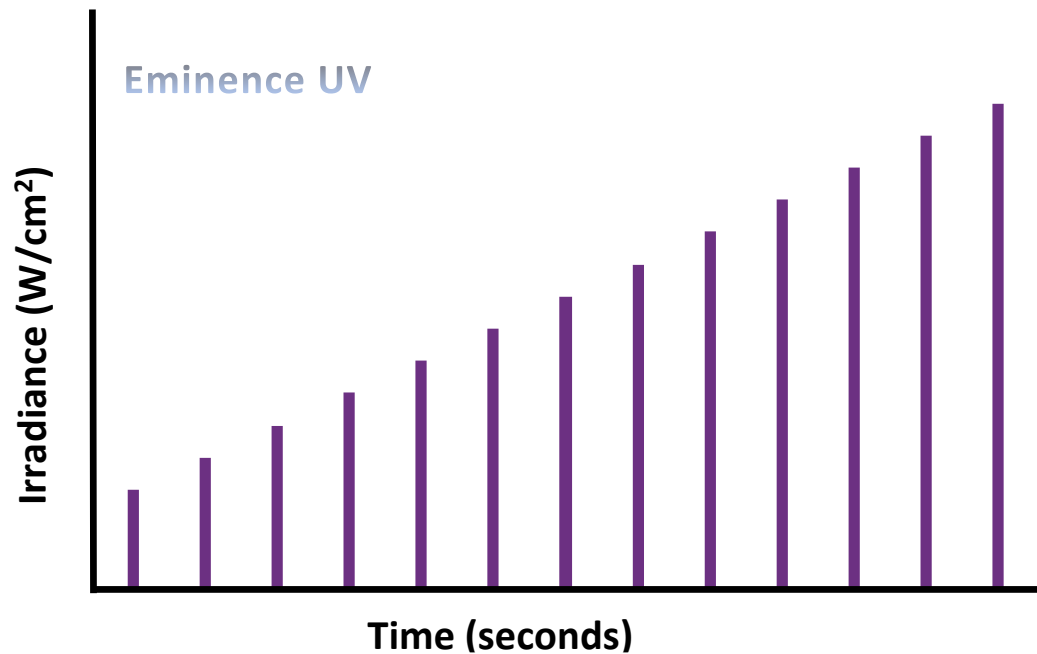
**Different Irradiance
Same Energy Density**



There exist unlimited UV LED pulsed and steady state outputs



There exist unlimited UV LED variable pulsed (or continuous) outputs



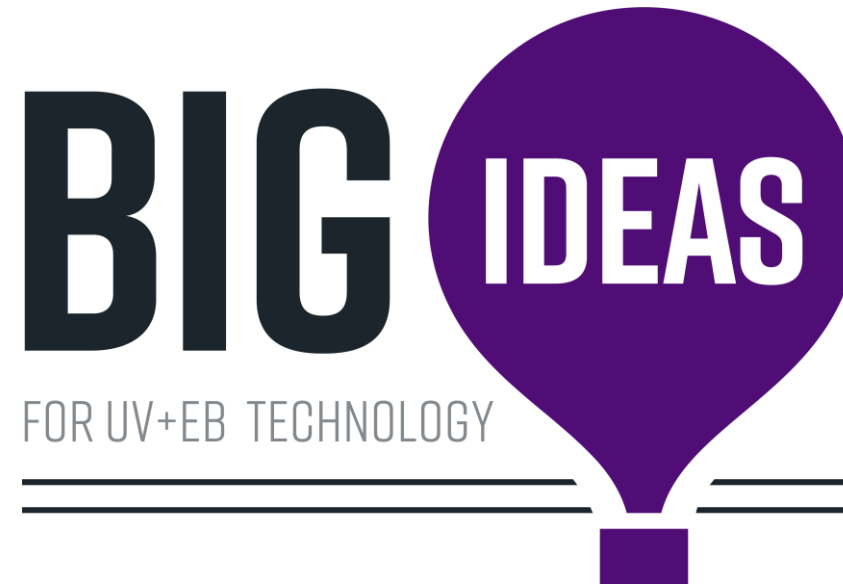
Balancing the pursuit of Big Ideas vs annual financial targets



- **Typical Supplier**
 - Driven by annual sales budgets and year-over-year growth
 - Primarily focused on capturing or protecting market share in established markets
 - Few have patience to pursue Big Ideas which may take 3, 5, 7, or 10+ years to properly develop and commercialize
- **Typical End User**
 - Doesn't always have resources to support long term development or even short term investigative research
 - Doesn't always clearly define problems the technology is meant to solve
 - Those that pursue Big Ideas need more support from supplier market. Learnings drive more optimal product development by suppliers (win-win).

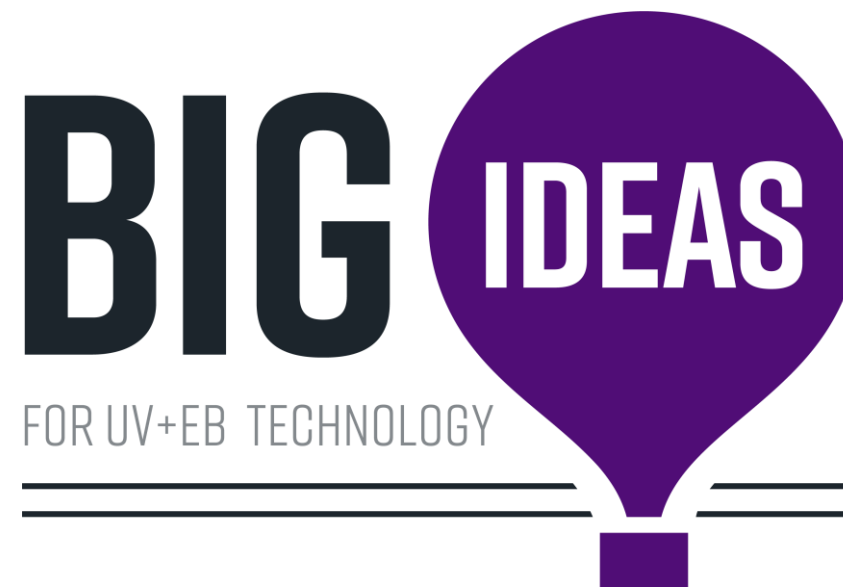
Industry players in positions to drive Big Ideas in UV LED...

- Raw material suppliers
- Formulators
- UV LED system suppliers
- OEM machine builders
- Integrators
- Multi-national converters
- Consumer brands
- End users



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Those that pursue Big Ideas need more support from the supplier market.

Learnings drive more optimal product development by suppliers (win-win).

The result is Application Pull vs Technology Push.



Eminence UV

Thank You!

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