Implementing UV LED Technology for Screen Printing

Our Sustainability Journey

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Our Sustainability Journey

Learn how one Screen Printing company became the first to successfully implement UV LED ink curing technology for screen print manufacturing. This presentation will tell the history and sustainability journey of Empire Screen Printing. Learn the why, how and what motivated Empire to partner up with industry leaders to develop UV LED ink curing technology.
What is Sustainability

Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations.

(https://www.epa.gov/sustainability/learn-about-sustainability#what)
What is sustainability in business?

Definition of business sustainability. **Business sustainability** is often defined as managing the **triple bottom line** - a process by which companies manage their financial, social and environmental risks, obligations and opportunities. These three impacts are sometimes referred to as **people, profit and planet**.

$47,138 vs. $1,044
Empire Screen Printing

Nestled between the bluffs in Onalaska, WI, our surroundings remind us of our responsibility to the environment, our employees and our neighbors to operate our business in a socially responsible manner.
Our Capabilities and Products

- OEM (Original Equipment Manufacturer)
- POP (Point of Purchase)
- Aluminum Nameplates
- Overlays
- Roll Labels
- Decals

Screen Printing •
Flexographic Printing •
Digital Printing • Doming
Our Mission

At Empire, we are dedicated to being a cutting-edge print supplier. We create custom products that enrich our customers' brand and identity by providing a friendly, knowledgeable customer experience every time.

Our Vision

Empire is customer focused. We listen to both our internal and external customers and look to improve based upon their input. Through relentless pursuit of customer satisfaction, we work to grow our customer base and make our company strong. We develop our people by investing in education and training to empower them to make improvements to the products, services, processes and themselves. We concentrate on implementing sustainable production methods that are environmentally safe to protect our planet for future generations.
Our Core Values

**Respect:** Create a culture that inspires creativity and regard for one another's input and contributions.

**Integrity:** Demonstrate sound moral and ethical values to instill trust with our employees, customers, suppliers, and within our community.

**Responsibility:** Take the initiative to lead by example and challenge oneself to shape the future.

**Continual Improvement:** Have the ability to not only accept change, but to look for it through strategic goals and teamwork.

**Knowledge:** Take every opportunity to learn and share one's expertise.

**Excellence:** Never settle for good. Strive for greatness.
Early Years

James A. Brush founded Empire Screen Printing in 1960.

Culture of Self Reliance

1967 moved to the Marco Rd. Farm, Today 150,000 square feet of manufacturing space and employ 275 people.
In the early years, we printed by hand using solvent based inks.

Late 70's: we did our first testing using UV inks (this was a total failure)
Solvent Inks

- Sticks to everything
- Certified by end users in a multitude of industries
- 50% evaporation of solvent (High VOCs)
- Extensive Ventilation Systems
- Harmful to employees
- Large footprint
- Slow process times (Air Dry or Heat Ovens - Racks needed for drying inks)
- Not energy efficient
- Higher Maintenance cost/downtime
- Pay the state for permission to put hazardous vapors into the air
- Requires explosion proof room and special cabinets for storage
- Use press wash that contains just about every bad chemical you should avoid
Late 80s, through lots of trial and error we started printing with UV inks again.

1988 - present: ink and solvent recycling/reclamation procedures.

By 1998, 5% of our manufacturing was done with UV ink.
UV inks

- Better for the employees
- Solid inks, no evaporation (no VOCs)
- Manufacturing Process improvements
- Improved ink curing rate using UV light
- Improved quality and finer detail
- More opportunities to recycle the inks
- Easy storage
UV inks curing with Mercury Vapor Bulbs

- UV Mercury lights add heat to the curing process, which requires wait time between processes
- Material distortion from the Heat
- Lots of electricity to run lights
- Requires makeup air - Large ventilation systems
- Mercury bulbs produce ozone emissions
- Lights run continuously (time needed to warm up and cool down)
- Mercury bulb life: 1000 hours
- Prevent Maintenance 6 hrs. Per month
- Mercury bulbs are hazardous
2000s

Transitioned to using 95% UV to 5% Solvent

Expanded into Digital printing and cutting

Empire builds first 3-color UV Mercury Press

Invests into a 6-color UV Mercury Carousel Press

2007 - first Direct-to-Screen Unit
Recession hits almost every industry - we lose 27% of our business in less than a year

We needed to do something. Started implementing Lean Manufacturing practices: reduce waste | balance resources | implement one-piece flow | value added | Cellular Manufacturing

Jim Brush read an article about the use of LED technology in the digital print industry
2008 - Beta Testing

- Beta tested curing UV inks using LED lights

- Successfully manufactured using UV LED - we were the first to achieve this
2011 - Introduced UV LED technology w/ the first roll-to-roll screen printing ECO-press
Benefits of UV LED ink curing technology

- UV LED improved the manufacturing process to allow us to print from raw materials to finished goods in **one-piece flow**
- No heat in the process
- No material distortion, the ability to print on more substrates
- No ozone emissions
- No ventilation systems required
- Does not require makeup air
- Small footprint
- Bulbs last for 10 - 14 years
- Instant on/off
- Lower energy costs
- Less Downtime (Prevent Maintenance 1 hr. Per month)
- Environmentally friendly
- Inks are 30% more expensive
Cure Rate

8 Watt LED:
380 - 410 Nanometers
Produces UVA rays
95% Light
5% Heat

Mercury Vapor Bulbs
280 - 410 Nanometers
UVA, UVB, Heat
95% Heat
5% Light
Making the switch

UV Mercury 3 Color 12x14

Total Cost of the Machine: $290,890.00
(Includes Materials, Bulbs)

Cost per Mercury Bulb:
- Uses 6 bulbs
- 30 Replacement bulbs per year: ($162.00 each = $4,860.00)

Power Consumption
- Average AMPs: 56
- Voltage: 480 Volts 3 Phase (46.6 kW-h)
- kW per YR: 232780 kW ($0.10 per kWh)
- Total Power Consumption: $23,278.00

Exhaust
- 5000 CFMs (58 kW-h) (Air Handler?)
- kW per YR: 190,000 kW ($0.10 per kWh)
- Total Exhaust per YR: $19,000.00

LED 3 Color 12x14

Total Cost of the Machine: $290,890.00
(Includes Materials, 14.7° 8 Watt LEDs)

Power Consumption
- Average AMPs: 5.8
- Voltage: 208 3 Phase (2.09 kW-h)
- Total kW per YR: 10447 ($0.10 per kW-h)

No Exhaust
UV Mercury Curing vs. UV LED Curing

$47,138 vs. $1,044

*based on 5,000 hrs/ $.10 kwh

After 5 Years:
Cost of Machine: $526,580.00

After 5 Years:
Cost for Machine: $296,113.50
In 2015 - 2016, two additional presses were added (12x14 3-color UV LED unit and 40x46 6 color UV LED unit.)

Since 2012, we have seen a 7.90% decrease in total energy costs.

Cost per kWh has remained constant since 2012.
Sharing our Technology

2012: Created a Green Team, Empire adopted a formal sustainability policy and applied for Green Tier Certification

2012: Created a company wide recycle program

June 5, 2013 we were accepted into the WI Green Tier 1 recognition program

2014: established an Environmental Management System, which was approved by an external auditor in 2016

2015-2017: Member of the MPower cohort through WTC's Sustainability Institute

2016: WI Green Masters Professional

2016: Hosted the Wisconsin Sustainable Business Conference
Awards and Recognition

2013, 2015, 2016, 2017: SGIA Sustainability Recognition Award

2016: WI Family Business of the Year

2016: WI Sustainable Business Council - Process of the Year Award

2016: WI Manufactures and Commerce Business Friend of the Environment

2013, 2014, 2016: Nominee for Wisconsin Manufacturer of the year
Future Projects

Continue reducing our annual landfill waste (garbage audit)

Cut back on our reject factor to reduce material usage

Convert a 6-color UV Mercury press into a 12-color UV LED press

Lighting conversion: 404 fluorescent T12 bulbs will be replaced with 404 LED T8 bulbs
MPower Program

Marketing Sustainability: “Printing with Purpose”

Employee Engagement:

- Landscape project: reduce our mowing for a more natural landscape to help in water runoff and reduced fuel/man hours
- Clean up the grounds
- Employee survey
- Getting employees involved in going to the sessions

Builds awareness, understanding and knowledge
UV LED ink curing technology

With advancement and innovations in UV LED ink curing technology we created a manufacturing process that is both economically sound and environmentally friendly. Today, 50% of our screen print manufacturing uses UV LED ink curing technology.
Thank you