

The True Economic Savings of UV Light

By Michael Kelly

UV coatings today are being qualified and implemented in a variety of industries and applications. The true benefit to implementing UV is *true Economic Savings—Return on Investment*. Understanding these true costs of each area is critical to your **ROI+E**—Return On your Investment. And with UV, you get one better—return on the **Environment**.

UV coatings can make production faster, smaller and cleaner.

Some sample customer applications for UV Coating on metal substrates:



Colored Conduit



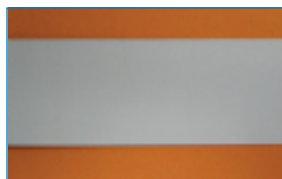
Propane tanks



Exchange Tanks



Security Product



Strapping

The main question is ... “Does the project have an acceptable economic ROI?”

In order to best answer this question, a detailed economic analysis needs to be completed. The following analysis was conducted on a conversion from 35% solvent-based liquid coating to UV 100% solids-based liquid coating.

Choose UV if you want **Faster**:

- Line Speed
- Coating Cure
- Coating Optimization

Choose UV if you want **Smaller**:

- Floor Space
- Work-In-Process
- Energy Consumption
- Maintenance Costs
- Capital Equipment Cost
- Quality Costs

Choose UV if you want **Cleaner** processes:

- Zero VOCs/No HAPs/NVPs
- Reduced Reporting
- Improved Health and Safety

Application: Hydraulic Cylinder Manufacturing

Overview—Black UV Coating on Cylinder

Substrate	Metal
Application	Rotary Bell Atomizer
Technical	High temperature will cause cylinder seal failure
Economics	Elimination of IR oven Elimination of work-in-process Improved quality/less waste Ability to re-claim and re-use coating



Economic Review / Analysis

Faster Production Capabilities

Currently, the solvent-based production line speed is maximized at 10 feet per minute, limited mainly due to the size of the customer's existing thermal oven system. With a well-designed UV-based coating system, 15 feet per minute can be attained, which equates to a net increase in production of 50 percent (See "Increase in Production" at right).

Faster Coating Cure

In the near future, the hydraulic cylinder is being redesigned with a new seal that will not tolerate any heat exposure. The customer's existing thermal system exposes the hydraulic cylinder to 400° F for six minutes, which would cause irreparable damage to the part. The UV system would



New seal—will not tolerate extended exposure to heat.

protect the part against excessive heat exposure, with maximum heat exposure being around 120°F.

This is mainly due to the fact that the

UV-curing system will cure/dry the paint in under two seconds.

Faster Coating Optimization—

100% Solids Versus 35% Solids Solvent

The customer is currently purchasing solvent-based formulation at 35% solids for \$27 per gallon. New UV coating is 100% solids and is priced at \$75 per gallon.

Comparing Apples-to-Apples

- 35% solids solvent = Coverage equals 1,604 square feet @ 1 mil times 0.35 equals: 561.4 square feet. So, one gallon of solvent-based coating gives you 561.4 square feet of coverage @ 1 mil.
- To equal 100% solids UV coating coverage of 1,604 square feet @

Increase in production

Parts	18 inch centers	
Current line speed	10 feet / minute	~ 6.6 parts / minute
UV coating line speed	15 feet / minute	~ 10 parts / minute
Additional parts per minute	3.4 parts	
Minutes per shift	480 minutes	
2 shifts	2 x 480 x 3.4 parts = 3,264 parts per 2 shift period	
220 production days	220 x 3,264 parts = 718,080 additional production units possible	

1 mil Coverage @ 1 mil—1,604 square feet / 561.4 equals 2.857.

- Meaning, you would need 2.857 gallons of 35% solids solvent to equal 1 gallon of 100% solids UV coating.

Real Cost of Coverage—

1,604-square-feet at 1 mil

- Real cost of solvent-based coating — 2.857 gallons times \$27 equals **\$77.14.**
- UV 100% Solids Coating—**\$75.00** per gallon.

Conclusion

Overall, UV 100% solids coating has a lower cost per gallon by \$2.14.

Faster Coating Optimization—Reclaim

Solvent-based coating technology does not allow for reclaiming any coating that is not applied directly to the part. UV is different—you can reclaim 100% solids UV coatings and reintroduce it back into the system after filtering.

Reclaiming 100% Solid UV Coatings allows the overall spray system to achieve an estimated efficiency of 95% overall. For this application, it allows the customer to reclaim an estimated six gallons per shift:

2 shifts: 2 x 6 gallons x \$75 per gallon = \$900 per/2-shift period.

220 production days:

220 x \$900 = \$198,000 paint coating savings.

Only 100% Solid UV Coatings can offer this additional benefit of reclaiming coating and reaching an estimated efficiency of 95 percent (Figure 1).

Smaller Floor Space Requirements

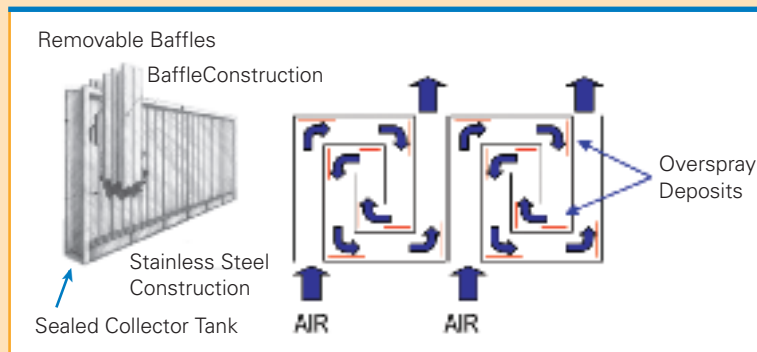
The UV system will provide a much smaller footprint on the manufacturing floor:

UV Footprint: 550 square feet
—Versus—

Thermal Oven Footprint: 2,300 square feet

FIGURE 1

UV reclaim overview



The UV-based coating system offers 72% less physical floor space versus the solvent-based coating system. This represents a significant cost savings for the customer (Figures 2 and 3). There is a cost associated with floor space.

Smaller Work-in-Process (WIP)

Work-in-process has associated costs because it ties up capital. The larger your WIP inventory, the larger your quality risk. The UV process basically eliminates your coating WIP. With the implementation of UV, the customer will reduce WIP by an estimated 450 units.

Smaller Energy Consumption

The UV process offers the opportunity to reduce energy consumption by a great margin. In this case, the UV system provides the customer in excess of \$27,000 in annual savings (Figure 4 on next page).

Current Electrical and Gas costs per hour	\$ 10.78
UV Light/Equipment Electrical costs per hour	\$ 3.07
Overall cost savings per hour	\$ 7.71
220 production days/2 shifts @ 8 hours each	\$27,139
<i>in annual energy savings</i>	

Smaller Capital Equipment Costs

UV Systems typically cost less than oven-based curing technology and typically require shorter conveyors, less material handling and less mechanics overall. In the case of this customer, the thermal oven system was purchased several years ago. The new UV curing system must be utilized due to a redesigned part.

FIGURE 2

Thermal oven system

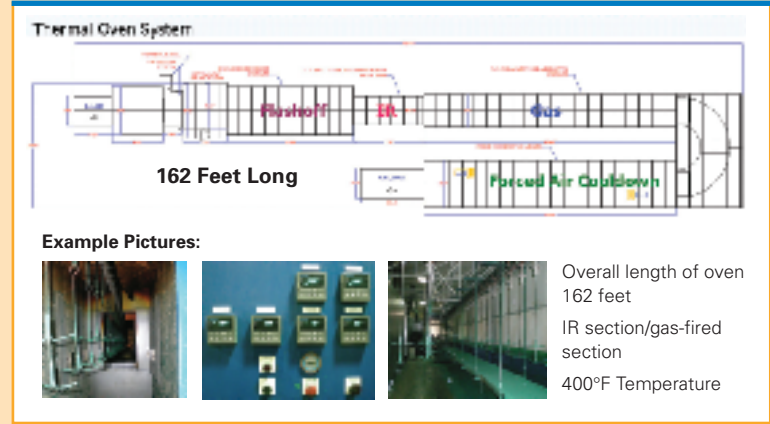
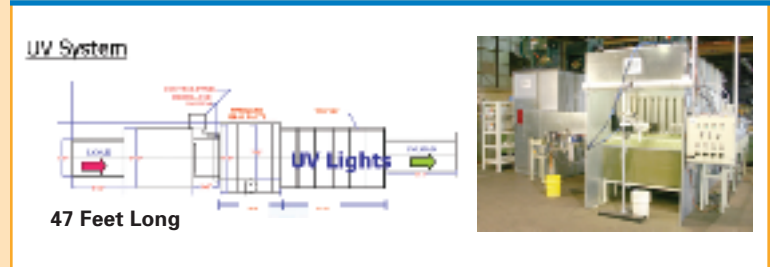


FIGURE 3

UV system—smaller floor space required



Smaller Quality Costs

With UV technology, quality problems are immediately noticed and addressed. With the current thermal coating system, you must wait until the product has been fully dried. Once you find a problem, you have a thermal oven full of scrap product, which dramatically increases your product scrap costs.

Cleaner Processes

100% solids UV systems typically have zero VOCs, no HAPs and no N-vinyl pyrrolidones. Solvent coating systems typically contain a variety of these pollutants and need to be specifically managed on-site at the customer's location.

Reduced Reporting

Solvent systems typically require specific internal controls. 100% Solids UV offers the benefit of eliminating any VOCs and the associated reporting that can be required by local and state regulatory authorities. Elimination of any VOC scrubbers will also provide significant cost savings.

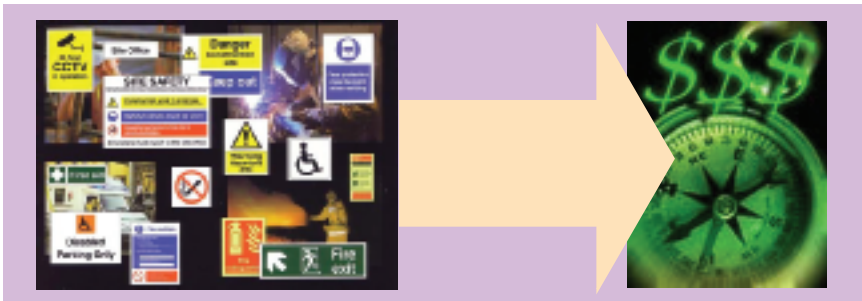


FIGURE 4

Details on UV oven versus solvent-based system/energy costs

Sample Evaluation on Energy Consumption Costs

Process Parameters—10 fpm current line speed

UV Oven—6 lights

(6) UV Star Electrode lamps 6KW x 6 lamps = 36 KW
 Exhaust blower for chamber 3KW

Total Cost: 39KW x \$0.0787/KWH = \$3.07/Hour



Solvent-based—400F/ IR Front end & Gas

Gas used after initial startup 412,000 BTUs/hour
 - 412,000 BTUs/hour / 100,000 BTU/Therm = 4.12 Therms/hour
 - 4.12 Therms x \$0.6927/Therm = \$2.85/hour

Electric Usage

IR Oven 30.0 KW
 Cool Down Blowers (2) @ 30 HP each 45.0 KW
 Exhaust Blower 1@ 5HP 3.7 KW
 Heat Air Seals 2@ 15 HP each 22.0 KW

Total: 100.7 KW

100.7 KW x \$0.0787/KWH = \$7.93 / hour

\$10.78 Oven minus \$3.07 UV savings = **\$7.71/hour**

220 days x 16 hours
 (2 shifts per day)

savings = **\$27,139****

**Based on 220 days per year—
 2 (8)-hour shifts of production

Total Cost: (Gas Cost: \$2.85 & Electric Cost: \$7.93)/hour = \$10.78 per hour

Improved Health and Safety

With 100% Solids UV systems, the customer can eliminate health and safety issues typically associated with solventborne coating systems. However, sound safety practices still need to be followed when using UV coatings. Again, this can be assessed by measuring worker time away from work, compensation claims and external environmental impacts.

It is critical that a complete cost analysis is completed before any coating technology is selected. UV coating technology offers a great deal of advantages which typically will show ROI—Return on Investment—for your application, plus provide excellent environmental benefits.

UV delivers Faster, Smaller, Cleaner ...Return on your Investment. ▀

—Michael Kelly is CEO/president of Allied PhotoChemical, Kimball, Mich.

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