Crossing the Chasm: NYSERDA and Non Profit Partner to Advance Technology

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ABSTRACT

The transition from early adopters to majority users (crossing the chasm) is the focus of an authoritative series from Geoffrey Moore geared to the "high tech" industries. "High tech" may also describe a quite different technology—in this case referring to the use of ultraviolet light and electron beams (UV/EB) as an energy efficient, nearly instantaneous, and clean way to assist traditionally "low tech" manufacturers in the fabrication of products ranging from pizza boxes to broom handles--as well as higher tech products like fiber optics, 3-D TVs and smart phones.

The promise of UV/EB making the jump over the chasm seems imminent--as it has been over the last 15 years or so. In fact, the chasm has been crossed in specific areas, for example all fiber optics and car headlamps are made with the technology; and other applications look very promising, such as printed electronics and the fabrication of flexible photovoltaics. However, given the renewed urgency to conserve energy and develop clean manufacturing processes, there are many applications both high tech and low, that may benefit from UV/EB. A unique collaboration between the New York State Energy Research and Development Authority (NYSERDA) and RadTech, the non profit trade association for UV and EB Technology, is looking to address the technical and market barriers to the adoption of UV/EB; and help document the process advantages including—saving energy; reducing CO2, VOC, and HAP emissions; and raising productivity.

UV/EB Market Position

Like seemingly countless technologies, ultraviolet and electron beam (UV/EB) systems were pioneered in the United States decades ago. With the industry now global, the market is generally recognized to have reached about $1 billion each, in North America, Asia, and Europe, respectively. With growth in the United States averaging about 5% annually over the last few years, the diversity of applications and the dynamic development potential of the technology offers continued excellent prospects. Growth has been accelerating in other countries as well, with China now considered a market leader, and nations such as Brazil, India, and Korea rapidly developing capabilities. However, unlike many other regions, the U.S. UV/EB industry receives little government support—despite the fact the world's three leading electron beam manufacturers used in curing are based in the United States; and the U.S. boasts some of the top researchers in the field.

What is UV/EB?

As presented in the NYSERDA *Three Year Strategic Outlook*[1], UV/EB systems use advanced materials that do not require thermal treatment for drying and eliminate the use of VOCs, thereby precluding the need for emission destruction after-treatment. UV/EB technologies provide alternatives that allow for reductions in energy intensity and CO2 emissions, and the elimination of volatile organic compounds. In fact, NYSERDA recognized this potential in a press release, describing collaboration with RadTech as a way "… to develop innovative applications of UV and EB technology as an example of how NYSERDA research and development efforts are working to create new economic activity based on innovative, green and sustainable technologies that use energy efficiently and reduce greenhouse gases in New York's economy," Francis J. Murray, Jr., NYSERDA President and CEO.

UV/EB describes a process wherein selected chemicals are dried or "polymerized" from the energy of electron beams or ultraviolet sources—it may be used as a coating, ink, adhesive, composite, or even to make a product. Individuals encounter the technology directly, for example dentists use it to harden materials for teeth using a curing light—this allows the dentist to work with the substance and not worry about previous concerns of premature drying, until he or she uses a special energy source to rapidly and accurately set the material. The technology is also now common in nail salons, where painted finger nails are set under a light source which offers rapid drying.

However, the bulk of the industry is involved with providing industrial manufacturing solutions in applications ranging from printing and packaging to fiber optics to wood flooring and furniture to inkjet printing. By one count there are now over 10 industrial processes which count on UV or EB as the primary method of manufacture across the industry. The technology is more of a platform for the development of processes rather than a single product, with industries and individuals alike finding unique applications in such areas including: jewelry making, fishing lures, surf board finishing, windshield repair, and even as a process for creating artful sculptors. Advantages of the process whether for big industrial manufacturing operations or for small boutique applications include: very rapid throughput, elimination of production bottlenecks, substantially reduced equipment footprint, the flexibility to tailor the process to the application, and elimination or reduction of harmful emissions.

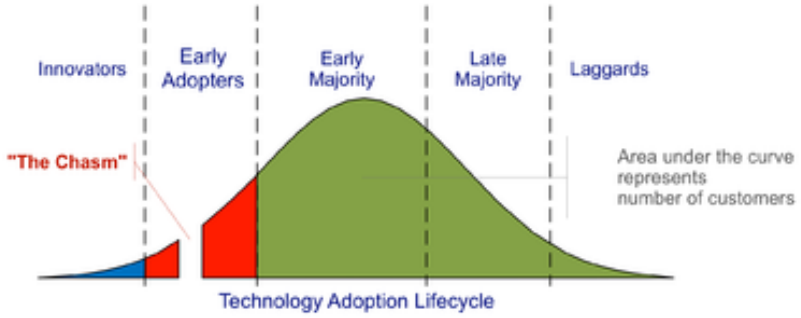
What Chasm?

In his book *Crossing the Chasm, Marketing and Selling High Tech Products to Mainstream Customers*[2], Geoffrey Moore outlines the traditional Technology Adoption Life Cycle that involves selling first to those that love new technology and seem to have the need to say, be the first to stand in line for a new Apple product. These folks and firms are referred to as innovators. The technology adoption process then expands to the next cohort or "early adopters," then to early majority users, late majority and finally technology laggards. However

[1] NYSERDA. 2010. "Toward a Clean Energy Future: A Three Year Strategic Outlook, 2010-2013." http://www.nyserda.org/publications/2010_Strategic_Plan.pdf.

[2] Moore, Geoffrey. Crossing the Chasm, Marketing and Selling High Tech Products to Mainstream Customers. New York: Harper Business Essentials, 1991.

Moore points out that this progression is not always successfully navigated as there are often "cracks" in the adoption cycle, and in particular a wider crack or "chasm" in an attempt to develop markets beyond the early adopters to the early majority.



In fact, some products do not survive past the early adopter stage for various reasons. While his thesis revolves around individual companies in high tech (i.e. computer/internet firms); and not sectors of the ink, paint and coating industries, his points are instructive to many of the issues faced by the UV/EB community in attempts to grow the technology. However, his theories are geared towards disruptive technologies, of which UV/EB may be considered.

In brief summary his prescription: The traditional model tends to break down as you progress on the curve and enter new cohorts—areas where buyers become more cautious and won't buy until the technology is proven and established, but has difficulty becoming established because buyers are cautious. His remedy calls for obsessive targeted market development, progressively winning each phase of the lifecycle, and using those gains as reference points for the next. In summary, the keys to success involve careful targeting and effective information development and sharing.

With Moore's work in mind, the RadTech and the UV/EB industry have its own particular set of barriers to reaching majority users based on the nature of the technology and industry structure, including:

- *Diverse supplier base*--following Moore's advice to target applications is impossible as the RadTech membership is composed of individual firms focusing on their own specific target areas, including: printing and packaging, wood finishing, electronics manufacturing; and most recently efforts off the factory floor and into the field such as floor refinish, automotive refinish and field repair of wind turbines.
- *Lack of industry standards*--both technical and marketing, as supplier participants seek to gain a competitive advantage through their particular offerings.
- *Secrecy*--both amongst suppliers and users of the technologies. Case studies which would be of value as sales tools that may help the technology progress through the life cycle curve are rare and information seeking on UV/EB products are typically met with "sorry have an NDA," (non disclosure agreement). Amongst end users, the secrecy is typically sought as the company believes that it will develop a competitive advantage by using UV/EB. (Ironically, except for perhaps proprietary modifications, this is often not the case as the technology is already used in that industry, but the barrier to information sharing has become a major hurdle in further technology adoption—a main point in Moore's thesis).

- *Supplier reticence.* As noted, UV/EB may be considered a disruptive technology—one that may disrupt or cannibalize current efforts amongst a suppliers current business (generally, suppliers to the UV/EB industry are also suppliers of other established technologies). Thus if a supplier already has business with a customer, the motivation needed to sell an entirely new process is often lacking.
- *End user reticence.* Potential customer companies have installed fully invested equipment, using techniques and trained staff that have been in place for years.
- *General lack of regulatory vision.* As a pollution prevention technology, UV and EB generally do not emit a host of bad actors including VOCs, HAPs, NOx, Sox and CO2. However, with the mandate of regulators often simply to control VOCs, the installation of energy consuming, CO2 emitting pollution control devices more often than not satisfies regulators. Thus less efficient pollute and clean-up methods are favored over more efficient pollution prevention processes such as UV and EB.
- *Disappearing customer base*. RadTech members often report lost potential customers that have taken their production overseas, or simply closed up shop. The shrinking of the U.S. industrial base is well documented.

Using a Chain to Help Cross the Chasm

The New York State Energy Research and Development Authority (NYSERDA) has as a mission to:

> Advance innovative energy solutions in ways that improve New York's economy and environment.

And a supporting Vision Statement:

> To serve as a catalyst – advancing energy innovation and technology, transforming New York's economy, empowering people to choose clean and efficient energy as part of their everyday lives.

As part of their efforts to work towards the NYSERDA mission and vision statements, the Industrial Research Work Group of NYSERDA recognized increased interest in, and the potential benefits of UV and EB technologies to New York State industrial firms. NYSERDA took the initiative and RadTech welcomed the interest as the groups met to discuss the benefits of the technology to manufacturers and emerging technologies and to gauge the potential of partnership—a partnership that quickly produced successful results.

With the NSYERDA RadTech relationship now in its third year, the specific accomplishments of the partnership may be viewed through a framework developed by NYSERDA as part of their three-year strategic plan: Toward a Clean Energy Future: A Three-Year Strategic Outlook 2010 - 2013. According to NYSERDA the plan "presents an overview of and outlook for NYSERDA's programs and services that are helping put the State on a path toward greater energy self-sufficiency, improved energy efficiency, smart economic growth, and a cleaner environment."

NYSERDA's model of an "integrated chain" of activities may serve as a roadmap for a technology such as UV/EB, as the industry seeks to "fill the cracks" in the adoption of the

technology and develop a path for higher levels of use by industry. The NYSERDA chain involves links, including: scientific research and market analysis → to technology development and demonstration → to business and market development → to market adoption and expansion → and finally included in standard practice.

Through a suite of NYSERDA outreach and programs, RadTech has been presented the opportunity to address each of these links and at the same time address barriers to the adoption of the technology. As documented in the NYSERDA Strategic Outlook: With the assistance of NYSERDA, RadTech "launched the first biennial RadTech East Coast conference in Niagara Falls, which was an overwhelming success and secured its recurrence in New York." RadTech recognized NYSERDA with The RadTech President's Award in 2010. At the conference, NYSERDA issued a solicitation targeted to ultra-violet (UV) and electron beam (EB) technologies seeking to create a Technology Applications Center; a subsequent webinar conducted in conjunction with RadTech further publicized the solicitation. In addition, NYSERDA, the Rochester Institute of Technology and RadTech partnered to conduct a market study to explore perceptions and opportunities for the technology (printing only focus) in the state of New York."

NYSERDA's initiatives to help produce a UV/EB industry event, conduct market research, offer project funding, and to create a technology center each represent contributions to an integrated chain of technology development as outlined by NYSERDA. More specifically:

- Scientific research and market analysis → the NYSERDA funded project opportunity promises to lead to new breakthroughs in the use of the technology. The UV/EB Tech Center will assist the industry in efforts to address technical concerns—with the hope to begin industry standardization efforts. The RIT study, helps document the industry potential.
- Technology development and demonstration →the technology center will provide the opportunity for firms to learn about and prove out the technology for their applications.
- Business and market development → NYSERDA's vision and creativity in the creation of a uv.eb EAST Conference and Exhibition provides an industry forum for meeting with local industry to not only showcase the technology, but to learn, discuss and develop new methods and applications particular to New York State manufacturing opportunities. One event attendee focused on aerospace and defense commented that uv.eb EAST was the best event he had ever attended as it offered the opportunity to learn about, and discuss new ways to develop his products.
- Market adoption and expansion; standard practice. These are areas that RadTech in partnership with NYSERDA will work to develop and document to report results and develop lessons learned for future efforts.
- By providing these new forums, NYSERDA has offered a potentially important manufacturing technology the opportunity to address competitive, industrial and regulatory concerns (as outlined above) in a proactive, open, transparent forum—a technology that, with NYSERDA's help, is laying the foundation to "cross the chasm" to offer energy saving, eco-efficient, and sustainable process solutions for the re-emergence of New York and U.S., manufacturing.

Lessons learned:

- The emphasis of UV/EB by NYSERDA is the result of early observation by staff of the impact and incipient, but growing, interest in the technology by State manufacturers.
- Before approaching RadTech, NYSERDA staff performed due diligence and was able to determine that RadTech is a respected trade group and the go to organization to reach stakeholders in the UV/EB industry in NY and manufactures and potential users.
- As discussed, the mission and vision and strategic plan of NYSERDA seem to match well with the needs and efforts of RadTech as an organization and UV/EB as a technology.
- Bottom line, business is based on relationships and RadTech and NYSERDA staff have formed a close, cooperative relationship and sense of mission in the development of this energy saving, environmentally proactive technology.
- As outlined both by the technology adoption curve and the NYSERDA chain, there are still steps to be taken in the progression of the technology. With plans to continue on the current path, there is a need to develop measures and success metrics to evaluate the efforts thus far—which may lead to future new activities.