Dear Clients, Friends and Colleagues:

I hope this quarter’s Tech M&A Reports finds all of its readers enjoying the prospects of a great year to come. For me, 2013 went by in a blur. I hope that 2014 will move along at an easier pace, but I do have my doubts… In the winter edition last year, I made some predictions for 2013. Before I make some predictions for 2014, I thought it might be interesting to see what my “hit rate” was for 2013.

1. An uptick in M&A: This was a mixed bag—early 2013 was down as many transactions were closed in the fourth quarter of 2012 due to tax changes, making 1Q and 2Q rather slow. The third and fourth quarters recovered nicely, but overall M&A activity did not increase that much. Verdict: ½ point

2. IT Services growth over 4.2%: Gartner increased this number to 4.5% in September. Verdict: 1 point.

3. BPO to increase: According to Bloomberg, the unexpected jump in GDP to 4.1% was driven primarily by larger than expected growth in services. Verdict: 1 point.

4. Labor market impact of Affordable Care Act: There is no consensus on this issue. Strong arguments have been made for and against the ACA having a significant impact on jobs, but no hard data has been seen to justify either position. Verdict ½ point (but I still think I am going to be right in the long run).

5. Focus on Innovation: If one equates large company innovation with spending on R&D then the continuous increase in this spending from the third quarter of 2010 would suggest that this was a good prediction. Verdict: 1 point.

6. More plug-in hybrids: According to Eartheasy, there are now seven plug-in hybrids available from the main auto manufacturers with another five under development. Verdict: ½ point.

7. Increase in NFC mobile payments: The ISIS mobile wallet (founded by AT&T, Verizon, and T-Mobile) was launched in 2013 and allows NFC-enabled phones to make payments with attached credit cards. A large percentage of smart phones are now NFC enabled and many of the latest point-of-sale devices now accept NFC. While NFC payments are not quite mainstream, the progress and momentum are undeniable. Verdict: ½ point.

8. Tablet computers get better and are more widely used: As of October, Gartner expects full year sales of tablets to be up by over 53% in 2013. Verdict 1 point.

9. Big data analytics will be big business: A recent Forbes article highlighted 13 software companies from the 2013 Technology Fast 500. Of these, eight primarily engaged in data analytics to provide value for customers. The other five on this list either use data analytics to some extent in the delivery of their solutions or provided it as a secondary offering in some way. Verdict: 1 point.

10. Interactive television: While there has been a lot of penetration of on-demand television (Apple TV, Google TV, Netflix, Hulu, etc.), more televisions that are web enabled, and new gaming consoles like the Xbox One and PS4 incorporating a wide range of capabilities, I believe we are only at the tip of the iceberg of this trend. Still the prediction was solid. Verdict: 1 point.
11. Astronomers will discover five “rocky” planets in “Goldilocks” zone: There were quite a few announcements on this topic in 2013. In June, astronomers identified three “super earths” in one nearby star’s “Goldilocks” zone, and in November a study was published that stated one in five stars in the Milky Way is now believed to have an earth-sized planet within the “Goldilocks” zone. Verdict: 1 point.

12. Indiana University to win the NCAA tournament: Despite a strong start in the season, Indiana struggled late. As a result, they only made it to the sweet 16 in 2013. Verdict: 0 points.

13. Alabama to be preseason #1 in football and would win the Championship and Purdue would make a New Year’s bowl game: The Associated Press had Alabama ranked #1 in the pre-season, but failed to win the title. Purdue, on the other hand, won only one game in 2013 and failed to make a bowl game. Verdict: 1 point for Alabama prediction, negative 1 point for the very poor Purdue prediction for a sum of 0 points.

Adding up the score gives me 9 out of 13 points or just over 69%. While this score would not do much for me if I was still in school, I could do quite well being right 69% of the time if I was in Vegas. In all, I would say 69% is fairly respectable.

Once again, I am going to put myself out there and provide some predictions across multiple categories (only 10 this year).

The standard disclaimer applies: these predictions are for entertainment purposes only and are not meant to be advice on potential investments. So without further discussion, here is a list of predictions for 2014.

1. M&A activity will accelerate in 2014. I still believe there is a lot of pent-up demand and this should be a shoe-in if we can avoid any major economic tremors.

2. IT Services will continue to see growth in excess of 4%.

3. The overall US economy will not keep its current pace and GDP growth for 2014 will be around 2%.

4. We will continue to see bickering in the federal government and will endure at least one budget “crisis” in 2014.

5. Oil prices will hover around $100/barrel as new discoveries in North America are exploited and provide a counter balance to strong worldwide demand.

6. Interest rates will begin to rise in late 2014. 30-year conventional mortgage rates will surpass 5% (now around 4.3%).

7. The emergence of the “Internet of Everything” will continue to accelerate making Cisco’s prediction of a $14 trillion industry seem plausible. Growth in this new industry will be driven by big data analytics that creates actionable intelligence from the massive amounts of data being collected and low cost printed sensors and electronics that enable the collection of data in ways not previously envisioned.

8. The Curiosity Rover will discover definitive evidence of (previous) life on Mars.

9. 3D printing will continue to gain traction. Growth in this industry will surpass 50%.

10. My high school team mate and Purdue head coach, Matt Painter, will lead the Boilermakers to the NCAA Tournament. Sadly, they probably do not have the horsepower to win it all, but it will be a great step in the right direction.

This quarter’s guest article has been provided by Bo Patel, Vice President of Business Development at a2z Green Lighting, an Illinois-based firm that designs, develops, and manufactures LED lighting. In this article, Bo highlights recent developments and inherent advantages of LED lighting.

In addition, Jeff Rudolph provides us some insights to a new development in 3D printing: bio printing, our “good news” section highlights a new type of reactor being pioneered at Argonne, and we examine recent acquisitions made by 3D Systems in the printed electronics space. As always, please feel free to send me your comments.

Respectfully,
Kurt Estes

A Look at Bioprinting
by Jeff Rudolph

In the Winter 2013 issue I wrote an article on 3D printing and the potential the technology has for the next industrial revolution. That article also mentioned how cartilage for a new ear was printed. The ability to print human “replacement parts” has spawned a new field—bioprinting. What clearly only a few years ago would be thought to be science fiction or ideas from the imagination of Mary Shelley has become, in fact, reality. Companies and research hospitals alike are making great strides in abolishing the need for donor lists and agonizing quests for finding and matching organs for transplants. The end game of printing a heart or a liver from the patients own cells is not in the realm of science fiction any longer.

Most organs in the body are filled with veins and the ability to print blood vessels is a very necessary step to printing organs; the company Organovo has printed veins that are about to be tested in animals with human trials on the horizon. Their near term goal is to replace veins that have deteriorated in patients with veins that have been printed with the patient’s own cells. In the meantime the veins are being used by pharmaceutical companies to gain additional data on how their drugs affect human tissue.

“The end game of printing a heart or a liver from the patients own cells is not in the realm of science fiction any longer.”

continued on page 3
The process for bioprinting varies, but basically it consists of these steps: 1) an MRI or CT scan is used to create a 3D image with exact dimensions of the tissue for replacement; 2) computer aided design software is used to create a file with instructions for the printer on how to print the tissue layer by layer; 3) “ink” is created, preferably with the patient’s own cells, and material, such as collagen, that cells can grow on; 4) the printer prints the tissue layer by layer using the ink.

The field has a long way to go to reach its goals and unlike printing airplane parts, printing organs requires arduous testing and the need for approval from the FDA. Thus, it will be a costly and slow endeavor, but one that I believe will come to fruition in our life time.

Jeff Rudolph is the Partner in Charge of Technology Services at Sikich LLP and can be reached at jrudolph@sikich.com.

Sources: Dave Bullock Wired magazine, The Washington Post, Organovo.com

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**Good News in Technology**

In December, the *Chicago Tribune* profiled developments at the Argonne National Laboratory. Researchers there have created a portable energy device called the Endurance Bioenergy Reactor (EBR). The reactor is fueled by waste products from the kitchen and the latrine and creates fuel that can be used in engines or generators without additional processing, refining or mixing.

In short, the waste materials react with enzymes and engineered bacterium in the bioreactor. The resulting mixture contains fuel that can be easily separated and is usable in standard diesel engines. Scientists estimate that the average family of four would produce enough waste to fill up their automobile’s fuel tank about once a month. Opportunities for military and humanitarian use are also quite broad as feedstock usable in the process is quite diverse: animal and human waste, kitchen waste, food processor waste, etc.

The EBR is beyond the development stage and plans to have units in military testing as early as 2015. Commercial units for use in households could be seen before 2020.

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**Light Emitting Diode**

*by Bo Patel, Vice President of Business Development at A2Z Green Lighting*

Light Emitting Diode (LED) technology, an energy efficient lighting alternative to conventional lighting, is nearing the inflection point of mainstream adoption. LEDs were first discovered at the University of Illinois in 1962 by Nick Holonyak Jr., who is regarded as the father of the first visible LED. In 1963, Reader’s Digest published an article where Holonyak predicted that LEDs would replace incandescent bulbs in the future. While his prediction was years ahead of its time, today it is becoming a reality.

Legislation in the US and across the world is helping to drive this migration from incandescent bulbs towards more energy efficient lighting such compact fluorescent lamps (CFL) and LED bulbs. In Europe, 100W incandescent bulbs were banned in 2009 and in the US, Russia, China, Japan, and Brazil they were banned in 2012. By 2014 these same countries will ban 75, 60, and 40W bulbs.¹

Incandescent bulbs convert approximately 10% of the energy they consume into light with the remaining 90% becoming heat. LEDs convert almost all of the energy they consume into light. The table below shows the comparison between incandescent, CFL, and LED bulbs.

Light output is measured in lumens, energy consumption is measured in watts, and efficacy is measured in lumens per watt. Table I shows that LEDs have almost double the efficacy of CFL bulbs and 10 times that of incandescent bulbs. The pace of LED development is similar to that of computer processor chips which follow Moore’s Law. Moore’s Law is the observation that, over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years. This implies that over the next few years that LED chips will become even be more efficacious than they are today and yield an even greater energy savings.

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**Table I: Comparison of LED, CFL, and Incandescent Bulbs**

<table>
<thead>
<tr>
<th>Light Output</th>
<th>LEDs</th>
<th>CFLs</th>
<th>Incandescents</th>
<th>Average Efficacy</th>
<th>Average Efficacy</th>
<th>Average Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumens</td>
<td>Watts</td>
<td>Watts</td>
<td>Watts</td>
<td>Lumens/Watt</td>
<td>Lumens/Watt</td>
<td>Lumens/Watt</td>
</tr>
<tr>
<td>450</td>
<td>4 - 5</td>
<td>8 - 10</td>
<td>40</td>
<td>100.0</td>
<td>50.0</td>
<td>11.3</td>
</tr>
<tr>
<td>300 - 900</td>
<td>6 - 8</td>
<td>13 - 18</td>
<td>60</td>
<td>85.7</td>
<td>38.7</td>
<td>10.0</td>
</tr>
<tr>
<td>1100 - 1300</td>
<td>9 - 13</td>
<td>18 - 22</td>
<td>75 - 100</td>
<td>109.1</td>
<td>60.0</td>
<td>13.7</td>
</tr>
<tr>
<td>1600 - 1800</td>
<td>16 - 20</td>
<td>23 - 30</td>
<td>100</td>
<td>94.4</td>
<td>64.2</td>
<td>17.0</td>
</tr>
<tr>
<td>2600 - 2800</td>
<td>25 - 28</td>
<td>30 - 55</td>
<td>150</td>
<td>101.9</td>
<td>63.5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

¹McKinsey Report: Lighting the way: Perspective on a global lighting market

*Actual results may vary from manufacturer to manufacturer*
Industry Perspective¹

For the 12-month period ending December 31, 2013, the Sikich Technology Index² (the “Index”) was up 23.1%. The Index was in line, albeit slightly lower, with both the S&P 500 and Dow Jones Industrial Average, which were up 26.4% and 23.6% respectively. The Application Software, Cable, Data Processing, Electronic Components, Home Entertainment Software, Internet Retail, and Internet Software and Services sectors³ outperformed the S&P 500 and Dow Jones Industrial Average. However, the Communication Equipment, Computer Hardware, Computer Storage & Peripherals, IT Consulting, Semiconductors, Systems Software and Telecom sectors underperformed in relation to the S&P 500 and Dow Jones Industrial Average. Although it was a new entrant to the Index, 3D Systems (NYSE: DDD) led all Index constituents with a 149.9% rise in stock price. The provider of three-dimensional printing (“3D”) content-to-print solutions has expected to end 2013 with revenues of $500 million, up 41% from 2012. The market has rewarded the company’s strategy of first securing key customers in the industrial sector and now making inroads with the consumer segment. In addition, the company has focused on growing its technology through acquisitions and significant R&D investment. As a result, analysts have been impressed with the lineup of new products that enhance the company’s competitive positioning.

From the prior quarter, Index revenue and EBITDA disclosed in the fourth quarter increased 2.3% and 4.5% respectively. The increase in revenue was due in part to the Application Software sector and in particular, Intuit (NASDAQ: INTU). The company, which develops QuickBooks, TurboTax and Quicken, recorded a 65% increase in revenue. A 33% growth in online subscriptions of QuickBooks in the Small Business segment drove the double-digit growth. While the Application Software sector performed well, the Home Entertainment Software sector is in need of innovation. Zynga (NASDAQ: ZNGA), which replaced CEO Mark Pincus with former Microsoft executive Don Mattrick, recorded a 27% drop in quarterly revenues. Zynga is working through innovation issues: (1) Zynga is searching for new games as “FarmVille” and “Zynga Poker” account for nearly 40% of the revenues and (2) the company has not been able to make the transition to mobile.

M&A Activity and Metrics⁴

M&A activity for the fourth quarter of 2013 was down 14.1% from the prior quarter and down 32.7% from the prior year. For the full year, technology-related M&A activity in 2013 was down from 2012 by 16.6%. Transaction volume, when compared to 2012, was down due to the end of the year push in 2012 to complete any transactions to avoid tax hikes. Value of disclosed deals dropped 8.1% from the prior quarter but was up 113.8% from the prior year. While Silver Lake’s $27.9 billion⁵ acquisition of Dell was the main reason for the increase from the prior year, it was not enough to match the $37.3⁶ billion for the SoftBank acquisition of Sprint Nextel Corporation in the third quarter of 2013.

¹ Capital IQ
² The Sikich Technology Index is made up of 40 publicly traded companies predominantly based in the US with a minimum market capitalization of $1B, covering a wide range of non-life science technologies.
³ Based on Capital IQ designation
⁴ Capital IQ
⁵ Total Gross Transaction Value per Capital IQ

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Key Technology Market Statistics

Public Market Performance

Source: Capital IQ

Median Transaction Multiples (on closed transactions)

Source: Capital IQ

Closed Deal Count & Value

Source: Capital IQ

M&A Transactions by Region

Source: Capital IQ

Q4 Most Active Buyers

<table>
<thead>
<tr>
<th>Top Acquirers (By Deal Volume)</th>
<th>Top Acquirers (By Deal Size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquirer Name</td>
<td>Number of Deals</td>
</tr>
<tr>
<td>Yahoo! Inc.</td>
<td>7</td>
</tr>
<tr>
<td>Cisco Systems, Inc.</td>
<td>4</td>
</tr>
<tr>
<td>Google Inc.</td>
<td>4</td>
</tr>
<tr>
<td>Andor Technology plc</td>
<td>2</td>
</tr>
<tr>
<td>Zayo Group, LLC</td>
<td>2</td>
</tr>
<tr>
<td>Mesa Laboratories Inc.</td>
<td>2</td>
</tr>
<tr>
<td>Apple Inc.</td>
<td>2</td>
</tr>
<tr>
<td>INTRIX Technology, Inc.</td>
<td>2</td>
</tr>
<tr>
<td>Untangle, Inc.</td>
<td>2</td>
</tr>
<tr>
<td>BrainSet Technologies, LLC</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

Source: Capital IQ
Industry Perspective  continued from page 4

In terms of disclosed deal multiples, both EV/Revenue (1.1x) and EV/EBITDA (12.4x) multiples were down from both the prior quarter and year. It is interesting to note that the decrease in multiples was not necessarily a function of decreased deal values, but instead the multiples were compressed due to better performance in terms of revenue and EBITDA. As the table below shows, median EV, revenue and EBITDA were higher in the fourth quarter of 2013 compared to the fourth quarter of 2012 and the third quarter of 2013. The data implies that with better performance, deal values do in fact increase but may result in a compressed valuation multiple.

<table>
<thead>
<tr>
<th></th>
<th>Median Deal Value</th>
<th>Median Revenue</th>
<th>Median EBITDA</th>
<th>Median EV/Revenue</th>
<th>Median EV/EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ in MM</td>
<td>4Q 2012</td>
<td>$22.21</td>
<td>$25.90</td>
<td>$0.84</td>
<td>1.8x</td>
</tr>
<tr>
<td></td>
<td>3Q 2013</td>
<td>$16.00</td>
<td>$24.93</td>
<td>$0.35</td>
<td>2.2x</td>
</tr>
<tr>
<td></td>
<td>4Q 2013</td>
<td>$26.60</td>
<td>$35.00</td>
<td>$2.39</td>
<td>1.1x</td>
</tr>
</tbody>
</table>

Industry and Deal Profile

In the introduction, we predicted continued growth of the 3D printing industry and briefly discussed 3D Systems stock growth in 2013. 3D printing takes a digital image and “prints” a three-dimensional object. These printers allow manufacturers to produce one-off parts, or small runs of parts, efficiently (in terms of cost and time) and are very convenient for building prototypes. With over 600 market participants, the industry is highly fragmented; the largest player in the industry is 3D Systems, which in 2012 accounted for nearly 18% of the industry’s unit sales.

DDD has implemented an aggressive roll-up strategy (as evidenced by its nearly dozen acquisitions in 2013) designed to expand its portfolio and capabilities. In the fourth quarter of 2013, DDD acquired two companies: Figulo Corporation and Village Plastics. The Figulo acquisition expanded DDD’s offerings into ceramics printing, which consumers, artists and architects use to create tableware, tiles, and kitchen- and bathroom ware. With the acquisition, DDD has expanded its portfolio in two ways. The first is by incorporating a new material into its line of printers, essentially creating a new product offering to attract a new market of customers. The second is by integrating 3D ceramics printing into its cloud-based printing services, which enables the company to provide another service to existing customers.

As discussed earlier, 3D Systems growth in revenue was primarily attributable to its customers in the industrial sector. The acquisition of Village Plastics, a leading manufacturer of advanced 3D plastic filaments, allows DDD to expand its current capabilities to target the consumer and prosumer segments. Village Plastics also provides 3D Systems with expertise in filament materials and manufacturing. Additionally, DDD now has access to all of Village Plastics’ existing customers and can offer them full access to DDD’s entire portfolio of products and services.

Light Emitting Diode  continued from page 3

While LEDs are clearly the most energy efficient light source on the market today, only recently have consumers begun adopting them as the prices have dropped dramatically over the last few years. The commercial and industrial sectors began adopting LEDs several years ago because of the large amounts of energy consumed by businesses and the amount spent for lighting. ComEd published statistics which indicate that the general range spent on lighting can be 25 – 65% of a business’s energy consumption. Various businesses can see their expenditures on lighting being even higher than this. For example, an open air parking garage may have nearly all of the electricity they consume going to lighting.

Quick Case Study

A parking garage in downtown Chicago was using 175W metal halide lights. While a metal halide lights provide a large amount of lumens, they are very inefficient and have a very short lifespan compared to LED lights. A 175W light consumes almost 215W of energy with the ballast losses that are incurred in the light. In a trial, a 60W LED light fixture replaced the 215W light fixture.

The LED light provided almost double the foot candles of light on the floor compared to the existing metal halide solution. To achieve the same level of lighting, the LED was dimmed to 40W. It’s important to note that all LED lights are different and just looking at the wattage shouldn’t be considered the gating measure for replacement. As previously discussed, everything has to do with the efficacy of the light at the system level. Some high-end light fixtures have efficacies around 115-120 lumens/watt at the system level which is on the higher end compared to low-ended light fixtures that are anywhere from 50-60 lumens/watt at the system level. In this example, if the parking garage chose the 40W replacement then they would realize a cost savings of over 80%. However, if they chose the 60W solution they would get twice the light and still save over 70%. If the parking garage was spending $10,000 per month on energy and 90% of the bill was comprised of energy that went towards lighting, then they would be spending $9,000 on lighting a month. By installing the 40W LED solution the company would save $7,200 per month and $86,400 per year.

Too many consumers only consider the wattage when it comes to identifying a replacement light, which is not the correct measure to consider when considering switching to a LED solution. The consumer should consider the amount of light, or foot candles, that need to be delivered. Unfortunately this isn’t an easy task for a consumer to figure out. There isn’t sticker on the package that provides this information. The foot candle measure can be a tricky number to derive without actually

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2 Loyal Sikich Technology Industry M&A Report readers may note that last quarter’s M&A charts did not include the transaction was not in Capital IQ at the time of the data pull.

3 LTM Revenue and EBITDA for target as of close of transaction; sourced from Capital IQ

4 Disclosed deal multiples

5 Wohlers Report 2013

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6 ComEd website: https://www.comed.com/business-savings/small-business/Pages/default.aspx

continued on page 7
physically mounting the light and measuring the light output, as the number is dependent on how far the light is from the source and what kind of LEDs are built into the light and the environment the light is being mounted in. Factors such as the color of the paint on the walls, ceilings, floor, and the reflectance of the paint all will affect the foot candles. Additionally, the foot candles will decrease as the mounting height of the light increases and may not decrease proportionally to other light sources like fluorescent, metal halide, or sodium vapor all traditionally used in in commercial industrial applications.

**System vs Source Efficiency**

A non-traditional approach is often used when comparing the efficiency of LEDs to traditional lamp sources. Traditional lamps such as metal halide and sodium vapor are typically evaluated based on their source efficiency, which is measured with a bare lamp at room temperature. This approach does not account for the impact on lamp performance from the luminaire in which the lamp is installed. As stated earlier, a common measure for source efficiency is efficacy. Let’s take a look at how efficacy compares between LEDs and traditional light sources in the commercial industrial environment known as high intensity discharge (HID). Earlier we compared LEDs to CFLs, and incandescent bulbs typically seen in a residential setting. Some HID sources, such as high pressure sodium (HPS) and metal halide (MH), appear very efficient (e.g., 100 lumens/watt or higher) when one focuses solely on source efficiency. However, source efficiency does not accurately reflect how much light is actually delivered from the light source to the target area, such as a street or a parking lot.

System efficiency is measured with the lamp installed in a luminaire. It is based on how many lumens actually reach the target area, not simply how many lumens are emitted from the lamp. System efficiency is always lower than source efficiency due to four primary sources of light and power loss when a lamp is installed in a luminaire:

1. **Power Supplies:** Most light sources require a ballast or driver to convert line power into a form which can be used by the lamp. These losses can vary from 5-25%, depending on the power supply used.

2. **Protective Covers and Lenses:** Luminaire always almost use some sort of secondary optics (such as tempered glass or acrylic) to help focus or redirect light, and to protect the lamps or LEDs from the environment. These materials do not allow light to pass with 100% efficiency, so system efficiency is reduced.

3. **Trapped Light:** Traditional lamps, which emit light in all directions, require reflectors inside the luminaire to reflect as much light as possible away from the lamp and fixture components to the target area. However, not all light can be effectively redirected. Typically, 40% or more of the light emitted from the lamp is trapped within the luminaire and does not reach the target area.

4. **Operating Temperature:** Many light sources become less effective as operating temperatures change. Because source efficiency is measured at a standard 25°C (or about 77°F), the actual operating efficiency under a range of outdoor temperatures may be significantly different.

When considering all of the factors that affect system efficiency, LEDs provide a clear advantage over HID lamps.

**HID lamp:** Source efficiency is typically 120 lumens/watt or higher. However, losses from trapped light, protective covers and lenses, inefficient ballasts and unfavorable operating temperature typically result in a measured system efficiency of 30 lumens/watt or less.

**LEDs:** Source efficiency can be 150 lumens/watt or higher, depending on the type and manufacturer of the LED used. There are no losses from trapped light due to the focused output of the LED, and secondary optics and protective covers generally reduce output by 25% or less. LED power drivers are also more generally efficient than HID ballasts, and reduce system efficiency by 5-15% depending on the manufacturer. However, even when efficiency reductions due to high operating temperatures are included, LED system efficiency often remains above 75 lumens/watt or higher.

**Lumen Depreciation and Useful Life**

Another important factor involved in comparing the efficiency of LEDs to traditional lamp sources is accounting for the lumen depreciation of both sources. Most other lighting sources suffer from substantial lumen depreciation over relatively short periods. This affects the useful life of the light source.3

The useful life of LEDs is typically defined as the operating time prior to 30% lumen depreciation. This level of LED lumen depreciation has been widely adopted as the standard for useful life, since a 30% decline in lumen levels is not easily detectable by most people. LED life expectancy can be 50,000-100,000 hours or more. This means that one can enjoy higher LED system efficiency for many more years than traditional sources with useful lives between 1,000 and 24,000 hours, and postpone costly maintenance required to change dim or failed traditional lamps. Higher system efficiency and slower lumen depreciation combine to provide substantially higher overall efficiency with LEDs compared to traditional light sources.

Compared to other lighting sources LEDs do have a higher upfront cost, but to truly understand the full value of LEDS, a customer must consider the life time cost of the product. Referring to the previous case study of replacing a 175W light with equivalent light sources, we find the total 12-year cost savings of using an LED to be substantial:

- Metal Halide: $3,625 per fixture
- Fluorescent: $1,367 per fixture
- LED 40W: $882

This example uses typical data which can vary based on the manufacturer, but shows that when you consider the lifetime costs of LED fixtures vs other traditional fixtures, the customer will come out ahead even with the higher upfront costs. This example is based on just one light, so when considering multiple lights in any installation the savings can be very large.

Bo Patel is the Vice President of Business Development at A2Z Green Lighting and can be reached at bo@a2zgreenlighting.com.

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Sikich Technology Group
We frequently serve as advisors to entrepreneur- and investor-owned companies, and we understand how to assess and groom these businesses in the context of today’s M&A marketplace. We assess and advise on the prudence and attractiveness of an immediate exit or alternatively, recommend strategic and tactical actions the company should take to maximize its value for a future liquidity event.

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› Methods for corporations to invest in venture-backed start-ups
› Hurdles companies must overcome to accomplish their goals for CVC
› Using venture investment to stimulate innovation from short-term to long-term impact
› Common themes associated with effective CVC programs

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Please contact one of our professionals to learn more about how Sikich can help your company.

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