

## EQUITY RESEARCH COVERAGE

### HARRIS & HARRIS GROUP: CAPITALIZING ON 10X CHANGE

[NASDAQ: TINY \$5.08]

Research<sup>2.0</sup>

Boston | New York | Paris

Stephen Waite & Kris Tuttle  
July 29, 2011

## HIGHLIGHTS

- It has been an eventful and productive year thus far for Harris & Harris Group (H&H), with the company benefiting from several liquidity events and favorable operating performance at many of its portfolio companies. **Two portfolio companies – NeoPhotonics and Solazyme – completed successful public offerings earlier this year and another (BioVex) was acquired in a deal with Amgen worth up to \$1 billion.** We see the potential for additional liquidity events in the next 12 months as several late stage portfolio companies are executing well in their respective markets, while others have become attractive acquisition candidates and are currently engaged with bankers.<sup>1</sup>
- **Nanotechnology is moving into a new phase of growth and maturation, marked by accelerating innovation and a proliferation of nano-enabled products in the marketplace.** This period isn't a replay of 2004-05, when hype was rampant and products few and far between. The reality today is one of increasing penetration of nano-enabled products led by companies with real revenues and real profits. We see this trend continuing in the years ahead, **culminating in a 10x change in the final value of nanotech products worldwide to \$3 trillion by 2020.**
- Nanotechnology is a general purpose technology (GPT). As such, it has the potential to be a game changing technology and transform key industries and sectors of the global economy. **Many companies in H&H's portfolio are harnessing the game changing power of nanotechnology to innovate and create wealth.** Solazyme's IPO earlier this year heralds an age of synthetic nanobiology and a time of accelerating innovation in the market for fuels, chemicals, nutritional and personal care products. D-Wave's sale of its first quantum computer to Lockheed Martin is a milestone in the history of computing. This event marks an inflection point in the evolution of technology and has potentially far-reaching implications for how companies solve problems, develop products, and do business.
- **Bridgelux is an emerging player in Solid State/LED lighting and an H&H portfolio company that is well positioned to capitalize on a new wave of next generation lighting solutions** that promises to radically reshape the global commercial and residential lighting landscape while significantly reducing the energy consumption of lighting. Our fundamental analysis of Bridgelux suggests an intrinsic value for the company's shares substantially above the value currently reflected in H&H's NAV.
- **Contour Energy is improving upon fluoride-based technology to produce lighter, more powerful and cost-effective batteries.** The company has a **superior business model** in that it focuses on innovation, joint development and licensing, and leaves downstream manufacturing and packaging to others. A **strong management** team is in place and the company **recently completed a series C** round of capital to fund its commercialization and revenue ramp toward profitability. **Schlumberger is a strategic investor** and is helping to lead the commercialization of the technology in the energy industry.
- **TINY offers investors an attractive way to gain ownership of some of the most promising companies commercializing nano-enabled products in the world at a time of accelerating nanotech market penetration.** The reported NAV for H&H was \$4.73 as of March 31, 2011. Our ongoing analysis of H&H's portfolio companies suggests that the current NAV understates the intrinsic portfolio value by at least 50%. TINY has historically traded on a P/NAV of 2x and is currently trading slightly above NAV today. **Our analysis implies a fully valued share price of \$12 of TINY.**

---

<sup>1</sup> As we were going to press, DuPont announced the acquisition of H&H portfolio company Innovalight. H&H made its initial investment in Innovalight in April 2006. The liquidity event will, ceteris paribus, provide a boost to TINY's NAV. As of March 31, 2011, H&H valued its position at \$3.92 million. H&H expects to receive up to approximately \$5.4 million in this transaction.

It has been an eventful first half of 2011 for Harris & Harris Group (H&H). Like Derek Jeter's stellar performance on July 9<sup>th</sup> to become the first New York Yankee in history to reach 3,000 hits, H&H's first half of 2011 could not have been scripted much better. The company has seen two of its portfolio companies – NeoPhotonics (NPTN) and Solazyme (SZYM) – come public through successful stock offerings this year. In addition, one of its portfolio companies, BioVex, was acquired by Amgen (AMGN) in a deal that could be worth up to a billion dollars if certain milestones are hit in the future.

These events come at a time of accelerating commercialization of nano-enabled products. The past decade has witnessed a 25% per annum growth rate of the final market value of nano-enabled products to around \$300 billion today. Some 60 countries have adopted nanotechnology research programs, making nanotech one of the largest and most competitive research fields globally. These research programs are laying the foundation for a proliferation of nano-enabled product commercialization activity that will dwarf anything we've seen to date.

With nanotechnology now widely recognized throughout the world as a transformative field of science and technology, comparable to the introduction of electricity, biotechnology, and digital information revolutions, there are good reasons to expect nanotech to continue to gain traction in the market. We have surveyed the nanotech landscape in depth in our previous H&H reports.<sup>2</sup> As we noted in those reports, we are entering a period of time of heightened nano-enabled innovation and commercialization. The decade ahead will be unlike anything we have seen with nanotechnology. Importantly, unlike the previous decade, it will be marked by the reality of real products and profits overtaking hype as nano-enabled products

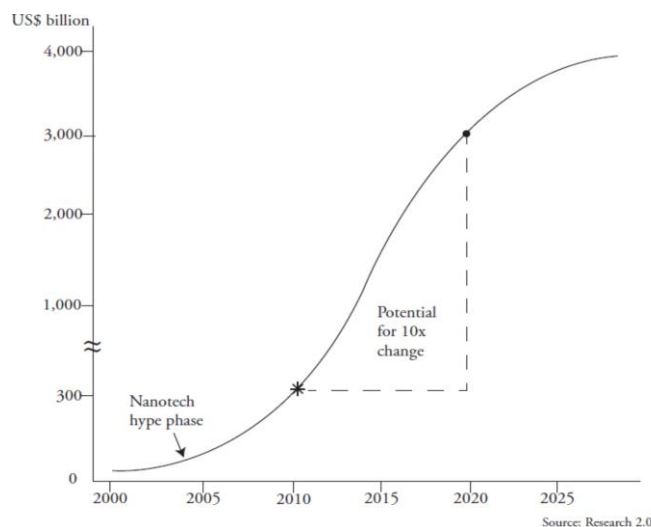
become an integral and significant part of the global economy.

## 10X CHANGE POTENTIAL

Technology investors are fond of trying to identify opportunities that can produce a 10x change in a business or industry. The potential for 10x change carries with it the opportunity for wealth creation and above-market investment returns. Based on the analysis we have done over the past decade, we believe nanotechnology has the potential to generate a 10x change in the years ahead. In the ensuing decade, we expect to see a 10-fold increase in final market value on nano-enabled products, from around \$300 million today to \$3 trillion by 2020.

What is unique about nanotechnology is that it has the potential to revolutionize and impact many industries and sectors, from computing and electronics, to energy, transportation and healthcare. A key distinguishing feature of nanotechnology is that it is a general purpose technology (GPT's). A GPT is a technology that has broad impact throughout the global economy. It has the potential to alter the way people live, work and play. Put simply, GPT's are game changers. They don't bring about incremental change. They generate massive change. Two prime examples of GPT's are electricity and the internet.

**The Growth Path of Nanotechnology**



Historically, GPT's have been very powerful drivers of innovation, economic growth, and wealth creation over periods that extend far beyond any given quarter into many years and decades. The innovation and wealth creation process associated with GPT's is a non-linear process that is difficult to project quarter-to-quarter and year-to-year. However, the profile of a GPT, in terms of its impact on innovation and wealth creation, is well defined over a longer time horizon. The path resembles a so-called S Curve.

A typical S Curve starts out as a flat line in the lower left hand corner of a graph and then turns up and begins to rise sharply over time (see exhibit below). The upward sloping part of the S Curve is a phase of

<sup>2</sup> See, Research 2.0, Harris & Harris Group, "[Survive to Thrive](#)," January 10, 2011 and "[Nanotech Renaissance](#)," April 28, 2011.

growth characterized by increasing penetration of a technology or product. After a period that typically extends out over many years or decades, penetration of the technology or product rises to a high level and growth eventually slows. Examples of GPTs following this growth path are railroads, electricity and the internet.

Looking at the evolution of nanotechnology as a GPT, we are entering the phase on the S Curve of accelerating penetration of nano-enabled products. The past decade in nanotech has been one of intensive effort in research and development, which is typical of a game changing GPT. Total worldwide nanotechnology R&D funding has grown from about \$1.2 billion (of which \$0.37 was in the U.S.) in 2000 to over \$15 billion (of which \$3.7 billion was in the U.S.) in 2008 with an average annual growth of 35% (33% in the U.S.)

The large volume of nanotech-related R&D has helped lay the foundation for an acceleration of nanotech commercialization in the decade ahead. Today, the outlook for nanotechnology and the companies that are using the science of nanotech to innovate and bring new products to market is as bright as it has ever been.<sup>3</sup>

The macro trends we are seeing in nanotechnology globally are evident at the micro level in the H&H group of portfolio companies. Between 2007 and 2010, aggregate revenue in the H&H portfolio group of companies increased from approximately \$198 million to approximately \$380 million, an average of approximately 24 percent per year. Over the past year, business activity has picked up and aggregate revenue of the H&H portfolio companies has increased an average of 42%, from approximately \$267 million in 2009 to \$380 million in 2010.

Business activity in the H&H portfolio group of companies continues to ramp up in 2011. There have been a host of announcements and disclosures made this year that are indicative of accelerated nanotech

---

<sup>3</sup> It should be noted that our base case outlook for nanotechnology in the decade ahead assumes no stringent legislation that would severely restrict or curtail the commercialization of nano-enabled products. That said, we expect policymakers in Washington and elsewhere around the world to continue researching environmental, health and safety issues related to nanotech. It is noteworthy that the 2012 U.S. federal budget proposes to invest ten times more in nanotech research than regulation through the National Nanotechnology Initiative.

commercialization in the marketplace. The table on the following page provides a summary of several notable announcements and disclosures from companies in the H&H portfolio (see, “Selected H&H Portfolio Company Developments.”).

## POTENTIAL NANOTECH GAME CHANGERS

Nanotechnology – due to its nature as a GPT – is a game changing technology. Earlier in the decade, there was a great deal of discussion (and associated hype, we might add) about nanotechnology and its potential to change the way we live, work, and play, but little evidence of it in the marketplace. That is beginning to change as we enter the second decade of the 21<sup>st</sup> century. One of the most significant developments we’ve seen in the nanotechnology landscape occurred earlier this year and was associated with the aforementioned public offering by Solazyme.

The Solazyme IPO marks an important inflection point and is highly significant in our view as it heralds the age of synthetic nanobiology – a period characterized by accelerating nano-enabled innovation in the market for fuels, chemicals, nutritionals and personal care products.<sup>4</sup> It is noteworthy that H&H was the first institutional investor in Solazyme, a fact that is not well known or appreciated by many investors.

As we observed in our pre-IPO report on Solazyme, the company’s technology platform has the ability to create a wide array of specifically and genetically engineered oils from microalgae. Solazyme’s oils have the potential to generate billions of dollars of wealth in the years ahead and, in the process, change the way we live, work and play. The company’s novel oils are targeted at several large end markets which collectively exceed \$1.5 trillion, from fuels and specialty chemicals to nutritionals and skin and personal care products. One can walk into a popular Sephora store today and purchase Solazyme’s *Algenist* skin care product, which is receiving positive reviews from customers. Solazyme’s *Golden Chorella*<sup>®</sup> nutritional products are available for purchase at Whole Foods and GNC stores. If the U.S. Navy has its way, its planes will be powered by Solazyme’s microalgae-derived fuel in the not-too-distant future.

---

<sup>4</sup> For more on Solazyme, see Research 2.0 Private Company Pre-IPO report, “[Solazyme: Synthetic Nanobiology Comes of Age](#).” May 19, 2011.

## SELECTED H&H PORTFOLIO COMPANY DEVELOPMENTS

### CLEANTECH

**Solazyme/Late Stage:** Priced an initial public offering (IPO) of 10,975,000 shares of common stock at \$18.00 per share.

**Nanosys/Late Stage:** The company's quantum-dot-enhancement film technology was featured in an article in *The Economist* magazine titled, "[Dotting the eyes.](#)" The article discusses potential new applications that could be enabled by Nanosys's quantum-dot-enhancement films.

**Cobalt/Early Stage:** Closed a \$20 million Series D round of financing. The additional capital will enable Cobalt to build its new 470,000 gallon per year demonstration plant in Alpena, Michigan, which will be the world's first cellulosic biorefinery for the production of the industrial chemical n-butanol. In addition, the funding will enable Cobalt to expand its network of strategic relationships, to begin development of its first commercial facilities and to progress its partnership with the U.S. Navy to develop bio jet fuel.

**Contour Energy Systems/Mid Stage:** Announced it successfully raised a Series C round of financing from Singapore's EDBI (EDB Investments Pte Ltd.) and previous investors CMEA Capital, Harris & Harris Group, Schlumberger and U.S. Venture Partners. Use of capital includes expanding R&D efforts and increasing production capacity to accelerate the commercialization of its portfolio of next-generation primary and rechargeable batteries targeting applications in automotive, consumer, industrial, medical and military markets worldwide.

**ABSMaterials/Mid Stage:** Produced Water Absorbents Inc. (PWA) announced the successful completion of an \$11 million Series A financing to expand its commercial operations treating produced water, flow-back and hydraulic fracturing water clean-ups. The funds will be used to accelerate upstream oil and gas usage of ABSMaterials' Osorb technology. ABSMaterials entered into a joint ownership and license agreement in the PWA unit and will manufacture Osorb material and provide technical expertise, ongoing research and laboratory work.

### ELECTONICS/SEMICONDUCTORS

**D-Wave Systems/Mid Stage:** Announced that Lockheed Martin entered into an agreement to purchase a quantum computing system from D-Wave. The multi-year contract includes a system, maintenance and associated professional services.

**Kovio/Mid Stage:** Raised \$15 million in a new equity financing led by Tyco Retail Solutions, a unit of Tyco International. The funding will enable Kovio and Tyco Retail Solutions to deliver solutions that take advantage of the emerging infrastructure of Near Field Communication (NFC)-enabled devices and printed silicon capabilities as the market opportunity for mobile interactive platforms evolves.

**Adesto/Early Stage:** Announced the formation of a development and manufacturing partnership with Altis Semiconductor that will lead to the delivery of the first Conductive Bridging RAM (CBRAM) based devices in 2011. Adesto and Altis reached their formal agreement after two and one-half years of close collaboration on the development of Adesto's CBRAM technology and products leading the way to the production of the first resistive RAM memory device.

### HEALTHCARE

**Mersana/Mid Stage:** Raised over half of a targeted \$10 million private debt offering with institutional investors. The additional capital raise follows an announcement last year of a deal with Israel-based Teva Pharmaceuticals that could be worth \$334 million.

Solazyme generated nearly \$40 million in revenue last year and revenues are expected to ramp up in the months ahead as the company builds out production capacity. Importantly, Solazyme's nano-enabled technology platform can profitably produce oils for all its targeted markets – a feat that wasn't possible during the hype phase of nanotech in 2004-05.

Another notable nanotech development this year with potentially game changing potential and direct relevance to H&H's portfolio was D-Wave's announcement that it had sold its first quantum computing system.<sup>5</sup> D-Wave's first quantum computer sale was to the established aerospace and defense juggernaut, Lockheed Martin (LMT). Lockheed entered into an agreement to purchase a quantum computing system from D-Wave called the D-Wave One. The deal was a multi-year contract reportedly worth \$10 million that includes a system, maintenance and associated professional services. The D-Wave One quantum computing system uses a 128 qubit processor.<sup>6</sup> The qubits in the D-Wave One are linked by structures called couplers made from superconducting niobium alloy, which can control the extent to which adjacent magnetic fields, representing qubits, affect one another. Performing a calculation with the D-Wave One involves using magnetic fields to set the states of qubits and couplers, waiting a short time, and then reading out the final values from the qubits.

What is the attraction of quantum computers? Theoreticians have shown that quantum computers could easily solve problems that are impossible for other computers. The major attraction of D-Wave's quantum computer system is its ability to find approximate answers to problems that can only be truly solved by exhaustively searching for every possible solution. D-Wave notes that its quantum computer produces results for difficult problems that are more accurate than those generated by conventional computers.

---

<sup>5</sup> Also worthy of note was [a letter](#) in the prestigious British science journal *Nature* reporting results of experiments with D-Wave's quantum computing system.

<sup>6</sup> Qubit is short for "quantum bit." Unlike bits in a conventional digital computer, which are represented as either a 0 or 1, a qubit can be a 0 or 1 or a superposition of both. For a general discussion of qubits and quantum computing, see "[Dream Machine](#)," by Rivka Galchen, *The New Yorker*, May 19, 2011.

Lockheed Martin says it intends to use the new purchase to aid identification of bugs in products that are complex combinations of software and hardware. The goal is to reduce cost overruns caused by unforeseen technical problems with such systems. Such challenges could help deal with issues related to product innovation at Lockheed and help the company deliver products on time and within budget. While Lockheed Martin is D-Wave's first customer, Google (GOOG) reportedly has been experimenting with D-Wave's technology for various search applications (e.g., facial recognition).

It is difficult at this juncture to assess D-Wave's investment value. Lockheed Martin's purchase of D-Wave One was an important event for D-Wave as it validated the company's *raison d'être*. It is clearly early days for both quantum computing and for D-Wave. The company has developed a game changing technology that has the potential to reshape the business and global economic landscape in the years ahead. While theoretical scientists continue to debate the quantum mechanical properties of D-Wave One, we are encouraged to see established companies purchasing and experimenting with D-Wave's quantum technology. We suggest investors continue to watch this fascinating space carefully.

Recent developments at Solazyme and D-Wave are prominent examples of the acceleration we are seeing in nano-enabled product commercialization and the game changing potential associated with nanotechnology. There are many other companies in the H&H portfolio who are illustrative of the S Curve dynamic and disruptive potential of nanotechnology.

In our previous report, we provided in-depth analysis of Metabolon and Laser Light Engines. In this report, we analyze H&H portfolio companies Bridgelux and Contour Energy Systems. Bridgelux is an emerging leader in solid state lighting solutions, while Contour Energy Systems is an innovator in next generation battery technology. As we will see, both companies are gaining traction and momentum in the marketplace with innovative, nano-enabled products.

## **BRIDGELUX: LIGHTING SOLUTIONS FOR THE 21<sup>ST</sup> CENTURY**

When investors think of LEDs, they are likely to think of a commoditized market with shrinking margins and a few major players dominating the space. Looking at the stock price performance of companies like Cree (CREE) and SemiLEDs (LEDS) over the past year, one certainly does not get the

impression of an industry on the verge of a major transformation led by accelerating technological innovation. Notwithstanding the current investor perception of LEDs and the companies in the market today, there is a potential major transformation unfolding in the solid state lighting (SSL) sector that is likely to usher in a wave of disruption in the lighting industry in the years ahead.

As we enter the second decade of the 21<sup>st</sup> century, we are moving into a world where Edison and his ubiquitous incandescent bulb are giving way to Feynman and a digitization of lighting technology. In the coming age of next generation digital lighting technology, light becomes just one feature of a bulb as its functionality grows exponentially (think networked intelligence and Smart Grid). The next generation of SSL technology is laying the foundation today for a proliferation of innovative lighting solutions that have the potential to radically reshape the global commercial and residential lighting landscape while significantly reducing the energy consumption of lighting.

## BACKGROUND

To set the stage for what is happening in lighting technology today, it is useful to go back a decade to an event that took place at the 1999 Optoelectronics Industry Development Association forum in Washington, DC. At that forum, Roland Haitz and Fred Kish of Hewlett-Packard, and Jeff Tsao and Jeff Nelson of Sandia National Laboratories, presented a white paper that made the case for a national research program on semiconductor lighting. In their white paper, the scientists stated:

“Dramatic changes are unfolding in lighting technology. Semiconductor light emitting diodes (LEDs), until recently used mainly as simple indicator lamps in electronics and toys, have become as bright and efficient as incandescent bulbs, at nearly all visible wavelengths. They have already begun to displace incandescent bulbs in many applications, particularly those requiring durability, compactness, cool operation and/or directionality (e.g., traffic, automotive, display, and architectural/directed-area lighting). Further major improvements in this technology are believed achievable. Recently, external electrical-to-optical energy conversion efficiencies exceeding 50% have been achieved in infrared light emitting devices. If similar efficiencies are achieved in the visible, the result would be the holy grail of lighting: a 200  $lm/W$  (lumen per Watt) white light source two times more efficient than fluorescent lamps, and ten times more

efficient than incandescent lamps. *This new white light source would change the way we live, and the way we consume energy.*”<sup>7</sup>

At the heart of the Haitz et al. white paper was a prediction of a revolution in the 130 year-old electric lighting industry – an industry that consumes some 6.5% of global energy today. Haitz and his colleagues saw something important in LEDs – that they could become a game changing lighting technology in the future as SSL technology evolved exponentially. To appreciate their vision of LEDs as a game changing technology, a little history is helpful.

Solid-state lighting (SSL), or LEDs, are semiconductor diodes that emit light in response to applied electrical current. The technology traces back to 1927 with the Russian scientist and inventor Olge Vladimirovich Losev, who noticed in the course of his work as a radio technician that diodes used in radio receivers emitted light when current was passed through them. Thirty-five years later, Nick Holonyak Jr. of General Electric developed the first practical visible-spectrum (red) LED. Today, Holonyak is viewed as the father of the LED.

Throughout the 1960s LEDs were expensive and therefore not used in consumer or commercial applications. Monsanto became the first company to mass produce visible LEDs in the late 1960s using gallium arsenide phosphide. In 1968, Hewlett Packard introduced red LEDs supplied by Monsanto for use in alphanumeric displays and the company’s handheld calculators.

LEDs received a big commercial boost in the 1970s when Fairchild Optoelectronics employed a conventional process for fabricating compound semiconductor chips to produce LED devices which cost less than five cents each. Those who grew up in the 1970s might recall those inexpensive LED watches that became fashionable. The key technology breakthrough for LEDs was the use of the planar process, the primary process by which modern integrated circuits are built. The planar process was invented by Dr. Jean Hoerni, a co-founder of Fairchild Semiconductor, along with tech luminaries Robert Noyce (inventor of the integrated circuit) and Gordon Moore (co-founder of Intel) and several

---

<sup>7</sup> Haitz et al., “The Case for a National Research Program on Semiconductor Lighting,” October 6, 1999. [http://lighting.sandia.gov/lightingdocs/hpsnl\\_long.pdf](http://lighting.sandia.gov/lightingdocs/hpsnl_long.pdf)

other technology innovators. Hoerni's planar process continues to be used today by companies to produce LEDs.

LEDs are a semiconductor technology. They have several characteristics that make them attractive relative to conventional lighting technology. For starters, LEDs can produce light more than ten times more efficiently, as measured in lumens per watt, than conventional incandescent bulbs, and are twice as efficient as compact fluorescent lamps (CFLs), thus significantly reducing lighting energy costs.<sup>8</sup> LEDs also last a long time. One can think of them as the "Energizer Bunny" of lighting. Conventional LEDs last in the range of 30,000-100,000 hours and in most applications will work for 10 to 30 years.

Additionally, LEDs operate at lower temperatures than conventional lighting, making them ideal for outdoor lighting, refrigerators and other cold spaces. Other key characteristics of LEDs include: shock and vibration resistance, compact size, directional light, and no infra-red or ultraviolet emissions or other potentially harmful elements.

The global lighting market is estimated today in the neighborhood of \$70 billion (it is important to note that this figure does not factor in the cost of energy, which is an important and growing part of the SSL equation, as discussed below). Light fixtures account for 65% of total spending on lighting. The remaining market is split between replacement lamps (i.e., light bulbs) at 30% and electronics at 5%. LEDs account for a small share of the total lighting market – around 4%, or \$3 billion.

LEDs are concentrated in niche applications today. Current uses include backlighting in mobile phones (including smart phones), computer displays and TVs. Other applications for LEDs include automotive, roadway signals, and street lighting. Blue LEDs, the basis for lighting applications, were only introduced in the 1990s. Since then, primarily due to issues related to cost/price relative to conventional lighting technology, there has only been modest penetration of LEDs in general illumination (e.g., interior lighting in retail, commercial and residential environments, and outdoor lighting on roadways and in parking garages). That said, the stage is now set for a dramatic

---

<sup>8</sup> In lighting *efficacy* is the measure of lumens per watt in lighting applications, or the amount of light produced for each watt of electricity consumed.

decline in cost and a new generation of SSL technology.

## SSL: THE NEXT GENERATION

Over the past decade, there has been an exponential increase in LED output, which has risen from roughly 20 lumens per watt in 2000 to over 100 lumens per watt in commercial applications today.<sup>9</sup> Last year marked a milestone in SSL technology as warm white LEDs over 100 lumens/watt became commercially available for the first time in history. We are now at an important inflection point where the so-called Holy Grail of lighting – a 200 lumens/watt white light source two times more efficient than fluorescent lamps and ten times more efficient than incandescent lamps – is attainable. One of the companies leading the charge in next generation SSL technology is Harris & Harris Group portfolio company Bridgelux.

Founded in 2002 and led by CEO William Watkins, formerly CEO of Seagate Technology, Bridgelux is seeking to transform the \$70 billion conventional lighting industry into a \$100 billion-plus market opportunity that offers a growing array of commercial and residential SSL lighting solutions. Bridgelux is positioned as an emerging innovator in SSL technology offering customers lighting solutions with greater functionality and energy efficiency. The company has developed a novel platform to enable lamp and luminaire manufacturers to provide high performance and energy-efficient white light for fast growing commercial and retail lighting markets – markets that heretofore have been out of reach for LEDs.

There is a lot of specialized industry knowledge that lies behind the production of LEDs and there are only a handful of companies throughout the world that have this knowhow. What separates Bridgelux from its competitors is an innovative technology platform that allows for extremely accurate control of band gaps at the nano scale, as well as the use of new materials, recipes and properties that are used to design and manufacture innovative lighting solutions that heretofore have not existed in the marketplace. The company's unique technology platform has the ability to significantly drive down the cost of SSL in

---

<sup>9</sup> See Roland Haitz and Jeffrey Y. Tsao, "Solid-stage lighting: 'The case' 10 years after and future prospects." *Phys.Status Solidi A* 208, No 1, 17-29 (2011). <http://onlinelibrary.wiley.com/doi/10.1002/pssa.201026349/pdf>

the years ahead while substantially boosting its functionality and lowering energy consumption.

Bridgelux is innovating along several paths today. In the process, the company has the potential to appreciably alter the economics and functionality of SSL technology in the years ahead, not to mention the dynamics of the global lighting industry. There are three main paths of innovation at Bridgelux: materials/design, packaging, and arrays/light engines. As we will see, each path of innovation gives Bridgelux a competitive advantage in the marketplace and lays the foundation for a new generation of SSL lighting technology.

With respect to innovation in materials and design, Bridgelux has developed proprietary and patented nanomaterials that allow the company to produce SSL equivalent in color to conventional lighting technology. Historically, the quality of white light LEDs has been poor relative to conventional incandescent bulbs and florescent lighting. Bridgelux's innovative materials put the quality of white light LEDs on a par with conventional lights.

Raising the bar on the quality of white light LEDs through materials and design innovation is a big deal. But there is another key innovation at Bridgelux in the area of materials and design that is a potential game changer in the lighting industry. Bridgelux has developed a unique process that will allow the company to manufacture LEDs that produce high quality white light using 200 mm silicon.

Up until now, no manufacturer has produced LEDs using 200 mm silicon, and many industry observers are skeptical of Bridgelux's ability to produce LEDs using this process.<sup>10</sup> Conventional LEDs are made using sapphire or, in the case of Cree, silicon carbide. Both are more expensive than silicon. Bridgelux's technology process has the potential to significantly drive down the cost of manufacturing LEDs and

---

<sup>10</sup> Samsung Advanced Institute of Science and Technology (SAIT) recently announced that it was following Bridgelux's lead and has developed a process to produce LEDs on 200 mm silicon. See story at this link: <http://www.compoundsemiconductor.net/csc/news-details/id/19733789/name/Samsung-develops-nitride-LEDs-on-200-mm-silico.html>.

make them competitive to conventional white lighting technology.

From a strategic perspective, the use of 200 mm silicon opens the door to using existing semiconductor fabs for manufacturing Bridgelux's LEDs. LEDs, after all, are a semiconductor technology. There are an estimated two hundred or so semiconductor fabs worldwide that can churn out the 8 inch wafers for LEDs suited perfectly to Bridgelux's manufacturing needs. One can imagine that many of the owners of these facilities (e.g., TSMC) would be very receptive to using these fabs to churn out Bridgelux LEDs, particularly since many of them have been fully depreciated and are underutilized.<sup>11</sup>

Bridgelux's innovative 200 mm silicon technology process for LEDs allows the company to pursue partnerships with existing semiconductor manufacturers and structure the company as an asset-lite or fabless SSL solutions company (think SanDisk). Leveraging existing semi fabs via partnerships with established semiconductor manufacturers has the potential to create extremely favorable economics for Bridgelux. This strategy is a recipe for lower production costs, higher margins and returns on invested capital.

The second path of innovation at Bridgelux is in packaging. The company has developed a process that reduces binning, which gives Bridgelux a potentially huge competitive advantage in the SSL industry. Reducing binning is considered by many in the SSL industry to be a major milestone. Conventional LED packaging requires splitting the dies into identical wavelengths and placing them into different bins. This process is expensive and increases the cost of manufacturing LEDs. Bridgelux's LED manufacturing process enables the company to package die with significantly less binning, thus driving down the cost of LED production.

The third and perhaps most important path of innovation at Bridgelux lies with arrays and light engines. When people think of lighting they normally think of incandescent bulbs and florescent lighting. Arrays and light engines are a vast, unexplored frontier in lighting and this is where the majority of future value resides.

---

<sup>11</sup> Semiconductor manufacturers have migrated to 12-inch wafers to produce semiconductors.



Bridgelux is in the early stages of building out its SSL arrays. The company is currently producing arrays off its next generation platform, which enables the company to sell into more applications and provides for a 15% increase in efficacy and represents a reduction in total system cost for customers.

Bridgelux's next generation array represents a significant increase in functionality and efficacy. The Generation 4 platform is capable of producing AC LEDs that enable a step function reduction in system level bill of materials costs by eliminating the driver and reducing the thermal management burden. For most fixtures, the cost of the driver and thermal management is between \$2 and \$10. In terms of efficacy, Bridgelux's Generation 4 platform is up to 30% more efficient than its Generation 3 technology. The company expects a 20% increase in average selling prices of its Generation 4 SSL array due to the added AC inverter content.

## INTELLIGENT LIGHTING SOLUTIONS

Bridgelux is innovating at every level, from the materials to produce LEDs to packaging and arrays. CEO Watkins believes that innovation is the lifeblood and key to Bridgelux's success in the SSL market. He and his team are focused on providing customers with an innovative, high value-add lighting solution while migrating up the SSL value chain. Bridgelux's technology platform is geared to producing plug-and-play and application-specific LED designs and solutions that increase performance and reduce total system cost (including, importantly, energy costs). A major part of the company's strategy seeks to form direct partnerships with luminaire companies that bypass established bulb companies and become a disruptive force in the lighting industry.

Another key ingredient to Bridgelux's strategy is to move beyond light as the sole function of a bulb and embed ever-greater intelligence into lighting systems. Adding increased functionality to lighting – such as dimming, sensing and networking – goes hand in hand with Bridgelux's strategy of providing great value to its customers.

Molex's Helieon® product is a prime example of how Bridgelux is innovating beyond the traditional bulb and moving up the LED value chain.<sup>12</sup>

The Helieon lighting system simplifies the process of designing, building and replacing luminaires. It is the first plug-and-play sustainable SSL module to integrate high-efficiency precision lighting with an easy-to-use socketed solution. Molex's Helieon® was awarded "Most Innovative Product of the Year" at *Lightfair International* in 2010. Bridgelux is working on next generation Helieon lighting systems that will add more functionality and increase performance and efficacy. Future innovations of the product include an AC light engine, secondary optic, and additional lamp form factors. Another example of Bridgelux innovation is in traditional street lighting. Today, the company offers two modules for \$70 that can be retrofit into existing street light Cobra Head fixtures. Installing Bridgelux's modules reduces the full install cost by over 2.5 times to below \$300 from over \$800 for a typical LED solution.

Bridgelux recently announced a partnership with HomeLights, a leading LED lighting company based in Paris, France. HomeLights will be using Bridgelux's high flux density LED Array technology to enable their new series of energy efficient, environmentally-friendly spotlight luminaires and bulbs. HomeLights appears enthusiastic about the partnership, noting that the new products will deliver high quality uniform lighting, much more closely matched to the traditional halogen and incandescent sources they are designed to displace, while significantly reducing operating costs. In addition, HomeLights and

Bridgelux are partners on new and unique LED lighting solutions that will be sold directly by HomeLights throughout Europe beginning in October of this year.

Looking at the competitive landscape, Bridgelux believes that its technology platform has given it a two year lead in the marketplace. The conventional LED market is dominated today by an oligopoly, the so-called "Big Five," which includes Nichia, Toyoda Gosei, Osram (owned by Siemens), Philips Lumileds and Cree.



---

<sup>12</sup> For a short video explanation of the Helieon lighting system, go to [Helieon.com](http://Helieon.com).

The niche applications LED market is a commodity market today and we are likely to see margins continue to fall amid increasing competition from China and elsewhere in Asia. Bridgelux views Citizen Electronics in Japan and Cree in the U.S. as its major competitors currently. Citizen is limited in ability to compete with Bridgelux, having limited access to die; Cree has an emitter LED product that competes with Bridgelux's array/module. That said, it appears that Cree's business strategy is in transition today with rumors in the market that it is looking to spin off its chip business. Other players in the market, such as SemiLEDs and Epistar, may be viewed as competitors to Bridgelux but neither has packaging technology.

## VALUATION AND SUMMARY

Our research suggests we are in the early stages of what is likely to be a revolution in general illumination led by advances in SSL technology with Bridgelux as an emerging player in the industry. Up until now, cost and quality of light has been the major obstacle preventing wider adoption of LEDs in lighting. A decade ago, SSL lamp costs were three to four orders of magnitude higher than those of incandescent lamps.

Bridgelux's innovative technology platform has the potential to dramatically drive down the cost of high quality general illumination LEDs in the years ahead. The tipping point for traditional light bulb replacement with an LED fixture is seen as a price around \$6 to \$10. Bill Watkins was quoted in *The New York Times* earlier this year saying that Bridgelux will drive the cost of LED lamps down to \$5 in the next two to three years versus around \$20 today. Thus, the tipping point for LEDs in general illumination lighting may be just around the corner.

The coming exponential decline in the cost of general illuminating LEDs, coupled with increasing functionality and value, will spur significant growth in adoption of SSL and ultimately lead to mass global penetration. Quickening the pace of adoption of LED general illumination lighting in the near term is government regulation. There have been major policy initiatives by governments throughout the world to curtail or ban the use of incandescent lighting. Incandescent bulbs are being phased out in Europe while in the U.S. efficiency policies will eliminate the 100-watt bulb in 2012.

LEDs for general illumination account for less than 1 percent of the total lighting market today. There are lots of scenarios out there as to how quickly LEDs will be adopted for general illumination in the years ahead. The speed of adoption will undoubtedly vary depending on the application in commercial and residential markets. One would expect the speed of adoption to be faster in commercial markets, where Bridgelux is focused on providing innovative lighting solutions.

In our base case intrinsic valuation (IV) model for Bridgelux (published below), we have baked in accelerating top line growth to reflect the dynamics we expect to see for LEDs in general illumination lighting. Bridgelux has publicly stated that revenues are likely to more than double this year to over \$70 million. We have projected a near doubling of revenues in 2012 as additional lighting solutions come to market and expect solid top line growth to continue during the next several years.

The model assumes gross margins in the mid to upper 30s and rising R&D expenditures as Bridgelux works to stay ahead of the competition in providing novel SSL solutions. Our IV model is consistent with Bridgelux's strategy to build an asset-lite or fabless SSL solutions company that moves up the value chain into high-value added SSL arrays away from commoditized products. We expect to see Bridgelux generating high returns on invested capital relative to existing competitors in the market.

Our base case IV for Bridgelux estimates intrinsic value at \$655 million this year and rising to \$1.3 billion in 2012. The company recently closed a venture capital round at \$1.90/share versus our IV share price of around \$5.50 which assumes further dilution, most likely in the form of a public offering within the next 12-18 months. Based on our IV analysis of Bridgelux, we can see that there is considerable upside for Harris & Harris Group's investment in the company that is currently not reflected in the company's estimate of net asset value.

In summary, we view Bridgelux as an emerging company in the next generation LED market that is transitioning away from niche lighting applications and headed for mass penetration globally for use as general illumination. There is a large market for lighting today and that market will be heavily disrupted by SSL in coming years.

We are at an inflection point in the history of lighting technology. As stated earlier, Edison and the unintel-

ligent incandescent bulb are giving way to Feynman and the digitalization of intelligent lighting solutions. There is a golden opportunity today for Bridgelux to become a driving force of innovation in the lighting industry. It is difficult to understate the potential magnitude of the change we are likely to see in lighting technology in the years just ahead.

## **CONTOUR ENERGY**

### **THE BATTERY CHASE**

Batteries have been a gating factor for a broad range of new technologies, particularly mobile computing and electric vehicles. Considering that demand for power is flowing into nearly everything in the form of sensors and other active technologies, there are myriad opportunities to improve performance in terms of power delivery, battery life, temperature operating range, weight, size and material safety. The potential is virtually unlimited.

The quest for better batteries is spawning billions of investment in basic research, technology, manufacturing plants and packaging facilities. Batteries, as they exist today, are already a massive business. A full listing of all the companies in the battery business runs to 63 double-spaced pages and includes very large industrial players like Panasonic, smaller public pure plays like A123 Systems and many private companies that focus on individual segments or regional opportunities. There are nearly 30 public companies that can be described, at least loosely, as being in the “battery space”.

Yet, for all this investment and effort, we still lament the battery in our laptop or cell phone, and auto industry pundits condemn the electric car because consumers will experience such “range anxiety” that they won’t adopt them in any major way.

Such problems are tailor-made for a nanotechnology approach. Contour Energy is using nanotechnology and a more innovative, capital-efficient approach to push the envelopes of battery technology to fit new applications and improve existing ones. Its approach makes more sense for equity investors than most other battery companies we have looked at.

### **A CAPITAL EFFICIENT MODEL**

The stock market is littered with public companies that have not rewarded investors over the long term. Thankfully, some lessons have been learned: 1) It doesn’t make sense to spend \$1B on building a battery manufacturing plant. 2) Packaging and integration is a commodity service business that requires substantial amounts of capital. 3) This is a mature

industry in which distribution is basically set in stone. There’s little point in trying to break into it or build a new network.

Much to its credit, Contour Energy is building its knowledge, protecting it where appropriate (43 patents and pending applications) and working with large industry players like Energizer, Biomet, Schlumberger, Motorola, HP and Ford to go to market.

Contour’s technology and business approach makes it far more able to be disruptive in the energy industry than other companies. Other companies with large investments in manufacturing and packaging find it difficult to develop new technologies that will render the past investments obsolete.

### **TECHNOLOGY DISCUSSION**

The “special sauce” at Contour is a set of improvements on fluorine-based chemistry that delivers advantages inherent in so-called CFx technologies without the shortcomings. Compared to other available technologies, CFx offers:

1. Higher energy density
2. Flatter discharge curve
3. Broader temperature operating range
4. Longer shelf life (low self-discharge)
5. Increased reliability and safety

However, historically there have been disadvantages like higher costs and excessive heat generation during periods of high discharge.

Contour has industry-leading capabilities in the development and manufacturing of CFx powder and materials needed for superior batteries.

In terms of future development, Contour has licensed some promising technology from MIT that can create very high power electrodes for special applications, and is said to have the potential to “bridge the gap between capacitors and batteries.”

Contour has created its own brand of Li-free battery technology called Fluorion™. In addition to improved performance, this Li-free technology can be safer and more environmentally friendly.

### **PRODUCTS & PARTNERSHIPS**

Contour products will range from small button batteries for consumer electronics to traditional can-shaped cells to specially designed packages for industrial applications. Their first commercial products were products for the OEM market and a button battery that has had success in the aftermarket.

Consistent with its capital efficient strategy, the company undertakes lots of joint development and working partnerships to create industry-specific products and revenue streams. We noted these above when talking about the business model. We expect this to become the favored approach to integrating the battery into the design of future products.

Schlumberger is both an investor and a partner for Contour. The focus is on more reliable and safer battery power that can work longer and in the higher temperatures common to oil and gas well environments.

Although batteries for electric vehicles get all the headlines, the more profitable opportunities in transportation are in batteries for applications like tire pressure monitoring, tracking systems, sensors, and backup power systems.

Contour battery technology is also being developed for computer and mobile devices as an improved alternative to conventional Lithium ion batteries. Motorola and HP are two of the initial companies Contour is working with.

In healthcare, we often think of pacemaker batteries, but batteries are also critical in many other applications, including glucose monitoring, defibrillators and electric stimulators. Contour is working with Biomet today on non-magnetic, longer life batteries.

Contour is working on government and military projects that will help create next-generation power packs to fuel what is increasingly electronic and information-based warfare. These batteries will be safer, with longer run times and lighter weight.

In many of these situations, Contour technology will be “designed in” and will provide the company with opportunities to enjoy long-term visible revenue streams.

## **A HIGH-POWERED TEAM**

There’s too much research in electrochemistry and materials technology for any investor to be able to attempt to judge it, let alone keep up with and invest in it. So the team is what matters most.

The company was founded by two professors – Dr. Robert Grubbs from Caltech, who won a Nobel prize in 2005<sup>13</sup>, and Dr. Andre Hamwi, who is a globally recognized expert in fluorine chemistry.

Most of the heavy lifting in the battery business begins where the science leaves off. Although Dr. Grubbs and Dr. Hamwi are involved with the company, the future belongs to operational leadership, market development, scaling up, product development and financial results.

The CEO of the company, Joseph Fisher, has over 30 years of industry experience and has had an extensive career in management at Energizer. The COO, Dr. L.C. Chiu, is a former HP executive with successful startup company experience as well.

Dr. Simon Jones heads R&D, with over 10 years of experience and over 30 publications in fields directly related to the Contour opportunities (electrochemistry, electrolytes and nanotechnology)<sup>14</sup>.

On the revenue side, VP of Sales and Marketing Joe Carcone has a long history of performance in the industry, at companies including Sanyo, GE and Powergenix. Lee Sailer, VP of Finance, has substantial financial operations experience with small to mid-size companies.

## **COMPETITION**

A review of all the competition in the battery industry would fill a book. Here we will consider the most direct competitors to Contour in terms of technology and markets. By far the largest is Panasonic, with 50% of the Li-CFx market. Fortunately for Contour, Panasonic aims mostly for standard aftermarket batteries for calculators, cameras, cordless devices, watches and memory backup power. Many of these

---

<sup>13</sup> For more information on the Nobel prize award and lecture visit:  
[http://nobelprize.org/nobel\\_prizes/chemistry/laureates/2005/grubbs-lecture.html](http://nobelprize.org/nobel_prizes/chemistry/laureates/2005/grubbs-lecture.html)

<sup>14</sup> For a complete list of publications, refer to his website:  
<http://simon-jones.staff.shef.ac.uk/index.php?id=11>

are very commoditized and best left to massive-scale players like Panasonic.

The next major competitors are Spectrum Brands, a conglomerate, and Great Batch Medical. Spectrum owns battery brands Rayovac and Varta. Although only peripherally related, it also owns companies like Black & Decker (power tools) and Remington (electric shavers). Spectrum has been producing Li-CFx button cells for decades and is expanding into the full range of cell packages.

Great Batch is a broad medical technology company that provides batteries that are implantable in the body. Although formidable in its industry, it also has competition at the medical device level, and those companies are more likely to want to work with an independent company like Contour. Great Batch also owns Electrochem, which competes in the more customized high performance battery space for industrial applications in oil and gas exploration and aerospace.

Having large competitors is a challenge, but so far Contour has been successful, and its approach in using partners like Schlumberger, Ford, Motorola, Biomet and HP allows Contour to avoid direct competition.

## COMPANY STATUS AND OUTLOOK

As a company, Contour is squarely in the “ramp” phase of its business. It just completed another round of financing (series C) which will allow the company to accelerate the programs and continue to ramp its revenues and build its path to profitability.

Contour has a management team, board of directors and a set of advisors that position the company to go the distance if that’s what it chooses to do. Going public in the battery space has not been particularly easy (just ask A123 Systems shareholders), but in a few years Contour could have the scale and profitability to support public company status.

Investors may find its positioning as an innovative technology company with an “asset light” model enough to really spark their interest.

## NEW INVESTMENT ACTIVITY

H&H made several investments in the second quarter that highlight the company’s focused investment strategy of building a diversified portfolio of emerg-

ing companies developing and producing innovative nano-enabled products across multiple sectors. New investments totaling over \$3 million made in Q2 include:

- A \$720,000 investment in Contour Energy Systems’ Series C financing. The investment brought H&H’s total investment at cost in Contour to \$4.03 million or 2.7% of total net assets as of March 31, 2011.
- A \$1.5 million investment in Produced Waters Absorbents’ \$11 million Series A financing. This investment is related to H&H’s investment in ABSMaterials, a mid-stage portfolio company in the Cleantech sector. The funds will be used to accelerate upstream oil and gas usage of ABSMaterials’ Osorb technology.
- An \$892,315 investment in Kovio’s \$15 million Series B preferred stock financing. This investment brings H&H’s total investment at cost in Kovio to \$6.5 mm or 4.4% of net assets as of March 31, 2011.

In addition to these investments, H&H participated in Cobalt Technologies’ \$20 million Series D round of financing. Also of note for H&H was Innovalight, receiving \$3.4 million of funding from the U.S. Department of Energy (DOE) to accelerate the development and production of silicon ink material and processes for high efficiency solar cells. Prior to the funding from the DOE, Innovalight had announced supply agreements with several of the largest solar cell manufacturing companies in the world. The company is a late stage H&H portfolio company.<sup>15</sup>

Currently there are six late stage H&H portfolio companies spread across three sectors – Cleantech, Healthcare and Electronics.<sup>16</sup> There are nine mid stage investments and nine early stage investments. We expect at least two late stage H&H portfolio companies to file for an IPO within the next 12 months and a couple more to be acquired by established companies. These liquidity events, should they materialize, will allow H&H to focus on building up positions in existing early and mid stage portfolio companies as well as adding new names to the port-

---

<sup>15</sup> As noted in the footnote on the first page, DuPont announced the acquisition of Innovalight. H&H expects to receive \$5.4 million once the acquisition is concluded.

<sup>16</sup> This figure does not include H&H’s investments in Solazyme and NeoPhotonics, both currently held in the portfolio but now both publicly traded.

folio to refresh the company's pipeline of investments.

## CONCLUSION

It would be difficult to script a better first half year for H&H. As we look ahead to the second half of 2011, we expect to see an accelerating level of commercialization activity across the H&H portfolio companies and more liquidly events.

One thing is clear: This isn't 2004 – a time of excess hype and little product commercialization to back it up. If anything, nanotechnology is flying under the radar screen today. Indeed, there is a great deal of nano-enabled innovation occurring in each sector and each stage of the H&H investment portfolio currently – more than at any time in history. As we have seen in this report, Solazyme, D-Wave, Bridgelux and Contour Energy are all ahead of the curve in their respective industries. What's more, they are executing well in the marketplace.

Additionally, there are a number of other H&H portfolio companies, such as Innovalight, Nanosys

and Cambrios that are flying below the radar screen yet gaining traction in the market. We expect H&H portfolio companies to become more visible to the general investment community in the months ahead as their products begin to penetrate the market in a deeper and more meaningful way.

Summing it all up, we continue to believe that TINY offers investors a compelling and attractive way to gain ownership of some of the most promising companies commercializing nano-enabled products in the world at a time of accelerating nanotech market penetration. Based on the analysis we've done over the past year, we continue to view TINY as undervalued and having a good deal of upside. The reported (unaudited) NAV for H&H was \$4.73 as of March 31, 2011. Our ongoing analysis of H&H's portfolio companies suggests that the current NAV understates the intrinsic portfolio value by at least 50%. TINY has historically traded on a P/NAV of 2x and is currently trading slightly above NAV today. Our analysis implies a fully valued share price of \$12 of TINY.

**Disclosure:** Harris & Harris is a research advisory client of Research 2.0. We have received compensation (not in form of warrants, options or restricted stock) in exchange for providing company investor positioning and advisory services. We also publish the results of our work for informational use. We maintain an independent research process, exercise full editorial control of all published content and apply the same standards to advisory clients as we do to all companies we follow. Research 2.0 employees are governed by rules to ensure that the interests of the organization are aligned with those of clients and investors. For additional information about our services, disclosures, disclaimers and employee policies, please visit our website.

Bridgelux

7/29/2011

Base Case

Dec YE	2008	2009	2010	2011	2012	2013	2014	2015	2016	Private	Ticker
YoY Change \$	\$12	\$2	\$18	\$48	\$95	\$91	\$95	\$105	\$135	NA	Exchange
Total Revenue	\$12	\$14	\$32	\$80	\$175	\$265	\$360	\$465	\$600	4630%	Rev Growth
YoY Growth	41107%	17%	128%	151%	118%	52%	36%	29%	29%	\$1.91	Current Price
COGS %	84%	76%	97%	76%	67%	64%	65%	62%	62%	215	Shares Out (mm)
COGS \$	\$10	\$11	\$31	\$61	\$117	\$170	\$235	\$290	\$370	17%	Avg. Dilution
Gross Profit	\$2	\$3	\$1	\$19	\$58	\$95	\$125	\$175	\$230	\$411	Cap (M)
Gross Margin	16%	24%	3%	24%	33%	36%	35%	38%	38%	\$27	Cash
SG&A %	96%	54%	63%	46%	11%	8%	6%	6%	5%	\$4.8	LT Debt (M)
SG&A	\$12	\$8	\$20	\$37	\$20	\$22	\$23	\$26	\$30	35%	Tax Rate
R&D %	116%	106%	85%	34%	17%	12%	10%	8%	8%	20	P/E Multiple
R&D \$	\$14	\$15	\$27	\$27	\$30	\$32	\$34	\$38	\$45	15%	Discount Rate
Operating Margin	-1203%	-559%	-4610%	-236%	14%	43%	54%	64%	67%		
Operating Income	(\$23)	(\$19)	(\$46)	(45)	8	41	68	112	155		
Other Income (expense)	0	0	3	(1)	0	(1)	0	(22)	0		
Taxes	0	0	0	(16)	3	14	24	39	54		
Tax Rate	35%	35%	35%	35%	35%	35%	35%	35%	35%	\$5.51	Intrinsic Value
Net Income	-\$23	-\$19	-\$44	-\$30	\$5	\$26	\$44	\$51	\$101	189%	Up/Downside
Net Margin	-196%	-136%	-136%	-38%	3%	10%	12%	11%	17%		
Market Value Using P/E	-\$469	-\$380	-\$870	-\$604	\$103	\$516	\$879	\$1,012	\$2,015		
Cash Position	\$0	\$2	\$4	\$25	\$30	\$56	\$100	\$150	\$251		
Shares (M)	79	99	168	215	235	236	237	238	230		
Period Share Price	\$0	\$0	-\$5	-\$3	\$0	\$2	\$4	\$4	\$9		
PV of MV 4 Years Out	\$59	\$295	\$502	\$579	\$1,152						
PV of Cash 4 Years Out	\$17	\$32	\$57	\$86	\$144						
PV MV + Cash	\$76	\$327	\$560	\$665	\$1,296						
PV Value Per Share	\$0.96	\$3.30	\$3.33	\$3.09	\$5.51						

## ABOUT RESEARCH 2.0

We have been building a new and unique brand of emerging technology research since 2005 with some new characteristics:

**Open:** Most research is seen and used by a small fraction of the interested audience. Our research is distributed broadly to more institutions, investors, company managers and individuals because we leverage the power of the Internet.

**Long Term Intrinsic Value:** We use a more reliable model for determining company valuation that is very effective over multi-quarter periods. It also avoids the noise of small quarterly fluctuations. It enables investors to exploit volatility.

**Focus on Emerging Technology:** Our coverage starts with technologies that are in the early stages of commercialization and stretches to those that are driving the bulk of industry and market growth. We avoid technologies that have reached a plateau or are declining.

**Interactive Platform:** Today, people are embracing more online and frequently updated information sources. Our research is targeted to the online community with distribution by email, blogs, syndication and social and professional networks.

**Professional & Independent:** We measure our success by the quality of our work and the independence of our research process.

Research 2.0 is based in Boston, Massachusetts with locations in Paris, New York and Connecticut. Visit our website for more information and to contact us: [www.research2zero.com](http://www.research2zero.com).