

# Winslow Environmental News

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## Electronic Waste Recycling

BY ELLEN PFEIFER

Hard drive bursting? Web pages lumbering onto the screen? Gotta have that megapixel digital imaging? Chances are, you're in the market for a new computer—or soon will be. But what will you do with that obsolete machine?

Like worn-out televisions and cell phones, most old computers will sooner or later find their way to the dump.

Electronic junk, previously just a tiny segment of the waste stream, has quickly assumed monster proportions. What's more, the mountains of CPUs and monitors in landfills probably represent only a fraction of the potential discards because most outmoded computers are gathering dust in people's attics and basements. It's not just the unsightliness, the wastefulness, and the low level biodegradability of the e-junk that is troubling. All those cathode ray tubes (CRTs), circuit boards, and plastic housings harbor toxic chemicals that can be dispersed into the air or ground water. (See accompanying chart)

How big is the problem? The Silicon Valley Toxics Coalition (SVTC) reports that currently 50% of US households own a computer and that the lifespan of computers has fallen from four-six years in 1997 to an expected two years by 2005. A Carnegie Mellon report estimates that there will be 325 million obsolete computers by 2005, of which 55 million will be land filled, 143 million recycled, and 127 million reused or stored until their end of life.

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FEATURED COMPANY

## Valence: The Next New Thing in Batteries?

BY CHANNING PAGE

HENDERSON, NV – CELLULAR PHONES HAVE MORE BELLS. PORTABLE COMPUTERS HAVE MORE WHISTLES. WITH EVERY GENERATION OF PRODUCT, ELECTRONICS MANUFACTURERS ARE ADDING FEATURES TO ATTRACT CUSTOMERS AND GAIN SHARE IN A MARKET THAT IS GROWING ANNUALLY BY 30%. THESE FEATURES REQUIRE MORE AND MORE ENERGY TO RUN EFFECTIVELY. WHAT IS GOING TO POWER ALL THESE GADGETS?

Batteries have been the obvious answer, but their development has failed to keep pace with electronic technology. Computers and cell phones increasingly demand smaller, lighter, more long-lived power sources, but batteries have rarely had sufficient flexibility to produce



custom designs. They have also frequently used heavy, toxic materials that create environmental problems when disposed.

Valence Technology of Henderson, Nevada (NASDAQ: VLNC) is among the companies confronting this technological challenge in a swiftly growing, competitive market. Its weapon is a new variety of battery, based on an updated form of lithium-ion. As anyone who has used them in a small camera can attest, lithium-ion (Li-Ion) batteries offer significant improvements over traditional nickel cadmium (NiCd) batteries (see accompanying chart). According to Earl Lum of CIBC World Markets, "lithium...is able to convert more energy by moving electrons back and forth in a chemical reaction than any other metal element... (These) batteries...offer more energy per volume and mass than batteries based upon other chemistries."

### A Lithium Breakthrough

But Li-Ion batteries have their limitations. The lithium electrolyte, which serves as the conducting medium, is in a liquid or gel form, requiring a metal case to contain it. This case is heavy and bulky, and constrains the design options for the battery.

However a new form of lithium, a solid Lithium Polymer (Li Polymer) pioneered by Telcordia Technologies (formerly Bellcore), is offering a solution. Because it is solid, the polymer electrolyte requires no metal casing, making it lightweight and malleable. Its thinness allows batteries to be shaped to meet virtually any design demand of portable equipment. Telcordia has licensed this technology to several companies, including Valence, which uses it as the basis for its own patented version.

### Valence's Particular Magic

Valence's battery uses manganese as the cathode material (energy travels between the cathode and the anode via the electrolyte medium). Unlike the competition, Valence casts its own anode, cathode and separator films to ensure the quality of these component materials. According to CEO Lev Dawson, "That's where the magic is." Manganese offers both financial

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# The Candidates: How Green?

BY JACKSON W. ROBINSON

During the week of the Republican convention, a client called to ask, "...How does Winslow rank the environmental platforms of the several Presidential candidates?" Frankly, and embarrassingly, we didn't know the names of all the candidates let alone each environmental platform. But we do now, and we'd like to share our findings, because the election outcome could influence the short-term outlook for green investments.



To answer the question, our researcher, Denise Garcia, combed the official campaign websites and reviewed the environmental news services. She and several of us at Winslow also

talked with each of the party headquarters. In order to focus our research, we limited our scope to five environmental areas: air, water, energy, biodiversity, and land use, and then graded each candidate. Under the Garcia grading system, each candidate received a "C" just for having an environmental policy, thereafter gaining or losing grade points for initiatives that benefit or harm the ecosystem.

## Greens Make the Honor Role; Republicans Squeak By

Not surprisingly, the Green Party led by Ralph Nader received all "A's". Ranking at the bottom of the scale, the Bush/Cheney Republican ticket barely passed, earning three D's, a C and an F. By way of comparison, consider the two parties' positions on biodiversity. Nader not only supports the Endangered Species Act, but he also favors public access to seed banks and the replanting of indigenous plant life, while discouraging the monopolistic production of engineered hybrid seeds. He received an "A." The Republicans took a diametrically opposite position. While Cheney opposes renewing the Endangered Species Act, Bush would eviscerate it. On a combined basis, Garcia gave them an outright "F".

## The Reform Party Split

The biggest surprises in the survey came from the two very different and warring factions of the Reform Party represented by Patrick Buchanan and John Hagelin Ph.D. (They were once vying for the Reform Party nomination; now Hagelin leads the Natural Law Party). The Buchanan wing had no



environmental platform whatsoever and was at a loss when we inquired. Given that Buchanan has been a strong proponent of nuclear power, we doubt that he would score high in this evaluation even if he chose to respond. He received five "I" grades, or Incompletes

In stark contrast to Buchanan, Hagelin received all "A's" and one "I". The Incomplete applied to land policy for which the candidate has no publicly stated views. Our curiosity piqued, we called Hagelin's press secretary, Robert Roth, who confirmed that Hagelin has no policy on land use. However, he invited our help in drafting one. Such interest and openness earned the candidate a provisional "A" in our grading scheme.

In the energy area, there were three "A's", with Nader and Hagelin offering the most proactive strategies for the development of alternative energy—especially fuel cells, solar power, wind, storage, and overall efficiencies. Trailing behind with a D-minus was Bush. While the Republican supports tax credits for renewable energy, he is also actively promoting the expanded use of nuclear power and fossil fuels, including drilling for oil in the Arctic National Wildlife Refuge.

## Bush's Underachievement

Bush's best grade was a "C" in the air category. While he opposes the Kyoto Protocol, he does support the new Tier 2 air standards that mandate lower-sulfur, cleaner-burning gasoline. However, Bush's overall grade point average for the five environmental categories would not allow him to graduate from Yale today, especially with a major in Environmental Studies.



## Gore's Back-Pedaling

Democrat Al Gore, author of "Earth in the Balance", scored better than Bush but, surprisingly, did not receive all "A's". Indeed, his credibility was undermined by the White House's recent contention that the United States can meet its obligation to reduce emissions by planting more trees rather than

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converting to green energy. Such a policy is clearly both politically opportunistic and without scientific merit.

### An Issue with Legs

However mixed the candidates' platforms might be, we find it significant and reassuring that three of the five Presidential contenders have strong environmental programs. Any one of these candidates (Gore, Nader, and Hagelin) would be environmentally proactive Presidents and therefore would have a positive impact on "green" investments. On the other hand, Bush slights the ecosystem at his peril. Should he be elected, we believe environmental issues such as the current droughts, fires, West Nile viruses, weather related airline problems, and sky rocketing oil prices could be his undoing. He might share with his father the unwelcome distinction of being a one-term President.


We should remember that the environment is a topic that was not even addressed in

### Environmental Platforms of Presidential Candidates:

Party	Air	Water	Energy	Biodiversity	Land/Forests
Democratic Gore/Lieberman	B	A	A-	B	A
Green Nader/LaDuke	A	A	A	A	A
Natural Law Hagelin/Goldhaber	A	A	A	A	I
Reform Buchanan/Foster	I	I	I	I	I
Republican Bush/Cheney	C	D	D-	F	D

Sources: Official campaign web sites, Party Headquarters, Lycos Environmental News Service, National Journal

Presidential elections as recently as twenty years ago. Now, we have a "Green Party" as well as another third party that promotes the Earth's well-being as a key component of its overall program. Obviously the subject of the

environment is gaining political momentum. No matter who is elected, the health of our ecosystem is a matter of concern to an increasing number of voters. It can no longer be ignored by any President of the United States. 

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#### No Complete Solutions or International Agreement

With the e-trash problem blowing up so suddenly, governments, businesses, and consumers have been slow to respond. The United States, with its traditional reluctance to interfere in a free-market economy, has taken little action. Indeed, American trade representatives and electronics industry associations have lobbied strenuously against rigorous European Community legislation. Although 13 states are considering regulation of electronic dumping, only one, Massachusetts, has banned computers and television sets from landfills.

#### Regulatory Initiatives

The most ambitious scheme for combating e-waste is the European Union's draft legislation on Waste from Electrical and Electronic Equipment (WEEE). Although it has been diluted after intense lobbying by US interests, the proposal would:

- Require manufacturers to take-back their products from consumers free of charge.

- Mandate separate collection of WEEE.
- Set minimum standards for the treatment and reuse of WEEE.
- Restrict use of toxics in manufacturing.

By contrast, the United States is taking a wait-and-see approach. "The pattern in the past has been that one to five states will take a leading role," says Concord, MA entrepreneur Ralph Earle, head of the consulting firm, The Assabet Group. "They stumble around, develop programs, and find out what works. Then, there is a quick land rush by the other states. That's what happened in 1985 when curbside recycling began."

In this case, Massachusetts has taken the lead, having banned the dumping of cathode ray tubes earlier this year. But, Earle says, the Commonwealth "is stumbling," as it tries to make the ban work.

The problem is that the new regulation left consumers and small businesses with few alternatives to trashing their old computers and TVs. Regulators had expected charitable organi-

zations like the Salvation Army and Goodwill Industries to pick up the slack. However, many of those charities are balking at what is becoming an overwhelming burden.

"When I took over here last August, I discovered that we had become an official drop-off location for broken TVs," says Lieutenant Glen Chandler, Administrator of the Springfield, MA Salvation Army. "People were bombarding us with stuff." The organization can sell working TVs, he said, but it does not fix broken sets. Those have to be taken to a disposal center approved by the Department of Environmental Protection — for a fee. "It costs me \$15 per TV," Chandler said, "and I must have 30-40 sets out back right now." Although \$100,000 is set aside annually for dumping fees, Chandler says he is already \$50,000 over budget. "This is not what we do. We are a 70-bed rehabilitation program."

#### Recycling-Still A Long Way to Go

Recycling of e-trash may provide a partial solution, but the industry is still in its infancy. For-profit companies face many obstacles, Earle

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and technological advantages over the more commonly used cobalt: It is less expensive, and it requires smaller amounts of lithium for standard operation, thereby reducing the likelihood of a dangerous chemical reaction if a battery is abused. To demonstrate the safety of this technology in seminars, executives often use a hammer and nail to administer what is affectionately known in the industry as 'The Dracula Test' — if no explosion results from driving a nail through it, a battery will have passed the initial safety test.

Valence has built a factory in Mallusk, Northern Ireland, which expects to reach an annualized production capacity of 9.6 million units by the end of calendar 2000. It is currently committed to manufacture batteries for the

QualComm Globalstar cell phone. The company hopes shortly to move into the higher margin realm of portable computers.

#### Intense Competition

But Valence is not the only contender in this market. The battery industry includes such giants as Sony, Sanyo and Matsushita, as well as a number of small private companies, all of which are developing some variety of lithium polymer technology. Nonetheless, it appears there may be enough worldwide demand to accommodate them all. According to CIBC's Lum, the market for mobile handsets is projected to grow at an annual compounded rate of 30% from 375 million units in 2000 to 1.7 billion units in 2005. Frost & Sullivan estimates that sales of laptop computers will increase at a compounded annual rate of 20% from 20 mil-

lion units in 2000 to 50 million units in 2005.

The accelerating demand is both dazzling and daunting. According to CEO Dawson, the battery market is growing so quickly that Valence could not keep pace even if it were to build and implement a new factory every two years. The company's strategy, then, is to gain market share by licensing the lithium-manganese technology to other battery manufacturers.

#### Impacts on the Environment

Given such an expansion of the battery market, what are the implications for the environment? While the recycling of batteries remains a logistical and technological challenge, it is encouraging to see that lithium polymer batteries avoid the toxic lead, cadmium

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### Rechargeable Batteries

The battery market is divided into two segments. Primary batteries, such as alkaline batteries used in flashlights and portable CD players, can be used only once. Secondary batteries are rechargeable and are in greatest demand by portable electronics, such as cell phones, camcorders and laptop computers.

Secondary, i.e. Rechargeable	Estimated cost for a cell phone battery pack	Self discharge <sup>1</sup> per month	Energy density <sup>2</sup> (watt hours per Kg)	Memory effect <sup>3</sup>	Lifecycle <sup>4</sup>	Characteristics	Environmental implications
Nickel Cadmium (NiCd)	\$27.95	25%	50	Yes	500	Enclosed in a cylindrical metallic can.	Cadmium is a toxic, heavy metal; harmful to public health and the environment. Danger is avoided by recycling.
Nickel Metal Hydride(NiMH)	\$33.95	25%	75	Yes, but better than NiCd	300-500	Similar to NiCd: Enclosed in a cylindrical can or prismatic case.	Concerns about toxicity of nickel, but not classified as hazardous. Recyclable.
Lithium Ion	\$49.95	8%	120-130	No	500	Lightweight. Highest energy density. Liquid form requires metal casing.	Leaching can cause fires.
Lithium Polymer	\$69.95	8%	120-130 (projected to increase to 240-250)	No	500	Lightest weight. Highest energy density. Exceptionally thin. Solid, therefore cannot leak. Safe under abuse conditions.	Benign materials; if not recycled, safe in landfill. Manganese and lithium are abundant and affordable. Cobalt is rarer and more expensive.

<sup>1</sup> Self discharge describes the degree to which a battery automatically loses charge when idle.

<sup>2</sup> Energy density reflects the length of time a battery can go without recharging. Watt hours is the average volt multiplied by amp hours. When divided by volume the number is standardized, allowing comparisons between different types of batteries.

<sup>3</sup> Memory effect describes a temporary or permanent loss of charge capacity in a battery when it is only partially discharged and then recharged.

<sup>4</sup> Lifecycle refers to the number of charge and discharge cycles a battery can undergo.

Sources: batterybarn.com, IT Week, Environmental News Network, Valence Technology, Inc, Environmental News Network, EDN Access, darnell.com

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says. These include the complicated logistics of separating, collecting and transporting the material to processing centers and getting enough volume to make the enterprise profitable. Then, marketable uses for the recycled material must be found. At every level, these operations must make commercial sense or they will founder, Earle says.

Still, there are some entrepreneurs who have developed ingenious schemes to reuse the materials from old computers. Take Greg Conigliaro, founder of Conigliaro Industries in Framingham, MA. His company has concocted Boston's Best Patch from ground-up plastics, derived from computers and old flower pots, combined with liquid asphalt and standard aggregate. A cold pavement patch, the goop can be used on everything from highway potholes to driveway cracks. It is sold in 3.5-gallon cans and is both lighter and easier to apply than conventional patching compounds.

Not everyone, however, is sanguine about the recycling of computer material. The SVTC, for example, warns that processing recyclables entails environmental risks. "The presence of

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and mercury that were used in their predecessors. And as the batteries are able to sustain more re-charges, their lifespan will increase, leading to fewer disposals in landfills. For its part, Valence has reaped financial benefits by investing more than \$5 million in machinery to reuse solvents needed in its manufacturing process. Because of the cost savings from fewer purchases and lower disposal fees, Lev Dawson expects the investment to pay for itself "in less than a year."

As portable electronics evolve, there will be demands for further innovation from the battery industry. It is unclear whether future developments of lithium polymer will yield increasing benefits to the environment, but already the technology has provided an attractive alternative to the dominant and damaging status quo. 

## A Poisonous Pharmacopoeia

THE FOLLOWING DESCRIBES THE POTENTIAL FOR HAZARDOUS WASTE CONTAINED IN THE ESTIMATED 315 MILLION COMPUTERS EXPECTED TO BE OBSOLETE BY 2004.

Toxic material	Function	Amount
<b>Lead</b>	Soldering printed circuit boards and glass panels of cathode ray tubes (CRT). Stabilizer in plastics.	1.2 billion pounds
<b>Cadmium</b>	Contained in CRTs, chip resistors, infrared detectors, and semiconductors. Stabilizer in plastics.	2 million pounds
<b>Mercury</b>	Used in batteries, switches/housing, and printed wiring boards.	400,000 pounds
<b>Hexavalent Chromium</b>	Corrosion protection of steel plates.	1.2 million pounds
<b>Plastics</b> (25% polyvinyl chloride)	Used as a covering.	4 billion pounds
<b>Brominated Flame Retardants</b>	Used in circuit boards, plastic covers, cables and connectors.	350 million pounds

Source: "Just Say No to E-Waste: Background Document on Hazards and Wastes from Computers," published by the Silicon Valley Toxics Coalition on its website: [svtc.org/cleanec/eccc.htm](http://svtc.org/cleanec/eccc.htm).

polybrominated flame-retardants in plastic makes recycling dangerous and difficult," a SVTC report states. "...furans and...dioxins are produced during the extruding process, which is part of the plastic recycling process."

### Design for Environment— A Better Answer?


Ultimately, it may be up to computer manufacturers to attack the problem through redesign of their products, including modular construction that allows for reuse of parts and the elimination of toxic chemicals. Ralph Earle, however, points out that there is a lag time of perhaps four years from conception to realization of such technological retrofits. He also warns that companies will need to be nudged by the threat of regulation — "They need to feel a little more pain."

Still, there are some computer companies taking a proactive approach. For example, Dell is pursuing a "cradle-to-cradle" strategy in designing the OptiFrame chassis for upgrading ease. The new design incorporates modular

parts that can be removed without special tools, reduces CFCs, HCFCs and other hazardous materials, labels plastics for easier recycling, and constructs the internal chassis of recyclable steel.

Whatever combination of approaches may be required to solve the problem of e-trash, it is certain

Ultimately, it may be up to computer manufacturers to attack the problem through redesign of their products, including modular construction that allows for reuse of parts and the elimination of toxic chemicals.

that in the US, at least, the solution will be market-based. As Earle puts it, we will have to learn "how to play on companies' leverage points so it is in their best interest" to increase the recycling of computers. 

# PORTFOLIO UPDATE

## **AstroPower** (NASDAQ:APWR)

NEWARK, DE — Unable to keep pace with demand for its solar products, AstroPower is accelerating its expansion plans. According to Dr. Allen M. Barnett, President and CEO, APWR “continues to be capacity-constrained in spite of more than tripling our manufacturing capacity over the past three years.” In Fall '99, the company had set the goal of expanding capacity to 25 megawatts by the end of 2000. “Over the past few months, we have increased this target to 30 megawatts, and have recently adjusted it further to 35 megawatts. We plan to further accelerate our plans for 2001 as well,” Barnett said.

The CEO pointed to skyrocketing demand for solar products from a major German on-grid program and from international customers in South Africa and Asia.

Barnett expects the expansion will result in a slight increase of revenues over the balance of 2000 and 2001 with product gross margins to be relatively flat for the next few quarters. He said the company “continues to expect growth in earnings per share of at least 50% per year over the next two years.”

With APWR stock up 87% this year, analyst Barry Sahgal of Brean Murray called the company “the Intel of the solar industry.”

## **SLI Inc.** (NYSE: SLI)

CANTON, MA — Although its miniature lighting division is experiencing double digit growth, SLI fell short of its second quarter target. It attributed the disappointing performance to negative currency translation effects brought on by devaluation of the Euro and by difficulties in integrating recent acquisitions in its North

American general lighting operations. Earnings per share of \$0.18 were down 54% from the previous year and 40% from the equivalent quarter. In addition, both gross profit and operating profit margins fell short of the previous year, with net income of \$5.4 million, down 42%.

According to CEO Frank Ward, the North American business was hurt by lower than expected prices in the ballast area, a delay in the introduction of new product designs, and slowed integration of 1999 acquisitions including Supreme Corp. and Marvel Lighting Corp. Reorganization in both Europe and the United States also took its toll in the form of severance and disposal charges.

Still, the miniature lighting side, led by new light emitting diode (LED) products, seems to be on a fast track. That division contributed \$44 million or 21% to 2000 revenues. According to analysts at SalomonSmithBarney (SSB), CEO Ward is currently evaluating several proposals to restructure the company, including splitting it into two branches, general lighting and miniature lighting, a move that could unlock the significant hidden value of the latter business.

## **NPS Pharmaceuticals** (NASDAQ:NPSP)

SALT LAKE CITY, UT — Thanks to its acquisition of NPS Allelix Corp in Dec. 1999, NPS is developing a new product that it expects to reverse the damaging bone thinning of osteoporosis. ALX1-11 is currently being tested in a Phase III clinical trial. An injectable version of human Parathyroid hormone (PTH), the compound uses a naturally occurring protein involved in the regulation of bone metabolism. Company scientists are also studying small molecule drugs, called “calcilytics,” that trigger transient

release of PTH to simulate bone growth.

On other fronts, NPS is engaged in developing products that treat Hyperparathyroidism, a disease in which calcium is leached from bones into the bloodstream, thereby creating osteoporosis. The company is also researching treatments for gastrointestinal ailments and several central nervous system disorders.

In early August, the company reported net losses for the second quarter of \$7.68 million or \$0.33 per share, compared to a net loss of \$5.01 million or \$0.40 per share in 1999. The net loss for the first six months of 2000 was \$18.52 million or \$0.85 per share, compared to \$10.77 million or \$0.85 per share for the same period in 1999. The increases in losses from 1999 to 2000 came about from operating activities in the newly acquired NPS Allelix Corp.

Company revenues for the quarter increased from \$915,000 in the previous year to \$1.71 million thanks to license agreements acquired in the Allelix purchase.

## **FuelCell Energy Inc.** (NASDAQ: FCEL)

DANBURY CT — As a result of successful field trials and increased orders, FuelCell Energy is ramping up its manufacturing capacity by 10 times the current level. The company recently broke ground on a new facility in Torrington, CT to meet demand for its high efficiency fuel cells for electric power generation. The new 65,000 square foot factory, with its \$16 million in new equipment, is scheduled to go on line by Jan. 31, 2001. It should boost production to 50 MW annually in 2001 with expected increases to 400 MW by 2004.

Customers for the company's proprietary Direct FuelCell include Rhoen-Klinikum AG, a hospital in Bad Neustadt, Germany; the U.S. Navy; the Los Angeles Department of Water and Power; and the Japanese firm, Marubeni Corp.

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