

Darnell in Depth

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The Ins and Outs of Building Energy Efficiency

Commercial buildings are viewed as a significant market for technologies that can increase energy efficiency. In fact, a study from McKinsey & Co. indicated that, “energy efficiency upgrades in buildings and appliances are the most cost-effective green strategy in the US, where buildings consume about 35% of all the energy used each year.” As a result, President Barack Obama has made retrofits a priority, setting aside \$2.8 billion in the federal stimulus package to promote energy-efficient lighting, heating/air conditioning, and other technologies.

The nation’s first standard for high-performance green buildings began its third public review period on May 1, 2009. *Standard 189.1, Standard for the Design of High Performance, Green Buildings except Low-Rise Residential Buildings* is being developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the Illuminating Engineering Society of North America, and the US Green Building Council. Meant to provide minimum criteria for green building practices, the standard is applicable to new commercial buildings and major renovation projects. When completed, it will address energy efficiency, along with a building’s impact on the atmosphere, sustainable sites, water use efficiency, and materials and resources.

With both financial stimulus and standards development, the push toward energy-efficient buildings seems like a sure thing. North American business leaders continue to express robust interest in energy efficiency. A recent survey by Johnson Controls and the International Facility Management Association indicated that 71% of 1,422 C-level executives said they were paying more attention to energy efficiency now than they were 12 months ago. More than half the respondents said energy management is “very important” or “extremely important” to their organization. And 45% said that undertaking projects to increase energy efficiency in buildings has been the most popular strategy to achieve greenhouse gas emission reductions.

Still, research has shown a decline in capital and operating expenditures for energy efficiency over the past two years, with fewer people saying they expect to make energy efficiency improvements in the next 12 months. This is due to limited funding, a desire for greater financial incentives and shorter payback periods, uncertainty about energy and regulatory policy, and the uncertain economic climate.

So, even though interest in energy-efficient upgrades is high, the lack of financial rewards is holding back technology upgrades. Major retrofits



in large, leased properties are cited as a particular problem, especially multi-tenant buildings. Operating expenses in these kinds of buildings, such as electricity, are often shared, so costs wouldn't necessarily fall because of a lighting upgrade, for instance. If a building's systems are inefficient but still fully functional, the owner won't bother with a green upgrade, according to Cycle-7, a green building financing consultancy.

Without a clear way to make money from energy savings, banks have found it difficult to finance big retrofits. Novel financing models are often needed, such as using the building rather than energy savings to back loans. Building owners often have to monetize a share of the energy cost savings to finance investment. With lighting, for instance, sensors that turn off lights in empty rooms can cut power bills by up to 30%. Swapping in more efficient light bulbs can pay for itself in one year. Switching to energy-efficient lighting and sensors, along with adjusting controls to reduce heating/air conditioning time, are the main actions taken by companies to improve energy efficiency.

Companies making products for the building automation and control markets, including energy harvesting, thin-film batteries and power management ICs, need to keep close tabs on these developments. The Johnson Controls research sponsors have expressed optimism that both action and investments in energy efficiency initiatives will rebound in the next 18 months as progress is made toward economic recovery, and clarity emerges regarding energy policy and regulation. The interest and intention are there, and financial incentives will provide the catalyst for commercial adoption of both existing and emerging technologies. — *L.B.*

Digital Control Enters Mainstream

The "mainstream" adoption of digital control has happened relatively recently and includes the introduction of dedicated, digital controller ICs. Since these products have only been around for the past few years, we are still a way from even a

50% market penetration of digital control into the overall power supply market. Darnell estimates that the digital power controller IC unit market share will be about 30% by 2013, but this is still a unit growth rate of about 10.8% between 2008 and 2013. Cumulative shipments of digital power supply controller ICs are expected to exceed five billion units by 2010. This includes embedded and external ac-dc power supplies, along with all dc-dc converters.

It took 10 years for switch-mode to go from mainstream commercial products to 55% of the market. If digital follows this line, it has a lot of market potential ahead of it. In fact, digital is just starting to enter its "growth phase," with the life-cycle curve not even flattening in the next five years. It is still rare to find a "pure digital solution," for instance. Price declines will only begin to slow by 2013, so dollar sales will experience a healthy growth rate of just over 29% up to this point.

What does this mean for power supply companies? First, the digital power management and control market is now firmly in the first stages of mainstream adoption. Its biggest growth spurts are immediately ahead, and maturity is still years away. This is always an exciting time for any market, since the groundwork has already been established and companies don't have to "make a case" for the technology anymore. Even though the major players are established, the way is now opened for companies to differentiate themselves in specific application segments and product lines.

Many companies have highlighted the benefits of implementing digital power management solutions. Microchip said that customers are initially drawn to the greater efficiency at all loads, and are then excited about the higher reliability later. The cost reductions have been the most significant benefit, however.

Most companies believe that the cost of digital is now comparable to analog. Although digital solutions are still primarily being used in high-performance applications, the pervasive emphasis on energy efficiency is pushing digital from high-end-only into the mainstream. Intelligent management of power can provide solutions to improve efficiency results, such as deciding on phasing at

start-up; changing operation at light loads or idle state; and dynamic phasing decisions via power management.

Analog and digital solutions are expected to continue to co-exist, however. A power supply is no longer a power supply but a system by itself. It has to interact with the system and, based on instructions from the system, has to sequence and ramp POLs for proper functioning of the system. The power system also has to interact with the main system in real time and configure itself based on the line and load requirements. Even though the benefits of migrating to digital technology are huge, the power industry is still lagging behind the rest of the industry. There is a great need for communication between the main system and the power system for energy efficiency reasons. Depending on the environment, and line and load conditions, a power system has to be configured in various modes to respond to changing conditions.

Change is always resisted until the time that the customer desires functions that cannot be accomplished by the old technology. As long as the old technology can perform the same functions that the new technology can, the old technology will continue to be used in one form or another. The transition point comes when the cost cross-over point is reached and the new technology offers more for less. – *L.B.*

APPLICATION TRENDS

THE WORLDWIDE SEMICONDUCTOR MARKET for portable media players (PMPs) is poised to drop significantly, from \$7.5 billion in 2008 to \$4.6 billion in 2013, according to IDC. This is a decline of 9.0% over the five-year period. The decrease in revenue is due to a mature market, the economic slowdown, and the growing similarity with mobile phones and mobile Internet devices (MIDs). Although revenue for most of the semiconductor components (including power management ICs) will decline in line with the total decline in PMP unit shipments, wireless connectivity semiconductors will exhibit modest growth. Moving forward, IDC expects the semiconductor companies to focus on the larger

multimedia phones and the growing opportunity in MIDs. – *L.B.*

SALES OF ULTRA-MOBILE DEVICES (UMDs) are expected to hit 200 million units in 2013, up from 10 million units in 2008, according to new forecasts from ABI Research. UMDs are defined as “larger than a smartphone and with full computing, but smaller than a laptop.” Revenue is projected to be nearly \$27 billion in 2013. Driving these forecasts is the rapid adoption of high-speed, mobile broadband, with Mobile WiMax available in selected markets by late 2009. New UMDs will launch over the next 12-24 months, spurred by these new networks being built. IMS Research supports this projection, saying that netbooks and MIDs have the opportunity to gain mass market appeal very quickly, considering low up-front costs. IMS forecasts that 207 million UMDs, excluding smartphones, will ship in 2014. T-Mobile, Orange and AT&T, amongst others, are expected to drive much of the volume. If such adoption does occur, it will also drive the battery and power management IC markets that enable these devices. – *L.B.*

THE RADIO FREQUENCY ID (RFID) market will reach \$5.56 billion in 2009, up from \$5.25 billion in 2008, according to a report from IDTechEx. This includes tags, readers and software/services for RFID cards, labels, fobs and other form factors. The biggest segment is RFID cards, while \$2.57 is being spent on other forms of RFID, from labels to active tags. Passive tags do not offer opportunities for power supply makers, but battery-assisted active RFID applications do. Such applications are broad and include pharma/healthcare, cold retail supply chain, consumer goods, postal, manufacturing parts and tools, archiving samples, military, retail CPG pallets/cases, shelf edge labels, conveyances/rollcages/ULD/totes, vehicles, people, and car clickers. The tagging of retail pallets and cases, for example, will use approximately 225 million RFID labels in 2009. US retailers often demand these kinds of tags, but IDTechEx sees “take-off” in retail outside of these mandates, such as Marks & Spencer and American Apparel. – *L.B.*

THE ECONOMIC DOWNTURN WILL HAVE a significant impact on mobile phone shipments in 2009, with global volume shipments down by 9.1%, according to Ovum. Shipments are expected to start recovering from 2010 onwards, although it will take until 2012 before volumes are back to the level seen in 2008. All regions will be affected to some extent, although connection growth in the Asia-Pacific region is still fueling handset shipments. Mid-tier handsets are being hit particularly hard, with vendors and mobile operators focusing on low-end and high-end segments. The downturn has also artificially extended replacement rates for handsets during 2009. Ovum expects a move towards longer replacement rates well into the forecast period even after recovery. Mobile phone shipments will grow at a compound annual growth rate (CAGR) of 1.9% and reach 1.4 billion by 2014. Similar growth rates can be expected for rechargeable batteries and chargers used with these products. Due to the focus on high-end handsets, 3G devices are expected to see relatively higher sales. Emerging markets, on the other hand, should experience some growth for ultra-low-cost 2G handsets. LTE-based handsets should enter the market between 2012 and 2013, although mass market volumes will not be reached until after 2014. – *L.B.*

GLOBAL TELECOMMUNICATIONS SERVICE provider capital expenditures “hit a plateau” at \$298 billion in 2008, marking the end of a five-year investment cycle, based on a recent report from Infonetics Research. This represented a 12.9% increase in capex spending from the previous year. Unfortunately, this was followed by a disappointing first quarter of 2009, with service providers exhibiting caution and pulling back significantly in areas like TDM and IP voice infrastructure and SONET/SDH optical equipment spending. Overall, however, Infonetics maintains an optimistic outlook for telecom service provider spending, due to clean balance sheets, telco revenue resilience, and increased mobile Internet usage on smartphones. Capex is projected to increase in the second half of 2009, due to stimulus plans in the US and China,

along with spending by Asia-Pacific and EMEA service providers. Mobile infrastructure capex will continue to dominate total global telecom and datacom spending, followed by voice equipment, which means continued sales for makers of small-to-medium communications power systems. Infonetics forecasts a 2.8% downturn in worldwide carrier capex in 2009, followed by a flat 2010 and a slow return to growth in 2011 with the start of a new investment cycle. – *L.B.*

THE CONSUMER ELECTRONICS MARKET is facing declining sales, and a possible solution could lie in new consumer device markets based on 3G and 4G wireless service access. In Europe, for example, the market for consumer electronics is expected to shrink in 2009, because “digitalization of this part of the electronics business has been completed,” according to German IT industry association Bitkom. This includes sales of HiFi and TV equipment, digital cameras, and MP3 players. These combined markets will decline by 9% during the current year to a market volume of about \$82.5 billion. The market for digital devices makes up 95% of the market volume; the value of analog equipment has shrunk to just 5%. Flat-screen TV unit sales have increased, however, so the lower revenue is due to average selling prices falling 10% during 2009. These trends could be reversed in the US, as mobile phone operators look beyond handsets to broader consumer electronics devices. Strategy Analytics says that these companies are looking at new device segments in which 3G and 4G wireless technologies can be embedded. This could create a market of 100 million installed devices for wireless operators in the US by 2014. By the end of 2009, more than half of the 8.4 million consumer electronics devices installed and enabled for 3G and 4G will be consumer notebook PCs. This could also open up new markets for power management IC makers. – *L.B.*

DEPENDING ON WHO YOU TALK TO, the home automation market is either poised for healthy growth or will be relegated to niche status. Re-

cent studies report that standards-based mainstream home automation systems, “do-it-yourself” home automation and home automation as a service are very new and have much room for growth. The “luxury” home automation market (systems costing more than \$50,000), on the other hand, is relatively mature and may see a downturn due to the economic climate. This could still produce a 2.8 million unit market by 2011, according to ABI Research. Another report says that home automation and security sales in the US generated \$2.3 billion in 2008, with an estimated \$2.5 billion in 2009. This will increase to \$8.1 billion in 2014, a CAGR of 26.5%. Lighting, home entertainment and security have the largest share of these sales. In fact, the success of home automation may depend on the adoption of home networks, which are primarily adopted to support home computing, telecommunications and multi-room distribution of home entertainment systems. Once this computer/entertainment network infrastructure is in place, the incremental cost to connect sensors, actuators and controls throughout the home will be small, so low-bandwidth can easily piggyback on the network backbone. Either way, such adoption could open up sales of power management ICs, microbatteries, and even energy harvesting solutions. – *L.B.*

POWER POINTS

- ◆ The commercialization and deployment of fuel cells has gotten a boost from the American Recovery and Reinvestment Act. The US Energy Secretary announced \$41.9 million in funding to “build a robust fuel cell manufacturing industry in the United States.” The money will support immediate deployment of nearly 1,000 fuel cell systems for emergency back-up power and material handling applications, such as forklifts, that have emerged as key early markets in which fuel cells can compete with conventional power technologies. Additional systems will be used to accelerate the demonstration of stationary fuel cells for combined heat and power in the larger residential and commercial markets. Sprint Nextel received \$7.3 million to test out new fuel cell systems as backup power for its wireless infrastructure. Fuel cell maker ReliOn got \$8.6 million to work on a back-up power system for AT&T. Even though established fuel cell companies, such as Plug Power and Ballard Power Systems, are expected to reap much of the telecom market, industry experts say there is also “big potential” in the telecom market for fuel cell startups, as well. The combined government and business stimulus could be the push fuel cells have needed. – *L.B.*
- ◆ After a record year in 2008, US venture capital funding in “clean technology” during the first quarter of 2009 was down 63% in capital and 48% in deals, compared with the same period in 2008. The bright spots in this forecast, however, are certain application segments that could benefit renewable energy inverter manufacturers and energy storage companies. For example, the energy storage segment more than doubled the \$50 million raised in the first quarter of 2008 – to \$114 million in the first quarter of 2009, according to an Ernst & Young report. Battery-storage companies did particularly well, raising \$69 million, a 37% jump from the same period in 2008. A123 Systems, a lithium-ion battery supplier, completed the largest cleantech deal of the quarter with a \$69 million infusion. Fuel cell companies also did well, raising \$45 million over the same period. The next-largest category, energy/electricity generation, saw increased funding for solar companies. Solyndra, a manufacturer of cylindrical photovoltaic systems, received a Department of Energy loan of \$535 million to expand its solar panel manufacturing capacity in California. Another segment that did well was hybrid-electric vehicles. Coca-Cola Enterprises has pledged to deploy 185 hybrid-electric trucks across North America in 2009, bringing its total number of hybrid-electric delivery trucks to 327. – *L.B.*
- ◆ Software-defined radio (SDR) is going through yet another “crisis” point in its search for market success. As noted in the December, 2008, issue of *Darnell in Depth*, SDR is finding

application in military and some commercial applications, such as upgradeable wireless infrastructure and handsets. Ericsson, for example, recently unveiled the company's first software-upgradeable base station. The selected radio baseband technology is loaded into the box as a software module. Alcatel-Lucent, Nokia Siemens Networks and Huawei Technologies also have software platforms in the market. Alcatel-Lucent adopted a software-defined radio development approach years ago, giving it a massive installed base of CDMA and UMTS base stations it claims can support an LTE upgrade. The software-defined nature of these platforms enables base station developers to "future proof" their products for the rapidly evolving world of cellular communications. Ericsson has the largest market share in the base station market, so their acknowledgement of this functionality could push the technology, particularly with LTE likely to be a key entry point for large-scale integration of SDR in base stations. SDR-based handsets may face problems, however. Within the next five years, it is projected that most handsets will only need LTE and Wi-Fi. A handset chipset that covers these technologies would be less expensive than one built from SDR and consume less power. This means more opportunities for power management IC makers, but a less attractive market for SDR batteries. – *L.B.*

◆ With renewable energy technologies, it depends on where you look. Even though solar power continues to rise in 2009, wind energy is facing challenges throughout the world. Emerging Energy Research (EER) says that the global wind industry is nearing the trough of the current economic crisis with capital expenditure reductions, project postponements, order cancellations, and corporate downsizings on a massive scale – which reduces the opportunities for manufacturers of variable frequency converters. EER projects annual megawatt additions to decline by 24% in the US and 19% in Europe in 2009. In Japan, the lack of coordination between power companies and differences of opinion over its efficacy have slowed the spread

of wind power. As a result, construction of wind farms in Japan have stalled, with solar power singled out as the prime alternative energy source. A "new generation" wind power plant was opened in April, 2008, which combines 34 wind turbines with storage batteries to hold and stabilize the generated electricity before feeding it into grids. Japanese utilities are now offering bids for wind power businesses to supply energy "on condition that the businesses install batteries." Wind batteries are very expensive, however. Countering these pessimistic trends are expectations that "post-financial crisis" wind growth will occur due to stimulus packages in the US, utility partnerships in Europe, and policy and technology initiatives in China and other Asian markets. – *L.B.*

◆ The US market for smart grid technologies is expected to reach almost \$17 billion by 2014, based on a report from SBI. Currently, the market for smart grid "enabling technologies" is estimated to be more than \$6 billion. Growth will be partly driven by the utilization of the technology to provide better sensing and control systems that maximize the use of electricity from renewable energy sources, which produce power that is highly variable and subject to intermittent operation, including wind and solar. MicroPlanet, a smart grid energy conservation company, recently deployed the company's 3-Phase smart grid system at the US Marine Corp. Base at Kaneohe Bay, Hawaii. The first system is expected to be delivered in the third quarter of 2009. The Base indicated that one building had very high maintenance costs due to power quality problems. Most of the equipment in the facility is controlled by computers, like the lighting systems, pin setters and scoring consoles. The MicroPlanet smart grid system is expected to "improve power quality at the point of delivery, and dynamically raise or lower and balance incoming voltage to the optimal and constant desired set point." The increased introduction and use of such systems are likely to spur the already evolving smart grid technology market, and lead to potential sales for renewable energy inverter manufacturers. – *L.B.*

WEB SIGHTINGS

AWEA Small Wind Turbine Global Market Study

<http://www.awea.org/smallwind/>

This 21-page report from the American Wind Energy Association provides the results of a survey of 44 global leading small-wind manufacturers (100kW and less). Of these, 36 had commenced production and sales by the end of 2008. The survey findings and analysis cover current market status; growth potential and projections; state incentives; potential market factors; investment; jobs; displaced carbon dioxide; building-mounted turbines; manufacturer profiles and trends; comparison to solar photovoltaics; and the global market. Manufacturing trends address efficiency and design issues, including inverter efficiency. – *L.B.*

IEEE P2030 Draft Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), and End-Use Applications and Loads

http://grouper.ieee.org/groups/scc21/2030/2030_index.html

The Institute of Electrical and Electronics Engineers has launched a new project to create standards and interoperability for the “smart grid,” an IT-driven upgrade of the electricity grid. Intel will host the first meeting to discuss IEEE P2030 on June 3-5, 2009. The standard provides guidelines in understanding and defining smart grid interoperability of the electric power system with end-use applications and loads. Interconnection and intra-facing frameworks and strategies with design definitions are addressed in this standard, along with end-use benefits to permit two-way power flow with communication and control. – *L.B.*

Thermal Measurements of Power Converters – How and Why?

<http://www.epsma.org/publications.asp>

This 14-page document from the European Power Supply Manufacturers Association, posted in March, 2009, describes thermal measurements of power converters. It describes what to measure and how to measure. It also contains

recommendations for datasheets and explanations of some temperature-related terms in datasheets. The document is divided into parts for each cooling method. Different methods of measuring temperature are discussed, along with different types of wind tunnels. – *L.B.*

Server and Monitor Energy Star Specifications

[http://www.energystar.gov/index.cfm?](http://www.energystar.gov/index.cfm?c=new_specs.enterprise_servers)

[c=new_specs.enterprise_servers](http://www.energystar.gov/index.cfm?c=new_specs.enterprise_servers)

[http://www.energystar.gov/index.cfm?](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&gw_code=MO)

[fuseaction=find_a_product.showProductGroup&gw_code=MO](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&gw_code=MO)

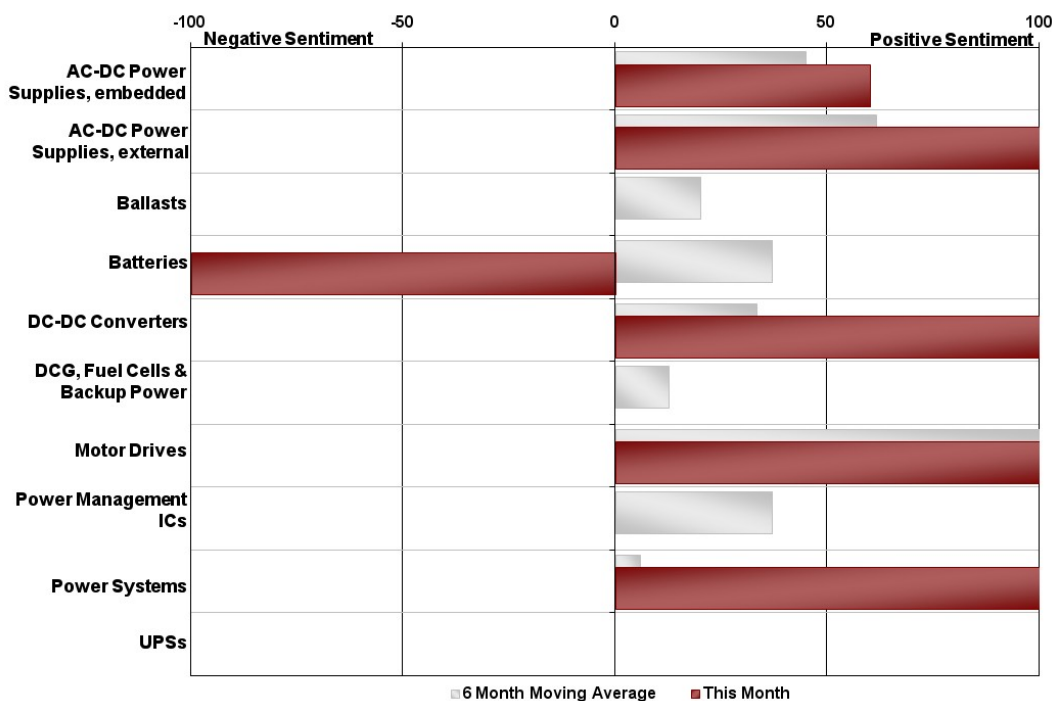
The Environmental Protection Agency (EPA) recently unveiled two Energy Star specifications: an updated specification for monitors/displays (<30 inches diagonal); and a new program for servers. The new monitor specification requires LCD monitors to use about 20% less energy overall than such monitors were allowed to use under the existing specification. The spec is voluntary and becomes effective October 30, 2009. A new specification for professional displays (30-60 inches diagonal) will be effective January 1, 2010. The server specification covers servers with up to four processor sockets and at least one hard drive. The main criteria are the efficiency of a server’s power supply and the amount of power consumed at idle. Vendors must also publish power and performance data in a standard way for qualifying models and configurations. – *L.B.*

The Energy Evolution: An Analysis of Alternative Vehicles and Fuels to 2100

<http://www.hydrogenassociation.org/general/evolution.asp>

The Energy Evolution is published by the National Hydrogen Association and compares more than 15 of the “most promising” fuel and vehicle alternatives over a 100-year period, using various mixes of fuels and vehicle alternatives. These include gasoline internal combustion vehicles, hybrid-electric vehicles, plug-in hybrid vehicles, hydrogen fuel cell vehicles and battery electric vehicles. The report then assesses the various combinations in terms of environmental stability, energy security and economic vitality. – *L.B.*

Power Prospects



Power Prospects is an indicator of the news reported in this issue of *Darnell in Depth*. Renewable energy technologies and portable devices are driving sales of power supplies, with power management ICs and batteries showing the biggest gains. The renewable energy sector is a mixed bag, with photovoltaics and fuel cells experiencing growth, while wind power is declining. Fuel cells are getting a boost from the US financial stimulus package, while solar technologies are the focus of “clean-tech” investments. Wind power, on the other hand, is experiencing capital expenditure reductions, project postponements and order cancellations. Portable devices such as ultra-mobile devices, mobile phones, and consumer electronics could benefit from new wireless technologies such as LTE. Portable devices are always good for power management IC makers and battery manufacturers. Finally, the focus on energy efficiency is driving building automation and smart grid technologies. Although in their initial stages, these solutions are also expected to open up more opportunities for renewable energy inverters and related energy storage technologies. —L.B.

Darnell in Depth



Jeff Shepard
 Publisher/President
jshepard@darnell.com

Traci Shepard
 Vice President / Associate Publisher
tshepard@darnell.com

Linnea Brush
 Senior Research Analyst
linnea@darnell.com

Richard Ruiz
 Research Analyst
r Ruiz@darnell.com

Michael Knepher
 Layout
mknepher@darnell.com

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Darnell.Com Inc.
 1159-B Pomona Rd.
 Corona, CA 92882
 phone: +1 951-279-6684
 fax: +1 951-273-9505