

2012 Year-End Review

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SUMMARY: *This month Dr. Hwang compares 2012 to predictions made in her January column, “[What Can We Expect in 2012?](#)” including business, technology, and global marketplace issues. Hwang feels that, overall, 2012 was another intriguing year filled with both wanted and unwanted events.*

Global Economy

From January 2012: “A crisis-riddled Europe, a weak U.S. recovery, and lack of a clear governmental strategy in Washington D.C., in both deficit and debt reduction, pose the most economic concern and uncertainty for 2012. General consensus points to a U.S. GDP of 2.3 to 2.9% while the Organization for Economic Cooperation and Development (OECD) forecasts the U.S. economy to grow merely 1.8% and the Eurozone to expand by only 0.3%. The U.S. unemployment rate is projected to stay high, above 8%. The housing market remains sluggish, so far largely impervious to various economic ‘stimuli’ instrumented by the Federal Reserve, although a bottoming-out is likely in 2012. Additionally, the upcoming U.S. presidential election adds another variable.”

Although political hurdles remain, it looks as though the 2012 U.S. GDP will settle around 2.2%. This is indeed a slow, halting recovery, which shouldn’t be a big surprise after the U.S.

financial crisis was compounded by Europe’s financial woes and overall economic cooling down in emerging markets. As the world is intimately connected, one country’s prosperity or woe can inevitably spill over to the rest of the world.

As of this writing, the U.S. unemployment rate hovers around 8%, and the housing market appears to have bottomed out and will gradually get back on its feet.

From January 2012: “Although not without challenges, Asia continues to be the high-growth region—the world’s economic engine. China is still sitting on a \$2.7 trillion foreign exchange reserve. The evolving balancing act in the country’s export and domestic consumption with manageable inflation is shaping up. While China is labouring to expand domestic spending to balance the export-centric economy, the weak economies in both Europe and the U.S. are hurting China’s exports.

“A slowdown in China would have profound consequences worldwide, from commodity prices to U.S. export to financial backing to Europe. However, I do expect that China will monitor its economic dynamics very closely and take the necessary measures to keep its economic engine humming, all while mitigating the risk of any unwanted level of inflation. Easing the monetary policy by reducing bank



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reserve requirements has already begun and more is expected in the future. Nonetheless, growth in China in 2012 is expected to reach more than 7.5%.”

As of this writing, the world’s second largest economy has kept its GDP above 7.5% (approximately 7.6%), although it’s slowing down from last decade’s levels. With the Eurozone’s deep and protracted decline, China, being the largest exporter to the region, cannot be expected to hold its historic double-digit growth. With this year’s global economic environment, holding a 7.6% GDP is quite satisfactory. Its inflation rate being below 2% is also low enough to deter government fears. Japan, another important economy in Asia and the third largest in the world, did relatively well, harvesting approximately 2.2% GDP.

From January 2012: “Multi-national corporations continue to perform well, enjoying strong balance sheets. These corporations collectively hold more than \$1 trillion in cash, which makes them poised for investing in growth when the time is right. Overall, indicators point to a not-so-strong economy in 2012. Under this low-growth economic environment, the wise practice is to operate efficiently, be fiscally conservative and keep the powder dry.”

Most multi-national companies have indeed exercised operational prudence and fiscal conservativeness. M&A activities have been low and the factory expansion is mostly either retracted or deferred. As the world transitions into a new era with a new economic formula, corporate focus is being repositioned and a different playbook is being formulated.

Regardless of the low level of U.S. growth and confidence throughout the year, most corporations have performed well in both revenues and earnings, having delivered impressive Q1 and Q2 earnings. Our industry has continued to innovate and advance.

The State of the Industry: Market, Manufacturing, & Technologies

From January 2012: “The semiconductor industry is expected to register positive growth in 2012, averaging a mid-single-digit growth. Some industry sectors will grow more than the others, just like 2011 when some companies (namely, Qualcomm and Intel) generated more than 23% growth and some dropped more than 30%. “Moving to the ‘smart’ world will be the driving force for the electronic hardware in innovation, as well as in manufacturing. Today, China functions as the manufacturing center for electronics hardware. Despite new and renewed challenges, I see China making a concerted effort, though slow and gradual, to shift toward a more consumption-based economy. This shift should further expand the demands of electronics products for all industry sectors, be it automotive, smartphone or industrial equipment, which should benefit all multi-national companies doing business in China.”

Two macro-gauges for the state of the electronics industry are the global economy and the upstream semiconductor global market. Semiconductor growth has shown segment-dependency. Wireless applications and industrial electronics were the strongest performers. Consumer electronics and wired communications did not do well.

Overall, global semiconductor revenue this year is expected to rise to \$325 billion from \$312 billion in 2011—most segments delivered a single-digit growth while wireless applications enjoyed double-digit growth. Companies that offer products outside the wireless area may suffer low growth or revenue and earnings declines.

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actual dollar value of inventory. Doing well in this area mitigates the mishap of production outpacing demand as well as eschews cash flow trap. In the current environment, “inventory is the story.”

In electronics hardware manufacturing, the strongest product lines this year were tablets and smart phones. The Chinese electronics industry is facing stiff challenges after more than a decade of phenomenal growth and prosperity—those strengthened with technology and sound business practice will thrive; those without are withering and survivability is in question.

Advanced manufacturing has drawn heightened attention this year in the context of competitiveness in the global marketplace. I define advanced manufacturing as “manufacturing capability and leadership capacity to sustain, grow, and excel in a global landscape to meet both anticipated and unpredictable challenges by leveraging technologies and business model.” This topic will be discussed in future columns.

On the technological front, many exciting innovations were announced. Intel revealed a neuromorphic chip design that builds chips that work more like the human brain, built from devices that behave like neurons. In other words, they transmit and respond to information sent in spikes rather than in a continuously varying voltage. (Reportedly, one reason the brain is so powerful and efficient is that neural spikes charge only a small fraction of a neuron as they travel. By contrast, conventional chips keep each and every transmission line at a certain voltage constantly.)

The multi-billion-dollar 450 mm wafer factories and the manufacture of 22-nanometer processors continued this year. These activities will lead to the continued advances in the chip industry to deliver increased functionalities and reduced costs in future computing and communication products.

Although no breakthroughs occurred downstream in the electronics hierarchy, new archi-

ture for IC packages were introduced and the use of PoP and BTC packages continue to gain market share. Downstream SMT assembly has identified the key parameters and processes to continuously maximize production efficiency through defect mitigation and cost reduction.

On the software side, Microsoft introduced Windows 8 in late fall, which is set to further facilitate its user-friendly interface. However, perfection is not expected. A debugging period throughout out the next 12 to 18 months should be expected.

Solar Photovoltaic Market & Technology

From January 2012: “As stated in my [forecast column](#) last year, solar is here to stay as one of many viable renewable energy sources. Regardless of heavy downward pricing, solar PV installations have risen by 25% +/- 2% in 2011, having reached 24GW. Going forward, reality will set in. We are going to see a heightened rebalancing and shakeout in 2012, which will inevitably cause short-term pain for suppliers.

“The rebalancing act will clear up some illusions and make the supply-and-demand and pricing theories appear non-applicable. It will also provide a wake-up call in modifying business models to generate revenues and profits. The shakeout will create immense challenges for companies that do not have a solid business plan and will also render changes in the supply chain and industry infrastructure. Many cell- and module-making companies will vanish. Yet the risk of non-participation and missing the market outweighs the risk of staying in the uncertain, challenging landscape.

“Then there is the ‘China factor,’ a potent one. Back in 2007-2008, China announced their vertical integration approach covering the entire spectrum of the value chain in an attempt to control the market. Most recently, China raised its target for solar power capacity to 15 gigawatts by 2015 (National Energy Administration). China further implemented the feed-in-tariff (FiT) program, emanating from the European model. In

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U.S., the tax credit and military projects will further increase demand. In the next two years, the total market value in dollars is uncertain due to various factors, but the continued increase in GW installation is anticipated. Nonetheless, the low prices and strained margins will be the name of the game.

“In technology, thick-film, crystalline silicon (c-Si) technologies will remain viable. The lower efficiency thin-film technology must be able to deliver less expensive front-end cost to compensate the back-end area penalty and hardware cost that thin-film technologies require, and must be able to resolve other technological and performance concerns. Consequently, thick-film, crystalline silicon (c-Si) cells will continue to dominate the market. Challenges created by this transitioning and rebalancing processes will truly separate the winners from the losers. Glorified winners have reaped not only revenue and profits, but also market share.”

Yes, the market has shifted geographically and economically. Despite some PV manufacturer failures, the global solar market has grown from low-20s GW in 2011 to near 30 GW in 2012. The 2012 U.S. installation of photovoltaic systems is set to increase 71% from 2011, with a total of 3.2 GW capacity. As the fastest growing market for solar energy, China’s PV installations would be doubled to 5 GW this year. However, a massive supply glut has led to the inevitable correction of an industry that has grown too far, too fast due to that many irrational players rushing in and jamming the market. The shakeout is in the works. However, this rebalancing and consolidation process is moving slower than normally could happen due to several subjective factors.

Deep down, the state of the industry is a textbook case of supply and demand imbalance and overcapacity, which caused precipitous price declines. While the low module pricing has driven increased solar power installations, that same low pricing has also driven the strug-

gling module manufacturers right out of the market.

The solar industry is crudely, but assuredly, entering the next phase of its development: Globalization. The ability to adjust quickly to changing market conditions arising due to sudden policy changes, trade action, or competitive strategies will become essential to the success or failure of industry participants.

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In 2012, thick film technology prevailed assuredly.

Column January 2012: “A viable solar operation requires a business plan that is positioned to weather the industry’s boom-and-bust cycle. It takes four core competencies to do business in the solar space: Technology capability, manufacturing prowess, operational agility and strategic foresight. These competencies are key to the future of a company, be it a cell and module maker or a materials and device supplier. Sustained success requires these integrated forces to defy the impact of unwanted external conditions.

“The most ‘adverse’ phenomenon in today’s solar industry is pricing and the price drop. Yes, pricing in solar cells/modules are going on a wild ride. To paraphrase Winston Churchill’s wise words: The more we understand the past, the better we can see the future. Analyzing current industry dynamics, coupled with understanding the industry’s historical backdrop, is the way to formulate foresight and

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vision in weathering this rigorous, yet rewarding, industry.

“And China will continue to take on or take over the global demands of electronics for solar photovoltaics, harvesting from its manufacturing prowess of solar cell, modules and installation, as well as its huge market.”

This year, module prices dropped precipitously affecting revenues and margins throughout the supply chain. In examining the rise and fall of each company in this sector, Solyndra, for example, demonstrated the lack of “how-to” in building an entrepreneurial business, the importance of cost control, and the criticality of assessing the viability of a technology. Other companies with significant deficiencies in managing capital structure, factory expansion, inventory management, production scheduling, and operational cost control, such as China’s LDK, JA Solar, and Germany’s Q-Cell, each had its own story of failure to tell and learn from.

The sector continues the shakeout process while gradually reaching stabilization.

Environmentally-Friendly Manufacturing & Lead-free Reliability

Column January 2012: “The mission is yet to be accomplished...Within SAC system, the current system is as good as you can get... And we have to resort to that cliché: innovate and work out of the box for sweepingly better performance. Simply put, a quaternary or higher alloy system is necessary. The substantive guiding principles were covered in my book, *Environment-Friendly Electronics—Lead Free Technology*. This set of principles works and has proven to work exceedingly well. Trust, but verify.

“More and more products will become RoHS-compliant, or move closer to the directive, and this means more existing exemptions will be removed. Environmentally-friendly production, from cradle-to-grave, will continue to gain momentum. For our industry, this ranges from semiconductor packaging to PCB fabrication to solder material to PCB assembly. Corporations’ environmental stewardship for global sustainability continues to be one of the most important corporate business policies in 2012.”

The mission is closer to completion.

My statement that “Overall, the industry has been long in generating reliability test results, but short on doing what it takes to have a high performing lead-free alloy,” still largely stands. Nonetheless, encouraging signs exist. It is also comforting to see that the fundamental material principles (metallurgical alloy-strengthening mechanisms) have been put in use after more than 15 years of my teaching and advocacy on approaches in achieving the desired reliability, which is a matter of record.

In RoHS global regulatory compliance, more companies are moving toward producing environmentally-friendly products in compliance with RoHS regulatory directives.

My next column will address my outlook for 2013. **SMT**



Dr. Hwang will present a lecture on “Preventing Assembly Defects and Failures” at IPC APEX EXPO, February 18, 2013, in San Diego, California.

Dr. Hwang, a pioneer and long-standing contributor to SMT manufacturing since its inception as well as to the lead-free development, has helped improve production yield and solved challenging reliability issues. Among her many awards and honors, she has been inducted into the WIT International Hall of Fame, elected to the National Academy of Engineering and named an R&D Stars to Watch. Having held senior executive positions with Lockheed Martin Corporation, Sherwin Williams Co., SCM Corporation and IEM Corporation, she is currently CEO of H-Technologies Group providing business, technology and manufacturing solutions. She is a member of the U.S. Commerce Department’s Export Council, and serves on the board of Fortune 500 NYSE companies and civic and university boards. She is the author of 300+ publications and several textbooks and an international speaker and author on trade, business, education and social issues. Contact her at (216) 577-3284; e-mail JennieHwang@aol.com.