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A Live Report from ABB Automation  
& Power World 2012



by the Editors of  
**CONTROL** and **control design**  
FOR MACHINE BUILDERS

ARTICLES



# ABB SEES GROWTH THROUGH MEGATRENDS, DISRUPTIVE TECHNOLOGIES

CEO Hogan Keynotes ABB Automation & Power World 2012

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

Despite the series of “unprecedented events” over the past year that include the tsunami in Japan that led to the Fukushima disaster, Europe’s financial crisis, slowing growth in China and failure of the budget “supercommittee” in the United States, players in the industrial automation and electric power industries should be able to look forward to a robust business climate for 2012 and beyond, according to Enrique Santacana, region manager, ABB North America.

Speaking at the Tuesday morning general session at ABB Automation & Power World in Houston, Santacana pointed to several trends that should help sustain a powerful economic growth climate: energy efficiency; increased availability of natural gas through fracking; exponential growth in data-driven processes; grid and infrastructure investments; and industrial productivity. “In this global economy, if you’re not investing in productivity improvement, you’re going out of business,” he argued.

As it happens, every one of those growth trends falls in ABB’s “sweet spot,” Santacana said before he introduced CEO Joe Hogan to detail ABB’s work in all of these key areas.

Energy efficiency, which Hogan called

“the greenest form of energy you can think of,” is a key focus for ABB. “Last year our low-voltage drives saved 260 million mW/h,” he said, explaining that the savings were achieved by matching the motors to the drives. “It’s really that simple.”

It’s more simple for ABB these days, now that it’s finding synergy with recent acquisition Baldor, whose motors are coming together nicely with ABB’s drives. “Motors use 40% of the energy in industry,” Hogan said. “If you put low-voltage drives on every motor, you would save \$40 billion.”

Data centers were a key talking point for Hogan, who pointed to that market for incredible potential energy savings. Data centers use 100 times more power than a similar-sized office building, he said, which in itself makes the potential huge. Added to that is the exponential growth in data-driven processes. “Every time someone develops a new app, you have to build a data center somewhere,” Santacana said.

“Data centers are critical for modern economies,” Hogan said. “You’ll see so much innovation from data centers in the next 10 years.”

Part of that innovation is likely to come in the form of dc power, which will be a



“Efficiency is the greenest form of energy you can think of.” ABB’s Joe Hogan on the enormous potential for industry to make energy go farther through efficiency gains.



“great disruptor,” Hogan said. In data centers, for example, energy efficiency could be improved 10% to 20% over an ac system. Utilities have used dc power distribution for a long time, but the concept is relatively new to data centers, Santacana explained later at a media briefing. In practice, using dc power would call for fewer rectification steps, leading to fewer losses and better efficiency, he said.

The planet used almost 18 trillion kWh of electricity last year. Although the world is standardized on ac power, it's time to take advantage of dc's ability in many areas to improve power efficiency, Hogan said.

ABB doesn't advocate that dc take over everything, Hogan explained, but there are places where it makes sense. “The need for dc power is on the rise,” he said. “We need to take advantage of every kilowatt of power—ac and dc.”

Finding and exploiting such disruptive technologies is part of ABB's growth strategy, Hogan said. An-

other part of the strategy is looking for megatrends, he added, such as within the smart grid, power electronics, mechanical equipment, and oil and gas. “We want to be in areas where the market's growing,” he said. “We look for markets where the wind is blowing.”

One of the markets that ABB is putting more emphasis on is the United States, which remains by far the largest economy, still about double that of China. “By far the most momentum we see in the world right now is occurring in the United States,” he said.

Listing the \$100 million of investments made so far by ABB Technology Ventures, Hogan noted that six of the eight companies have been from the U.S. “It shows you just how innovative this country still is.”

The days of “labor arbitrage,” in which companies run to China to take advantage of lower labor costs, are coming to an end, Hogan argued. Companies are organizing instead around geographies, enabling faster response times for customers and more localized products and solutions. ■



# ARENA IMMERSSES ATTENDEES IN 800xA EXPERIENCE

Dramatization Drives Home Benefits of ABB Automation Platform and Control Room Technology

by Jim Montague, Executive Editor of *Control*, *Control Design* and *Industrial Networking*

If a picture's worth 1000 words, then what about a 45-minute dramatization?

That's the logic behind ABB's effort to paint a real-life picture of the problems faced by the staff at a hypothetical process plant, and how its System 800xA extended automation platform and related solutions can help solve them. The players lay out in graphic detail all the performance and emotional difficulties caused by their lack of organization and then demonstrate how 800xA's many tools can give them common views into their applications, help them learn to speak the same technical language as their colleagues, and coordinate their efforts for far better results.

For example, even as the "operations VP" is scolding the plant's staff for poor key performance indicators (KPIs) and missed alarms, the plant manager reports a trip in a main application area. Meanwhile, the maintenance manager says his staff is doing regular monthly checks, but they're short on expertise due to retirements, and the process safety manager and electrical engineering manager complain that their recommended updates aren't being implemented. And everyone

seems to have different documentation that none of their co-workers can access.

All of these are, of course, common problems in real-world applications. Spoiler alert: The cavalry arrives when the plant's staff adopts 800xA, allowing them to get on the same page with single-view display and reports, cooperate, and improve their operations and performance across multiple applications. Whew, a truly happy ending.

The dramatization debuted this week at the ABB Automation Arena on the exhibit floor at ABB Automation & Power World 2012 at the George R. Brown Convention Center in Houston. The Arena itself is headed for a permanent home in Houston, and three more are to be built around the world: in Abu Dhabi, Singapore and Zurich.

"When customers are told by sales people about how a process control solution works or read about it in a text or a PowerPoint presentation, it remains an abstract concept that can be hard to grasp and remember. We wanted to offer a more immersive explanation and experience," said Tobias Becker, senior vice president and global business unit manager for ABB



"We wanted to connect with their hearts as much as their heads and show how these tools can help them save the day." ABB's Tobias Becker explained how the company's Automation Arena dramatization can help drive home the potential for its solutions to improve the performance of processes and people.



Control Technologies. “We wanted to connect with their hearts as much as their heads and show how these tools can help them save the day.” The Automation Arena showcases how operators can use 800xA on ABB’s latest flat-screen displays, ergonomic workstations and other solutions to help fewer operators control more I/O points and functions, optimize performance, minimize risk, reduce unplanned shutdowns, improve profits, and even attract and retain talented staff—especially younger candidates who are likely more familiar with Xbox and Game Boy interfaces.

“Control rooms really haven’t been talked about in a substantive way for 20 years, so we’re trying to move the operating environment back to center stage and create a place that can improve users’ awareness, effectiveness, performance and their daily lives, too,” explained Becker. “Printed brochures and sales calls simply can’t do enough to get this message across, but the Automation Arena shows 800xA’s true value proposition and

lets visitors experience what they can do with ABB’s solutions.”

According to Becker, the combination of products in the Automation Arena can save users 40% on the space in their control rooms, which can add up quickly because control room costs average are about \$6000 per square meter, not including long-term lifecycle costs and other expenses.

“In addition, where process facilities used to have 10 to 20 control rooms for separate functions, many are now consolidating them into just a few control rooms, and this makes it even more crucial to make them as efficient as possible,” explained Becker. “The Arena shows how local and remote operators share relevant screens, instructions and even video; understand problems faster; collaborate on real-time problem solving; and even demonstrate to managers, accountants and CEOs who haven’t worked in control rooms the true value of what operators are doing to achieve higher-efficiency operations.” ■



# NORTH AMERICA ANCHORS ABB GLOBAL STRATEGY

Services for the Company's Extensive Installed Base Also a Key Focus

by Jim Montague, Executive Editor of *Control*, *Control Design* and *Industrial Networking*

Just as it's hard to see the forest because of all the trees, sometimes it's hard to see individual countries and markets because of that big, blue globe. This worldwide perspective and the recent fascination with China, India and emerging regions is certainly justified, but it may cause some folks to forget what are still among the planet's biggest industrial and manufacturing players. Such was the reminder stressed by several of ABB's key executives in a media briefing today at ABB Automation & Power World 2012 in Houston.

"ABB in North America is expanding and growing its presence, increasing its investments and growing its value to customers," said Greg Scheu, ABB Group's newly appointed head of customer and marketing solutions. "We're achieving these goals through the organic growth of our power production and power systems, process automation business and, in discrete automation and motion, with our recent acquisition and integration of Baldor. Meanwhile, our inorganic growth has come from the significant value and growth of our low-voltage business and by our soon-to-be-completed acquisition of Thomas & Betts."

Scheu added that ABB is crystallizing its concentration on North America and other well-defined regions with an "In Country, For Country" strategy that sharpens its focus on the priorities and values of these regions and improves services to better meet those needs. To back up its promises with action and capital expenditures, he reported that ABB is in the process of building a \$100-million, high-voltage, direct-current (HVDC) cable manufacturing plant in Hunterville, N.C., helping to expand Baldor's motor-building facilities, and already has had more than 400 customer visitors to its Smart Grid Center of Excellence at North Carolina State University in Raleigh, N.C.

Likewise, Enrique Santacana, president and CEO of ABB Inc., was even more succinct in describing how crucial North America is for his company. ABB Inc. is ABB Group's North American division. "ABB in North America represents the largest installed base of ABB's power and transmission and distribution equipment," said Santacana. "North America is our largest market for products, systems and services such as discrete automation and motion, low-voltage products, power



"We're going to double our North American footprint again." ABB's Santacana on the company's pending acquisition of low-voltage electrical equipment maker Thomas & Betts.



products, process automation and power systems.”

With its headquarters in Cary, N.C., ABB Inc. has nearly 19,000 employees working in the U.S., Canada and Mexico, and serves the firm’s five main operational areas, including manufacturing, assembly, services, sales and engineering, and research development. In fact, ABB Inc.’s five product divisions—power, power systems, discrete automation and motion, low-voltage and process automation—already had \$8 billion worth of orders in 2011.

“In North America, we already have numerous strategically located service centers, and with our anticipated acquisition of Thomas & Betts, we’re going to double our North American footprint again,” explained Santacana.

He added that ABB is using its wide portfolio of solutions and services to address seven global megatrends, which will enable it to overcome short-term economic volatility and continue to grow over the long term both in North America and beyond. These megatrends consist of resource economics, green technologies, transportation and mobility, electrification and communicating to smart grids, increasing urbanization, digital information and data center growth, and power shifts in emerging economies.

“Energy efficiency is ABB’s foundation, so we can help users reduce their energy use at every step from primary extraction, generation, transportation, transmission and distribution, industrial processes and production,” Santacana said. “Overall, ABB can reduce users’ energy losses by 20% to 30%.”

On the process industry side, Sandy Taylor, global business unit manager for ABB’s chemical, oil and gas business, reported that ABB is active across the entire oil and gas value chain. The markets it serves include oil and gas exploration and production, oil and gas transportation and distribution, refining, petrochemical, chemical, and marine supply, transport and support.

“All of ABB’s product divisions are active in oil and gas too,” said Taylor. “We have thousands of successfully completed projects worldwide and had more than \$4 billion in sales in 2011. We hold the number one position in

the upstream oil and gas DCS market, and we have more than 7500 dedicated chemical, oil and gas employees in 40 countries.”

Taylor added that oil and gas and other process industry users prefer to buy unified bundles of technologies and services, and that ABB can serve at whatever main electrical contractor or main automation contractor level they require. “We’re getting involved in many projects much earlier in the design stages, and this can help everyone reduce costs. But we’re able to bundle in many electrical solutions, and this helps many users even more by combining our best-in-class technology with our execution excellence.”

Despite traditional research indicating that many hydrocarbon resources have reached a peak and will decline in the future, Taylor added that more recent data shows that only about 1 trillion barrels of oil and gas equivalents have been consumed throughout history, and that about 9 trillion barrels remain. Meanwhile, though demand for oil and gas from established economies won’t grow as quickly, most increases in future demand will come from emerging economies. “The only question is at what price will this oil and gas be available. Previously, most oil and gas was located on shore or near shore, and so it cost about \$10 to \$30 per barrel to produce. However, most future oil and gas will come from deep water, shale and other sources, and these will cost about \$60 to \$100 per barrel to produce.”

To aid these efforts, ABB is already constructing subsea drives, transformers and other systems that can operate down to 7000 feet below sea level and run for years without requiring maintenance. Not surprisingly, ABB plans to use its HVDC cables to deliver efficient, long-range power to many of these devices. ABB is also helping 100 customers automate 20,000 sites with a variety of horizontal drilling equipment, which is used in hydraulic fracturing to free natural gas and oil from shale formations. In addition, Taylor added that ABB’s 800xA Extended Automation DCS platform and related HMI solutions will help users monitor and manage these new process applications. ■



# DON'T LEAVE ENERGY PROJECT ROIs ON A SHELF

Accelerated Implementation Moves  
Energy Assessment Results to the Bottom Line

by Paul Studebaker, Chief Editor of Sustainable Plant

For every 10 industrial energy assessments, maybe one company actually does a recommended project and carries it through until its results improve the bottom line. “The rest never get anywhere,” says Cahal Devlin, ABB’s energy efficiency manager for North America.

Devlin’s presentation, “Industrial Energy Efficiency Assessments and Accelerated Implementation,” at ABB Automation & Power World 2012 this week in Houston began by pointing out that we all know U.S. and global energy demand is rising. U.S. industries are generally more energy-intensive—use more energy per unit of production—than their European and increasingly, Asian counterparts.

We can see the potential for improving competitiveness by controlling energy spend and especially by reducing energy intensity. A recent ABB research report, “Trends in Global Energy Efficiency 2011: An Analysis of Industry and Utilities,” says more than 70% of managers recognize the importance of efficiency. But asked whether or not they’ve invested in it, only 40% of global companies, 34% in developing regions, and just 21% of U.S. companies say “yes.”

“Demand and impact are clear, so why so little action?” Devlin asks. He identifies four major barriers:

Lack of knowledge and awareness of plant and business operators. Energy lacks the visibility of availability, quality or safety. It’s difficult to quantify the potential benefits and costs.

- Lack of trust in outside consultants who may lack specialized knowledge of their processes.

- Problems with measurement and verification of results.
- Financing energy projects whose returns are typically 18 to 24 months.

ABB is rolling out a new energy efficiency assessment approach called “energy value acceleration,” where Devlin’s group in the United States and its counterparts around the world are helping industry “get past the sticking point that projects don’t pay until after implementation.”

When ABB performs an assessment, along with a list of low- or no-cost improvements (“quick wins”) that can be made immediately, it identifies the five or six potential projects that offer the highest certainty of rapid payback. The list includes financing options, as well as performance guarantees. “Typically, the quick wins fund the projects,” Devlin says, but ABB will offer a financing plan.

The program includes a behavior and management assessment of the company’s policy, strategy, KPIs, measurement/monitoring/reporting systems, etc. to help the company maintain savings and improve for the long term.

ABB has implemented the program at companies including U.S. rubber and monomer plants, a steel mill in the United Kingdom, a paper mill in Finland, and chemical and aluminum plants. “Most facilities realize 15% to 25% savings on site energy spend,” Devlin says. “Some less, some more.”

Energy efficiency assessments used to pay off for only one in 10 companies, Devlin says. Now, for the other nine companies, “Instead of leaving a dusty report on a shelf, we accelerate implementation.” ■



For every 10 industrial energy assessments, maybe one company actually does a recommended project and carries it through until its results improve the bottom line. “The rest never get anywhere,” Cahal Devlin at ABB Automation & Power World 2012. To solve that problem, ABB is rolling out a new energy efficiency assessment approach it calls “energy value acceleration.”



# INNOVATIONS CONTINUE TO FLOW FROM ABB MEASUREMENT LABS

Autonomous Sensors and Laser Level Scanners Are Among the New Technologies on Tap

by Walt Boyes, Editor-in-Chief of *Control*

While ABB's Measurement Products business is built on more than 120 years of experience and great brands like Taylor, Fischer & Porter, Hartmann+Braun and K-Tek, the company has not rested on its laurels. Rather, it continues to invest heavily in new instrumentation technologies.

"On average, our current measurement line-up consists of products introduced within the past five years," said Greg Livelli, head of ABB's flow instrumentation group, as he reviewed the company's recent and soon-to-be-introduced measurement innovations at ABB Automation & Power World 2012 this week in Houston.

For the past several years, the company has focused on making its instruments easier to use, unifying its many disparate human-machine interfaces (HMIs) into a common platform. "Our HMI operates with the ease and simplicity of a cell phone," Livelli explained. "The top works for two-wire field instruments share common components, assembly and supply, as do the top works for four-wire instruments," Livelli said. "One of the coolest things I've heard from a customer was, 'I no longer need a manual to program your devices.'"

New to the measurement line-up in 2012 is a laser scanner level monitor that builds a three-dimensional picture of the interior of a bin and computes level and volume from the topographic scan. There's also a new magnetostrictive level transmitter with improved electronics, HART, WirelessHART and Foundation Fieldbus connectivity and hazardous-area, through-the-glass operation. "This is a very cool thing," Livelli said. "You can operate the transmitter through the glass so you don't have to get a hot-work permit to program the transmitter. And you can use it with most gloves too."


ABB is rolling out WirelessHART capabilities for its pressure and temperature transmitters, as well as WirelessHART adapters for transmitters already installed. Some, like a wireless temperature sensor that harvests energy based on thermal gradients introduced in 2011, will operate fully autonomously.

Also in 2012, ABB's analyzer portfolio will be bolstered, Livelli said, with the introduction of ACF-NG analyzers for hot or wet gas analysis solutions. Built on the successful ACF-NT line, the NG analyzers offer lower cost of ownership, new solutions for new markets and extended measurement



"On average, our current measurement line-up consists of products introduced within the past five years," ABB's Greg Livelli reviewed the many new measurement innovations issuing from the company's research and development efforts.



The background of the page is a dynamic, abstract graphic consisting of thick, flowing lines in shades of red, orange, and yellow. These lines curve and swirl across the page, creating a sense of motion and energy. The lines are more concentrated on the right side, where they form a large, curved shape that resembles a stylized 'C' or a wing. The overall effect is modern and high-tech.

ranges. In addition, ABB is introducing new tunable diode laser (TDL) in situ analyzers for continuous gas analysis. Oxygen and ammonia analyzers will be available by the end of 2012, Livelli said, and extractive analyzers with specific sample pretreatment applications will follow. On the wet chemistry side, Livelli noted, the Navigator product line will be getting a new Navigator 500, with hydrazine, sodium and dissolved oxygen capabilities aimed at the power market.

New to the flow measurement offering is the Coriolis-Master bent tube mass flowmeter in line sizes from 15-mm to 150-mm (.5-in. to 6-in.). "Our Coriolis meters now are available for both liquid and gas, have the common ABB user interface, have HART and Foundation Fieldbus connectivity, with Profibus to come, and have the same hazardous-area, through-the-glass operation as our other flow products do. And because our customers have asked us to, we've introduced a complete line of differential pressure flow devices—pitot, wedge and integral orifice devices that are already assembled, leak-tested and calibrated, ready to install," Livelli continued.

Also set to debut in 2012 is a thermal mass flowmeter based on new ceramic sensor technology, the StackMaster gas flow measurement system for emissions monitoring and the LiveStressometer 8.1 for rolling mill applications.

"Further into the future, we're working on an advanced

portfolio of autonomous devices in flow, temperature, level and analysis," said Livelli. "These products will be powered by advanced new energy techniques, including energy harvesting from temperature, solar power and vibration, and will communicate via WirelessHART. In fact, the first of these, the wireless temperature transmitter using a thermal gradient of 30 °C for power has already been introduced."

"Over the course of the next year or two," Livelli said, "we will be completing the rollout of our new measurement product transmitter lines. There will be four electronics platforms for all of our products: two-wire, four-wire, field transmitter and advanced transmitter versions. The two-wire, four-wire and field transmitter product lines are released, with the advanced electronics platform following on soon. We expect to see it by the end of 2013."

"The advanced electronics platform will feature a gesture-driven HMI and feature-rich electronics," Livelli said. "Our electronics platforms will be intuitive, easy-to-use interfaces in wall-, rack- or panel-mounted configurations, and in hazardous area formats."

"In the future," Livelli promised remote wireless access to field devices with handhelds like smartphones and tablets. "We will be able to give you service information directly in the field on these devices," he said.

"And that's what over 100 years of measurement product experience can bring you." ■



# DEAL WITH RENEWABLE ENERGY'S DIRTY PROBLEM

## Keep Wind and Solar PV Sags and Spikes from Tripping Grids

by Paul Studebaker, Chief Editor of Sustainable Plant

Windmills and solar photovoltaic (PV) systems are popping up—and popping the protection systems—on grids all around the world, frustrating owners and perplexing power companies. The installations are by the book, the SCADA systems say everything's running smoothly. So why won't the renewable energy sources stay online?

The problem has become increasingly apparent as we try to increase the percentage of wind and solar versus fossil-fueled generation, said Alan Langworthy, global business renewable energy integration manager, ABB, in his presentation, "Microgrids and Renewable Integration," this week at ABB Automation and Power World 2012 in Houston, Texas. "It's like the Goldilocks fairy tale," he says. "We don't want so little renewable power that we can't get a good return on our capital investment or so much that it causes a trip. We want just the right amount so we can make the best investment and get maximum returns."

The problem is the variable output of wind and solar PV, and not just because sometimes the wind doesn't blow and there's no sun at night. "A windmill can go from 100% to 20% output and back in three seconds," Langworthy says. "On a cloudy day, a PV array can go from 30% as a cloud passes over it to 130% as it catches full sun plus a reflection from the underside of another cloud. These rapid variations wreak havoc on grid-protection systems."

Windmill output can vary so rapidly because the blades are made light-weight and low-inertia so they can react to gusts within the prevailing winds. "They're designed to

pump energy out of the air by taking advantage of gusts," Langworthy says. These variations are happening much too quickly to be caught by SCADA systems, which may be sampling as slowly as every 15 minutes.

Battery-energy storage systems are not well-suited to absorbing and discharging energy to stabilize these oscillations. Existing batteries are able to discharge fast enough, but absorb a charge more slowly, and this asymmetrical behavior makes it difficult to use them effectively. Plus it's really hard on them, Langworthy says, "It's essentially putting an AC current on the battery."

Langworthy's group solves the problem using flywheel-based energy storage units that introduce "synthetic inertia," and are able to absorb peaks and fill sags with a reaction time of five milliseconds, an order of magnitude faster than they occur. The inverter and flywheel units correct both real and reactive power fluctuations, controlling voltage and frequency to stabilize the grid and keep renewable units online and producing usable power.

The PowerStore flywheel/inverter units can be combined with ABB communications and control systems to fully integrate renewables. With full integration, the "Goldilocks" sweet spot can be expanded enormously, in some cases up to 100%. Langworthy described, among other examples, a diesel generator and solar microgrid for the town of Marble Bar in Australia. On sunny days, a 300-kW solar array with a 500-kW PowerStore unit can power the town with no diesel generators running—and no batteries.

Goldilocks would find that to be "just right." ■



"Rapid variations in renewable energy output wreak havoc on grid protection systems." ABB's Alan Langworthy discussed the use of flywheel/inverter systems to effectively integrate renewable energy sources onto power grids.



# ECONOMIST PREDICTS STEADY GROWTH, BUT ON A ROUGH ROAD

Despite Headwinds, U.S. Recovery Will Continue, Predicts NEMA Economist

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

**W**arning: If you want to feel good about the economy, don't get your information from Don Leavens, and don't continue reading this report. But for a bit of moderate optimism couched in warning signs that could spell trouble if we're not careful, read on.

Leavens, vice president and chief economist for NEMA, spoke at the Business Forum this morning at ABB Automation & Power World in Houston. He expressed considerable concern about the economy going forward in the United States and around most of the globe. What positive things he had to say were generally tempered with bad news. On the plus side, though, many of the negative things he had to say were tempered as well.

So, in a nutshell, don't expect much growth anytime soon, but maybe it won't be so terrible. As he summed up his discussion, he said, "I don't think I've painted a grim picture, but there are really some serious risks out there."

There are some high points now and on the horizon, to be sure. "It's a good feeling now compared to where we were just two or three years ago," Leavens said. "The U.S. economy is one of the brighter spots, surpris-

ingly. But there are some storm clouds out there; things we're still concerned about."

The United States is seen as one of the bright spots in manufacturing. "That's good news. But if you look at industrial production, it's tapering," Leavens said. Capacity utilization, which is somewhat overstated to begin with, is still not back up to where it could be. "We've improved, but we're not back to where we were in pre-recession."

The housing market continues to look pretty dismal, and Leavens does not share the optimism of some other analysts in this area. "The best we can say is we've reached the trough," he said, later adding, "I remain quite pessimistic with regard to housing going into 2013."

In the meantime, the world order has changed significantly over the past four years, Leavens noted, with the recession exacerbating a number of trends that already existed. China became the second-largest economy, surging ahead of Germany and Japan and leading a trend in which the economic growth rate for developing nations exceeds that for developed nations. The financial market failure was debt-based, so it centered in the developed nations. China, India and other developing countries were



"There are a number of strong headwinds going forward, but I'm not putting a recession forecast in the cards." NEMA's Don Leavens on the global economy's mixed forecast.



not part of the “debt orgy,” Leavens said. “So they don’t have to rid themselves of this huge largess of bad debt.”

Meanwhile, European governments are scrambling to defuse ticking sovereign-debt time bombs with austerity plans of varying degrees as the Euro zone sinks back into recession. Europe’s austerity measures have focused on spending cuts rather than restructuring economies to foster faster growth. “The question going forward is how governments and central banks can remove the mammoth life support structure without triggering a second severe global recession,” Leavens said.

The U.S. economy is unlikely to deteriorate to the levels in Europe, simply because the government will take the steps necessary to avoid that, Leavens predicted. “There are a number of strong headwinds going forward, but I’m not putting a recession forecast in the cards here,” he said. “We’ll resolve this, and the economy will keep ticking, but it’s going to be a little rough.”

Leavens later added, “The fiscal cliff that we face going forward will create a bumpy road. But don’t expect another recession, because the government won’t sign off on an austerity plan.” ■



# NOT JUST MOTOR EFFICIENCY: LOOK AT THE WHOLE SYSTEM

While Upgraded Components Can Boost Energy Efficiency,  
a System-Level Review Is More Likely to Pay Off Big

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

**E**ver-increasing electricity costs are a universal problem. As plants look for ways to mitigate those costs, energy efficiency is the simplest, least-expensive way to go. And yet nearly a quarter of the facilities (24%) have not addressed energy in any way, according to John Malinowski, senior product manager, ac motors, for Baldor Electric, and chairman of NEMA's motor and generator section. "They just assume it's a fixed cost, and there's nothing they can do about it," he said.

Particularly as more laws go into effect mandating improved efficiencies in motors, reviewing and updating the motors in a plant is a good first step in improving plant energy efficiency. An even better step, however, is doing a full review of system efficiency—looking beyond the motor at the application as well, adding adjustable-speed drives on pump and fan applications, using increased-efficiency gear reducers and premium-efficiency transformers, and adding servos for increased throughput. "Something like using servos will use more electricity, but your throughput will be higher," Malinowski explained. "So my electricity might go up, but at the end of the day, looking at kilowatt-hours

per widget, my number goes down."

Malinowski explained the benefits of system efficiency during a session at ABB Automation & Power World 2012 this week in Houston. To explain the importance of considering a motor's efficiency level, he pointed out that energy accounts for more than 97% of a 20-year lifecycle cost of a motor. "About 2% is the purchase of the motor itself. The rest of it is cost of operation," he said. "Investing upfront in the motor is going to save a whole lot as time goes on."


On this point, purchasing agents need to be educated on the benefits of spending more for a high-efficiency motor. "Purchasing agents are there to save money when they buy things," Malinowski said. "So they're going to fight against spending money up-front, and they're going to hurt you on this."

Upgrading just one 200-hp, four-pole motor from average efficiency (93.5%) to NEMA premium efficiency (96.2%) could save a plant close to \$80,000 over a 20-year period, not even considering the rising cost of energy during that time. According to Department of Energy (DoE) estimates, replacing lower-efficiency motors could translate to \$3 billion to \$5 billion in savings every year in the



"We can save money by replacing components, but it's minimal." Baldor's John Malinowski urged ABB Automation & Power World attendees to assess energy efficiency performance from a systems perspective.



The background of the page is a dynamic, abstract composition of flowing, wavy lines in shades of red, orange, and yellow. These lines create a sense of movement and energy, resembling a stylized representation of fluid dynamics or perhaps a close-up of a high-speed camera capturing a liquid surface. The lines are more concentrated and vibrant in the lower half of the page, where they sweep across the width of the layout, and become more sparse and translucent as they rise towards the top, where they blend into the white background around the text area.

United States. Waiting until those motors fail to replace them could take 15 to 20 years.

But it's more than just upgrading to premium-efficiency motors. DoE best practices, as Malinowski pointed out, also encompass improving rewind practices, reducing system load, controlling motor speeds, matching equipment to the load, upgrading component efficiency, maintenance practices and motor downsizing (right sizing).

"When a motor fails, find out why it failed," Malinowski urged. "Work with the service shop and have it give you a good assessment." He told of one plant that replaced the same motor over and over again, until engineers finally discovered that they were using a motor that wasn't designed for the application. It was getting water in it and needed an upgraded enclosure.

A basic plant survey that anyone could do would involve inventorying motors and deciding what to do with them when they fail, Malinowski said. A more advanced survey would add measuring the current draw on each motor to

determine appropriate sizing. A third level of plant survey is a full-system approach. "Put your engineer hat on, stand back and look at more of an expenditure level here," he said, explaining that the first two levels work more with existing motors, while the third level is more an overhaul.

It's not difficult to look at system-level efficiency—any number of organizations can perform assessments, or your own plant people can do the surveys—and the payback is significant. The Baldor Energy Savings Tool can provide a payback analysis that quickly brings to light the fact that switching out motors might take you 30 to 32 months to recoup the investment, while using a drive could shorten the payback period to more like six to eight months, Malinowski said.

"You've got to look at the systems," he said. "We can save money by replacing components, but it's minimal. A motor might give you 6% to 8%, but one of these system improvements might give you 50% to 60%. Electricity costs are going to keep going up, so you'll save more if you do it now." ■



# BASF REJECTS RIP AND REPLACE WITH SYSTEM 800xA

How a Paint Plant Preserved Its Legacy System Investments while Modernizing for the Future

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

**A**t ABB Automation & Power World 2012 this week in Houston, ABB has its System 800xA control system on display in the Technology & Solutions Center, showing how the platform can provide an evolutionary upgrade path that preserves legacy control system investments.

During a session this afternoon, conference attendees got the opportunity to hear one customer's account of how his plant has been able to evolve its control system with System 800xA, leaving in place its legacy INFI 90 systems while updating operator stations, controllers and power supplies.

BASF's site in Windsor, Ontario, which makes automotive paints, has been around for more than 100 years. It became part of chemical giant BASF through the Inmont acquisition in the early 1980s.

In 1994, the plant installed its first distributed control system (DCS), an INFI 90 from ABB, including Conductor VMS redundant servers and Conductor VMS clients. By 2004, the plant was facing issues and had to figure out how it was going to support an aging system, said Jiri Prochazka, instrument and electrical engineer, who faced the challenge of increasing productivity and overall equipment effectiveness (OEE). "Instead of

ripping it out, we decided to preserve the installed base," he said. "So we developed an evolution plan with ABB."

The team began by upgrading the engineering tools and then moved on to the front-end control stations, controllers and power supplies. In June 2007, BASF installed new operator stations. ABB had standardized on the 800xA platform, Prochazka said, "So we decided to go ahead and upgrade our VMS stations."

Because BASF's operations are manually intensive, the plant does not have a classic control room, but rather has operator stations sitting on the plant floor, Prochazka said. "We had to come up with a solution to install clients on the floor in a classified environment."

They ran the systems in parallel for a couple months to make sure everything would work correctly, then disconnected the VMS units. As it turns out, it was just in time, with problems cropping up on the VMS systems. "We could probably find the hardware to replace the VMS systems, but the problem was to find the people who still remember how to work with VMS code," Prochazka added.

In 2009, BASF decided to expand its



"In the end, we completed the migration process and ended up with an up-to-date, state-of-the-art DCS." BASF's Jiri Prochazka explained how the company was able to modernize its automation infrastructure while retaining still functional elements of its legacy control systems.



Windsor facility to include refinishing products. The existing system had about 2000 I/O points for process automation of blending, mixing, batch processes and dispersions, and the new line would add about 600 more.

BASF needed the operators to seamlessly control the new refinishing products line while operating the existing blending, mixing, batch processes and dispersion lines. The field wiring would remain unchanged, so the INFI 90 needed to interface with the System 800xA.

ABB's solution was to use a Harmony PCU Gateway (HPC) to connect the existing BRC400s to the new refinishing line's AC800M controllers. The HPG 800 was designed to provide robust, peer-to-peer communications with the AC800M controllers via CI867 Modbus TCP CEX modules. "We're actually controlling across that HPG a lot," said Jim Luffman, project manager for ABB in Burlington, Ontario. "We expected about 200 links, but ended up with around 1000."

The operators have seamless control of the new refinishing

line with the addition of some new graphics, Luffman said. "The operator can't tell which controller he's using," he added. "Whether it's the new or old system, it's transparent to the operator."

Working in a Class 1, Zone 1 environment, BASF had limited real estate to add the new refinishing line. ABB's solution added S800 I/O modules with embedded intrinsic safety, creating a total of six I/O cabinets distributed throughout the process areas with a minimized footprint.

"Our site continues to evolve," said Prochazka, noting that the next steps earmarked in the process are to replace obsolete PLCs to AC800M controllers and S800 input and output cards, eliminating control islands.

"I think we have made the right decision to protect the installed base," he said. "We did not rip and throw away the existing infrastructure. In the end, we finished and completed the migration process and ended up with an up-to-date, state-of-the-art DCS." ■



# THE ENERGY PERFORMANCE CONTRACT: BETTER THAN DOING NOTHING

How Energy Performance Contracts Work and Why You Might Want One

by Paul Studebaker, Chief Editor of Sustainable Plant

“There’s no downside to energy efficiency projects,” says Pierre Langlois, president, Econoler. Not only do they reduce costs, help the environment and put people to work—you also usually get new, more reliable equipment that improves reliability and productivity. “So why are so few implemented?”

Is it the typical one-to-three-year payback? That’s better and more certain than most other corporate investments, and with prices bound to rise in the long term, it will increase over time. So it’s not because energy efficiency projects aren’t worth doing.

“It’s because of internal barriers,” Langlois told attendees of his session, “Developing Energy Efficiency Projects Using Energy Performance Contracting,” this week at ABB Automation and Power World 2012 in Houston. Langlois asserted that in a typical manufacturing company, the combination of lack of awareness, lack of knowledge, lack of capacity (no one is dedicated to the task) and, perhaps especially, lack of financing and lack of confidence in obtaining the promised returns add up to—doing nothing.

That barren field has become fertile ground for the energy performance contract (EPC), defined by Langlois as “a con-

tractual arrangement between a beneficiary (your company) and a provider called an energy service company (ESCO) for the implementation of an energy efficiency project, where the global investments have to be paid for through a contractually agreed level of energy cost reduction.”

The ESCO works with contractors, equipment manufacturers, governments, financial institutions, consulting engineers, energy suppliers, etc. to define and implement the project. You get a single point of contact—the ESCO—and a guaranteed return on the project for a specified period of time. (The ESCO’s skill set includes risk management so it can guarantee savings.)

EPCs come in several flavors. Under a “guaranteed savings” contract, the end user company finances the project and the ESCO guarantees the returns. Results are measured and verified during an expected payback term, typically three or five years, and any shortfall is paid by the ESCO.

Under a “shared savings” contract, the ESCO finances the project and takes the lion’s share of the savings for a defined period. The end user has no up-front cost. “You will never have a deficit and will have an immediate savings as well, from Day One,” Langlois



“There’s no downside to energy efficiency projects, so why are so few implemented?” Econoler’s Pierre Langlois discussed the growing use of energy performance contracts to execute and finance these projects.



says, “along with better equipment and production.” This approach has been very popular in the United States, involving “probably 20,000 projects over the past 10 years,” Langlois said.

A third contract format, “chauffage,” has the ESCO taking over an energy-related asset or system, such as a boiler or compressed air, and providing its output to the plant under agreed-upon terms. The ESCO pays an equity share—typically 10% to 30% of the assessed value of the asset—then finances, implements and owns the improvements.

It’s important to note that one of the ESCO’s most critical skills is financing. Financial institutions are used to providing “asset-based” lending at 70% to 80% of the market value of assets being financed or other collateral. They don’t recognize the cash flow generated by energy efficiency projects as a new asset to be valued in the financing structure (credit enhancement), and they’re not familiar with the intricacies of financing energy efficiency, so they impose a high-risk lending profile for energy efficiency projects.

So ESCOs have become proficient at alternative financing, drawing on one or a combination of the end user, the ESCO, leasing and special-purpose vehicle (project) financing. This non-technical aspect of energy efficiency projects is not a strength of most engineering and operations teams, so it’s an important ESCO capability for enlisting the folks in finance and accounting.

Since a major benefit of the EPC is the guarantee of savings, measurement and verification (M&V) becomes critical. Langlois said, “You can’t measure savings because it’s not there.” Instead, you measure and establish a consumption baseline before the project, measure the consumption after the project, and calculate an estimate of the savings. Post-project measurements

must be adjusted for any differences—weather, production rates—between the baseline and current conditions.

“The most critical part is to agree on how these adjustments will be done,” Langlois said. That agreement must be in place before the project is performed, because it affects how the baseline measurements will be taken and for how long. “Once the project is done, the baseline is gone—you can’t go back and take more measurements.”

Baseline measurements might be possible using only the utility metering, as in the case of an office where the primary adjustment would be weather, or it may require additional metering, as in a complex facility where the energy savings due to, say, replacing motors might be impossible to separate from other consumption variations from product mix or equipment condition or operation.

Baseline measurement periods may be brief, as for a motor replacement where efficiency is essentially constant over the equipment lifetime, or may have to be extended to account for equipment efficiency variations due to, say, product mix, weather or maintenance. A good resource for understanding M&V and how it affects baseline measurements is the International Performance Measurement and Verification Protocol (IPMVP).

To decide if you need an ESCO to help you get an energy project done, bear in mind that it will add some cost to the project compared to doing it all internally. Langlois estimated the additional cost for the ESCO’s profit adds about 8% of the construction costs, and guaranteeing the results adds about another 6%. But the rest of the project costs are about the same as they would be if you did them with your own company resources.

The biggest cost—and risk—is doing nothing. ■

### Typical Energy Performance Contract (EPC) Cost Structure

Category	Cost	Percent*
Investment grade audit	\$35,000	4.5%
Construction costs	785,000	100
Engineering	87,000	11.1
Adm. & project manager	87,000	11.1
Profits	60,000	7.6
Guarantee premium	50,000	6.4
Training	15,000	1.9
Interim financing	9,000	1.1
Sub-total (TCI)	1,128,000	143.7
M&V	34,000	4.3
Financing	357,000	45.5
Total Project Costs (TPC)	\$1,519,000	193.5%

\* Baseline construction costs equal 100%.



# HOW TO BUILD A BETTER OPERATOR

Collaborative Research Effort Looks for Keys to Improved Effectiveness

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

If you want to keep your plant operators performing at optimal levels, how many alarms should you try to hold your system to? A commonly quoted number is 10 alarms in 10 minutes. But how do you know whether that's right for your group? What's the best way to present procedures to those operators so they know what to do when they do face an alarm situation? And what's the best way to train them how to follow those procedures?

There's no shortage of anecdotal evidence to provide suggestions for these and other questions related to target alarm rates, worker fatigue, training, display colors and graphics, information hierarchy, and any number of factors that could contribute either to operators' ability to keep a plant running, or the likelihood of them bringing it to its knees, noted Dave Strobhar, principal human factors engineer at Beville Engineering. But hard research can be harder to come by, so several players in the petroleum industry joined forces about five years ago to get the research done.

Strobhar presented several interesting findings from the open industry-academia collaboration, the Center for Operator Performance, at ABB Automation & Power

World this week in Houston. The group has found, for example, that the alarm-per-minute average isn't as magic a number as some might believe; that providing procedures that span several units improves performance over per-unit procedures; and that operator error rates do not rise linearly over time as one might believe, but instead double on the ninth day of work after eight days of consistent performance.

Driven by operating companies, which are primarily in petroleum, the center also counts among its members three of the major control system suppliers: ABB, Emerson and Yokogawa. The group was founded at Wright State University in Dayton, Ohio, which has a strong background in human performance research, and is managed by Beville Engineering, which specializes in the analysis of operator performance issues in the refinery and petrochemical industry.

Research is done across a range of performance-shaping factors: interface/information systems, procedures/job aides, selection and training, automation/system demands, job design, and organization and staffing.

An ongoing project with associate professor Sandeep Purao at Penn State University is exploring the best way to present



"It's a skill like anything else." David Strobhar of Beville Engineering stressed the importance of practice in helping operators make better decisions.



procedures, which are growing ever-more voluminous. Procedures tend to be organized by unit, each with its own set of procedures. “The problem is that in some cases I might have responsibility for more than one unit,” Strobhar said. “I’ve seen console operators that have three sets of procedures in front of them because alarms are going off on three different units at the same time.”

Modularizing those procedures instead could help companies tailor procedures to an individual operator instead of a unit, mixing and matching procedures that occur across several units. “If you could modularize them, you could tag them with certain attributes,” Strobhar explained. “Then you could recombine them to create procedures for an individual.”

Through an algorithm that converts procedures to text files, Purao and his group are able to build a set of heuristics that are parsed into a table, finding the key steps that tend to occur together, and creating a single task module from them.

One thing that came out from this research was the ability to identify gaps in procedures; certain steps that were missing key elements. The research also can help find opportunities are for procedural automation.

With Louisiana State University’s Craig Harvey, the center has also researched the ideal alarm frequency within an operating system. As Strobhar notes, the oft-quoted number of 10 alarms in a 10-minute period seems reasonable, but why that particular number?

The group ran university students through a series of controlled experiments—with rates of one, two, five, 10 and 20 alarms per 10-minute period—to see how operator response time would measure up. “For one, two, five and 10 alarms in 10 minutes, performance was flat,” Strobhar said. “But at 20 in 10 minutes, you see the alarms starting to queue up.”

The first study ran the experiments in 10-minute bursts, so researchers then wanted to see how the numbers would be affected in one-hour time spans. In this case, they looked at 15, 20, 25 and 30 alarms per 10 minutes. Although there was a slight increase across the timeframes, it wasn’t until 30 per 10 minutes that alarms started really queuing up more.

They also wanted to see if it made a difference whether the experiment subjects were students or professional operators. At a rate of 10 alarms per 10 minutes, the operators performed just a little better. But at a rate of 20 alarms for the same time period, the operators were twice as fast as the students. “That shows there’s an experience effect,” Strobhar noted. “You’re not going to see a performance difference until stress comes up. That’s when experience is really going to show.”

The conclusion was that 10 alarms in 10 minutes is in fact a very conservative number. “A lot of companies are beating themselves over their heads trying to reach that number,” Strobhar said, noting that with better operators, better displays and other positive factors, that number could be more like 20-25 alarms per 10 minutes.

Of course, everyone wants to know the best way to make a “better operator.” In a study with Klein Associates, the center looked into whether the researchers could adapt the military’s decision making exercises (DMX) to process plants. What they found was that it could be done easily with very short training sessions—one hour on occasion at the start of a shift, for example.

“You need to practice making decisions,” Strobhar emphasized. “It’s a skill like anything else.” Through relatively simple, low-cost training sessions, companies have been able to keep their operators’ skills honed, identify knowledge gaps and lost practices, and help build mental models. ■



# CONTROL SYSTEM EVOLUTION AT BAYER: 24 YEARS AND COUNTING

Bayer Healthcare Partnered with ABB to Bring its 1980s-Era Control Systems into the Future

by Walt Boyes, Editor-in-Chief of *Control*

The Bayer Healthcare plant in Berkeley, Calif., was built in 1903 and has produced everything from black-leg and smallpox vaccines to its current product, Kogenate, a blood-clotting agent for persons with hemophilia.

"In more than 24 years of partnership with ABB, Bayer has managed a program of continuous upgrades to its control systems," said David Kavanaugh, process control systems engineer for Bayer, who, along with his colleague Mike Kylo, discussed the company's migration journey this week at ABB Automation & Power World 2012 in Houston.

"Efficiency and flexibility are now strategic requirements for plant automation," Kavanaugh said. "Originally, our systems had a low level of automation with no closed-loop or advanced control and with poor standardization. Automated sequences were hard-coded and inflexible. Code was poorly documented, if at all. Interconnection between different manufacturers' systems was difficult, and it was hard—or flatly impossible—to automatically get data from a system."

"Today's plant," Kavanaugh said, "has on-line and at-line process analyzers and advanced control has been implemented. The use of OPC and standard third-party drivers

has made interconnection and data transfer straightforward. Electronic batch records with recipes are selected through manufacturing execution systems. We have self-documenting tools and auditing, and our systems are integrated in a site-wide network among different plants and utilities and buildings, and with IT. Data can be automatically transmitted and web services are implemented."

"How did we get here?" Kavanaugh asked. "There were three basic paths open to us. We could maintain our older MOD and Process Portal systems. If we did that, we would have no capital expenditures, no additional training and no problems with operator familiarity. But we would also have higher maintenance costs, an inability to meet new strategic functionalities, and we'd face ever scarcer and ever higher-priced spare parts.

"Or we could gut the existing systems and do a 'rip and replace.' That would give us the functionality we needed, ensure longevity of systems and software, and the lower maintenance costs associated with new systems. But we would also have production downtime, large capital costs and increased training requirements."



"Efficiency and flexibility are now strategic requirements for plant automation," Bayer Healthcare's David Kavanaugh discussed the company's continuous evolution of automation capabilities using ABB technology.



Kavanaugh said that Bayer chose the third path. “We chose to evolve,” he said. “This gave us new features, more flexibility and less time pressure. We think it was a good trade.”

What does evolution look like? Changes are occurring through concurrent multiple projects: MES, DCS upgrades, batch implementation and others, as Bayer staff learn the new skills required for new technologies. Bayer is adding new functionalities to its systems (connections to other systems, remote desktop, advanced control, etc.), making hardware and software changes standardized across systems, and learning to partner with internal and external suppliers.

“We are producing a new, site-wide automation platform that will integrate all the existing DCS systems,” Kavanaugh said. “Upgrading to the latest 800xA version will allow that integration. We’re integrating our systems to MES for electronic batch records, based on the ISA95 standard. We will add new, small, scalable controllers (ABB’s 800M) for on-skid installation while using existing controllers and logic for the remainder of the plant.”

A flexible integration connector will also allow future integration with other plant information and control systems. “We’re implementing open-standard automation interfaces, including OPC and fieldbus, to be less dependent on a single vendor and to be ready for PAT integration,” Kavanaugh said.

The introduction of ISA88 batch technology will prepare Berkeley to become a multiple-products site through flexible-control recipe management. Plus, the use of object-based development with reusable library objects from the Bayer Standard Libraries will allow streamlined implementation and validation, and will simplify system documentation.

A funny thing happened along the way, Kavanaugh noted. “We now use standard IT hardware and software [for our automation platform],” he said. “We need the same services as IT: anti-virus, operating system patches, application patches, performance monitoring and so on. We talk the same talk: TCP/IP, firewall, switches, routes and permissions.”

Because of this commonality between the process control system and IT worlds, the process folks found they must follow IT’s rules—and it hasn’t always gone smoothly. “They understand Windows,” Kavanaugh said, “but they may not know process control and its special requirements.”

“The IT department said they can provide on-call coverage,” Kavanaugh explained. “But when we investigated the on-call procedure, we found that the best response time available was four hours. Escalation procedures and support costs also were issues.

“We are working on training the IT department on control system technology and the engineering department on IT. We’re supplementing IT support with engineering on-call support and have established service level agreements (SLAs) that specifically outline responsibilities and the escalation of issues. We’ve purchased warranties from vendors for onsite support, again with well-defined SLAs.”

What’s next for Bayer Berkeley? Kavanaugh said that there would be continued evolution of the control system platform for flexibility and connectivity. “We’re investigating the virtualization of process control systems and a new site-wide historian. We’re looking at new operator interfaces and technology like tablets, PDAs, smart phones and cellular. We want to look at remote connectivity and access through web-based applications. And we want an even tighter integration between the process control and IT groups.” ■



# PEOPLE ISSUES, POLICY UNCERTAINTIES HEADLINE POWER INDUSTRY CONCERNS

Panelists Agree: Whatever Keeps You Up at Night,  
What Really Matters Is What You Do About It

by Walt Boyes, Editor-in-Chief of *Control*

When asked what business worries keep them up at night, a panel of power industry executives at ABB Automation & Power World this week in Houston responded with a range of predictable concerns, from the aging workforce to worker safety, from cybersecurity to the nonexistent U.S. federal energy policy. All agreed, however, that what you were worried about didn't matter as much as what you did about it.

The panel discussion was moderated by Allen Burdett, ABB's senior vice president for business development, and included Mike Heyeck, senior vice president for transmission at AEP, Paul Wyman, general manager, smart grid solutions for Lockheed Martin, and Ron May, senior vice president of DTE Energy.

"What is most important in any company is people," said AEP's Heyeck. "We have in our company the same kind of human performance initiative that the nuclear power industry has. We've been working on the issue of the aging workforce for fifteen years, with a co-op program for young engineering students. We've found that the key to the program is that you have to hire them...otherwise you and your company are poison at that school."

Lockheed Martin's Paul Wyman agreed. "Our primary customer is the federal government, and we are often sending people into harm's way. We have to make sure that we provide the backup and in-country service and support that will keep them safe. We just did an early retirement program, and 600 of our older workers left. This allowed us to make room for younger people to be promoted. We also do co-op, as well as an engineering leadership program, and we support STEM education projects as much as we can."

Ron May from DTE Energy said, "DTE as Detroit Edison has been around 100 years, and our Michigan Gas subsidiary has been around 150 years. All of our ongoing activities are generated by the employees that we have. Programs are in place to train and maintain our workforce. "For example," he said, "in 2009 we weren't laying off, even when General Motors was in bankruptcy. Our people are an asset. Our safety rating is an OSHA-recordable 0.7, where the general construction industry for example is 5.0, and where the nuclear industry is 0.1. Basically we are doing very well, but not as well as we want to be on safety."

ABB's Burdett quoted a lobbyist friend of



"This is not a problem; it is an opportunity." AEP's Mike Heyeck discussed the resurgence of energy decision-making at the state level in the United States in the absence of a coherent federal energy policy.



his saying, “In my 40 years as a lobbyist inside the beltway, this is the most dysfunctional government I have ever seen.” Burdett pointed to a lack of a national energy policy as an example.

Ron May responded that no cogent energy policy hurts long term investment. “We don’t know what long term policy will be, so we don’t know what to invest in,” he said. “We need decisions on oil policy, nuclear policy and grid investment.”

Heyeck agreed, “But as Joe Hogan said in his keynote this morning, this is not a problem; it is an opportunity. We have all-time record coal exports. We have good penetration in most states for renewables. The states have taken charge of setting energy policy. I don’t think we are as dysfunctional as your friend thinks. I am a student of history, and when you think back to the Jackson v. Adams campaign, and the others, it isn’t any more dysfunctional than it was back then—we just hear about it 24/7 from the media. Texas is an example of what you can do when regulatory agencies and requirements are pared down. They wanted many gigawatts of wind power, and they went out and did it. This is an example of government not being dysfunctional.”

“We support any regulatory climate,” Paul Wyman interjected, “that exists. Our customers drive our investment decisions. If we wait for the federal government to make policy before we make investments, we’d never get anything done.”

“What about NERC (National Electrical Reliability Corporation)?” Burdett asked.

Heyeck responded, “Reliability is in our blood at AEP. Conceptually, the NERC CIPs are okay, but they are way too prescriptive. If NERC becomes more like the nuclear

industry, we may have an asset here, but we are early in the process. Ron May agreed. “We don’t have a transmission company at DTE, but we all have a sense of urgency toward the CIPs and other reliability requirements. What we need is an even-handed smart mechanism for ensuring reliability.”

“What about cybersecurity?” Burdett asked. “You are all high value targets.”

“Oh, we get attacked,” Wyman said. “Over 400 times a day. But what’s significant? We have to create systems and tools that can filter threats that don’t matter and concentrate on those that do. We are confidentially threat-sharing with 17 utilities including AEP, with NIST and with NERC. But as far as the CIPs are concerned, we have to remember that compliance does not always equal improved security.”

May agreed. “We get attacked all the time. Cyber- and physical security are very important, especially in our nuclear plants.”

“This is a continuing battle,” Heyeck said. “We have to watch out for control systems, and the government has to talk to us in a quicker way. The more reliant we become on technology, the more we have to design new mechanisms against cyber attacks, solar storms and whatever. We can’t stand still.”

“What keeps me up at night?” Heyeck said. “Nothing. It is all about what you’re doing about it.” Wyman agreed. “Mitigation strategy is critical,” he said.

“For me,” Ron May said, “dealing with what keeps me up at night is all wrapped around what we do about it. The drivers are customer satisfaction and customer service and how to keep making it better.” ■



# THE CHALLENGE OF A MULTIGENERATIONAL WORKFORCE

Commitment, Leadership, Respect Help Generations Find Common Ground, Communicate, Collaborate

by Jim Montague, Executive Editor of *Control*, *Control Design* and *Industrial Networking*

**B**ridging generation gaps is never easy. But doing it successfully is increasingly crucial for multigenerational teams of engineers, technicians and other industrial professionals.

"Some of the latest research indicates that electric utilities worldwide are expecting to lose 40% of their staff to retirement by 2015, and the process industries are only two or three years behind us," said Dirk Hughes, director of Luminant Academy. "As a result, we had to become more aggressive in attracting, training and retaining new employees. We're looking at ways to bring in Generation Y, but only 3% of high school graduates say they want to work in power or petrochemical facilities because we're seen as companies where workers shovel coal. We have a branding problem to overcome. The question is how can we convince young adults that we can be their employer?"

To provide some of these vital communication tools, Hughes and two other experts presented the session, "Innovations in Human Capital; Motivating and Managing a Four-Generation Workforce," this week at ABB Automation and Power World 2012 in Houston. The presentations were moderated by Bill Strohecker, vice president

of strategic utility accounts in ABB's U.S. Power Sales division. The trio included:

- Hughes, of Luminant Academy, which reaches out to schools and colleges, presents scholarships and recruits students to work at one of Texas' largest power providers;
- Terry Taylor, president of Global Genesis, a staffing consultant that helps companies develop their workforces; and
- Diana Oreck, vice president of the Leadership Center for the Ritz-Carlton Hotel Co.

To connect its power generation and distribution facilities to their local education systems and craft a pipeline for securing new employees, Hughes reported that Luminant developed a \$10,000 scholarship program for an 18-month or two-year associate degree program for high school seniors. This program supports the students' technical education, but it also gives them the practical experience of working in Luminant's facilities for two summers and holidays, which better prepares them to work in the power plants later.

"One of the most important parts of an educational outreach program like this is committing at least some staff to it full-time," said



"We jazz up all our generations by promising that they'll be working in an environment of respect and trust." Ritz-Carlton's Diana Oreck discussed the importance of a well-understood company culture in encouraging cross-generational collaboration.



Hughes. "You can't have someone just add a little outreach to his or her regular tasks and expect this to work." In fact, Luminant hired an educational outreach manager, who is required to spend 75% of the time away from the office visiting schools and junior colleges.

"We've also worked on branding to try fixing young people's image of power plants as places where their grandfathers used to work, and we've also made our websites a lot more kid-friendly," added Hughes. "We found it was important to meet young people's preference for working within about 40 to 50 miles of where they grew up, because if they got training and experience further away, then they would often move back later. Consequently, we started recruiting within 40 to 50 miles of our plants for positions at those facilities. Now they can earn an associates degree and go to work earning \$60,000 per year."

Hughes reported that 31 students have already completed the first year of Luminant Academy's program, another 43 students were just awarded scholarships at Texas State Technical College, and the program's first graduates will go to work in May 2013.

When you add recent high school graduates to the mix, many organizations today employ a mix of four generations of individuals, each of which has been shaped by shared life experiences, explained Terry Taylor of Global Genesis. The present four-generation workforce consists primarily of:

- Traditionalists, born before 1945, faced the Great Depression and World War II, and are hardworking, stable, detail-oriented and thorough, but are hesitant to disagree or buck the system and are less comfortable with new technologies;
- Baby Boomers, born 1945-65, grew up with economic prosperity, civil rights struggles, the Vietnam War and Watergate, and are knowledgeable, experienced, service-oriented and have a team

perspective, but have less respect for governments and institutions, often have a harder time balancing work and family, and also are reluctant to go against peers;

- Generation X, born 1965-80: are latch-key kids that faced divorce rates triple those of earlier generations, and so developed independence, resilience and adaptability to the growing technological explosion, but also are skeptical and distrustful of authority. They're also devoted to balancing work and family and demand flexible work environments.
- Generation Y, born after 1980, were raised in the most child-centric era in history and are the first completely technologically savvy generation. They're optimistic, able to multitask, driven to learn and respectful when communicating, but they also need supervision and mentoring about people, and they often reject the concept of paying dues.

Taylor explained it's crucial to pay attention and address the very different perceptions of work and life that characterize each generation. "When working with on multigenerational team you have to ask yourself: 'How do you know what you notice is true? Or is it maybe just a perception?' Different generations perceive and act differently," explained Taylor. "The core values of all these generations—family, home, success and stability—are usually the same, but the way they act and handle them is different, and this is reflected in their teams."

Taylor added that key strategies for managing multigeneration teams include:

- Respect and accommodate difference when practical and possible, but don't be trapped by them.
- Balance generational differences by respecting commonalities.
- Be aware of team members' personal generational

patterns and biases and keep them from getting in the way of supporting team members.

- Establish team rules that help guide cross-generational interactions and try to acknowledge and understand those differences.
- Match team challenges and tasks to members with the appropriate mix of abilities and experience.
- Develop and manage multi-mode means of communications.
- Develop each team member's understanding of the work styles of members from other generations and how they define respect, feeling valued and motivated.

Finally, Diana Oreck reported that Ritz-Carlton provides "legendary service" by creating and reinforcing—in short, through daily meetings—a culture that empowers its staff to routinely go out of their way to serve their guests. "Our staff are self-directed to surprise and delight our guests," said Oreck. "This comes from consistency that creates trust in our staff and in our guests, and the crucial role of our leadership in service excellence. Our motto is that 'We're ladies and gentlemen serving ladies and gentlemen.' It just becomes part of every generation working at Ritz-Carlton and who they are. Every team and organization needs to articulate its culture because it's your moral compass."

Ritz-Carlton also encourages its staff to anticipate and fulfill their guests' unexpressed wishes by having their "radar on and antennas up," and generally keeping their mind off autopilot. "We jazz up all our generations by promising that they'll be working in an environment of respect and trust, and who wouldn't want to work in place like that? We also emphasize, not just functions of their tasks, such as cleaning a room, but also the purpose of each job, which is to create a caring home away from home." ■



# VIRTUALIZED COMPUTING AIDS PROCESS VISUALIZATION

There's More than One Way to Display Graphics on a Remote Screen, and Not All Are Created Equal

by Jim Montague, Executive Editor of *Control*, *Control Design* and *Industrial Networking*

**V**irtualization, in which application and operating system software are essentially abstracted from the computer hardware on which they run, is a well-established practice in the world of IT. But now the discipline is being applied to process control and automation systems—even control room operator stations and collaborative displays.

A guided tour of this increasingly virtualized world, encompassing everything from thin clients to bus extenders, was conducted by Katrin Kerber, account manager at Matrox Electronic Systems, in her presentation, “Combining Workstation Virtualization with Control Room Process Visualization and Collaboration,” this week at ABB Automation & Power World 2012 in Houston.

“Virtualization is one concept of separating the host from the operator interface by using bus extension technologies, KVM-extender solutions, virtualization-over-IP, and compression/decompression technologies,” said Kerber.

The oldest of these separation technologies is thin computing, which joins a host computer to a client appliance via TCP/IP communications. “Its communication protocols are responsible for separating appli-

cation logic from user interfaces, and only key strokes, mouse movements and screen updates travel network to the server,” said Kerber. “But the latency caused by its separation means it can’t function in real time.”

More recently, virtualized computing over IP has provided a more modern approach to thin-client computing. “It’s easier to deploy and more powerful. It has more intelligent software, and it’s made big steps overcoming challenges in network latency,” added Kerber. “And there are new software solutions on the market that accelerate its standard protocols and reduce packet losses, but performance is still not real-time.”

I/O compression/decompression methods also link a host to a client via TCP/IP, but use algorithms to compress graphics from the host system and extend them. “There are limits to resolution and performance, depending on assured network bandwidth. For example, using multiple monitors at high resolution requires significantly more assured network bandwidth,” explained Kerber. “I/O compression schemes are proprietary architectures, requiring back-end and front-end equipment from the same manufacturers. And compression necessarily implies manipulation of pixel data, even



“Bus extension is the most reliable and robust virtualization method.” Matrox’s Katrin Kerber discussed alternative technologies for driving remote-control room displays. Network latency is a key factor.



though most of these algorithms claim to be mathematically 'lossless.' "

Meanwhile, keyboard, video and mouse (KVM) extenders describe a range of black boxes that alter the basic host/client arrangement by instead going from the host through a KVM transmitter unit via an analog Cat 5 or fiber-optic extension cable to a KVM receiver that exposes display and I/O data to operators. "In this case, a display compression scheme takes rendered outputs of graphics data and combines them with an I/O extension mechanism for keyboard and mouse," added Kerber. "This necessarily implies manipulation of pixel data with a strong potential of affecting display quality. Also, I/O extensions for keyboard and mouse are limited by their native protocols, which can involve latency over longer distance. And asymmetric graphics quality and performance can occur, depending on what equipment

is contained in the main workstation."

Likewise, bus extenders go from a host computer through a hardware bus transmitter card via a digital extension medium like fiber-optic cable to a client appliance that again exposes the display and I/O data to operators. "Extenders such as PCI or PCI-Express bus are serialized to an appliance, and only bus commands are transferred over the link. This renders uncompressed graphics locally on the operator's appliance," said Kerber.

"Bus extenders have a finite transmission distance, but usually it is adequate. Also, the computing session requires the link between the appliance on the operator side and the main system in the computer room to be available at all times," said Kerber. "But in general, bus extension is the most reliable and robust virtualization method, and it provides true real-time performance because the bus itself is communicating with the display." ■



# MANAGERS INNOVATE TO KEEP LARGE PROJECTS ON TIME, BUDGET

Compressed Timelines Require Communication, Collaboration and Flexibility

by Aaron Hand, Managing Editor of *Control Design* and *Industrial Networking*

When managing a large, complex project, it's all about the pre-planning. It's also all about managing the schedule. And it's about being flexible when your schedule gets derailed. And teamwork. And communication. OK, let's face it: To manage large, complex projects, you have to be ready for just about anything.

Two presenters Thursday morning at ABB Automation & Power World detailed their management experiences on projects that include some of the largest wind energy sites in the world, major solar installations and an ambitious new energy transmission line. The bottom line in most cases is to expect the unexpected and be prepared for anything and everything.

Bob Venturin, senior project manager for the Renewable Energy Group at Mortenson Construction in Minneapolis, detailed the steps he must take to mitigate creeping costs. The project development phase, he noted, includes exhaustive preparations on the front end to mitigate costs in right of way (ROW), permits, engineering, procurement, environmental constraints and scheduling. Massive amounts of up-front details help prepare the teams for transportation

difficulties, seasonal weather conditions, commodity fluctuations, unforeseen geotechnical issues, labor availability concerns, impacts on migratory birds and other wild animals, and much more.

San Diego Gas & Electric (SDG&E) faced considerable licensing and regulatory constraints to create the Sunrise Powerlink. A formidable project nearing completion, it's a 117-mile transmission line that SDG&E is building to carry 1000 MW of power from California's Imperial Valley to San Diego County. The environmental impact report (EIR) alone entailed some 11,000 pages, noted Patrick Lee, vice president of Sunrise Powerlink.

For his presentation, Lee focused on many of the time constraints and schedule setbacks he and his team have faced. The project has a completion date of June 2012—a date that has never changed despite delays in getting the approvals that had to come before construction could even begin. After getting the approvals from the Bureau of Land Management (BLM) and California Public Utilities Commission (CPUC), the project continued to wait for approval to come from the U.S. Forest Service (USFS), ultimately shortening the construction window from 24 months to 17 to 18 months, Lee said.



"There's always some opportunity that you can find." Sunrise Powerlink's Patrick Lee stressed the importance of flexibility and creativity in dealing with inevitable project setbacks.



Lee also faced major logistics concerns when he learned that the 20% of the towers that would require aerial construction (with helicopters) turned into 55% of the towers overnight. It created several new demands not only in helicopter scheduling, but also in the weights the helicopters could handle as opposed to land-based cranes, and providing places for the helicopters to land.

While detailing their seemingly endless project constraints and requirements, both Venturin and Lee pointed to their reliance on project management software tools that help estimate costs, model logistics, detect and resolve conflicts, and more. Venturin mentioned in particular model-based estimating and model site logistics capabilities, and 4D scheduling through Primavera. “That’s something new we’re doing,” Venturin said. “We can see things a lot easier that might be conflicts.”

With the time constraints he’s faced, Lee said that everything on the Sunrise project operates just-in-time. “Wherever we can work, we start working.” He has relied heavily on software management tools that enable him to stay up-to-date on every aspect of the project, including Primavera software for contract management and McDonnell’s One-TouchPM system to get multi-layered information about the route and other project efforts. Lee gets daily dashboards and reports that he can even push out to his iPad.

Lee and Venturin also noted how important it was to create

a collaborative environment; to create project teams that really understand everything that must be done and communicate effectively. “It takes the collaborative effort of the whole team to meet a compressed schedule,” Venturin said. Both men commented on the importance of accountability for the separate teams and managers.

Although changes in dates and other roadblocks could easily add cost to the process, Lee noted that there’s a flipside to that as well. “Looking at all these roadblocks, for each category of cost, you can look at the risk or you can look at the opportunity in each area,” he said. “There’s always some opportunity that you can find—some expenses increase, and some expenses decrease.”

Addressing a key discussion point from a session earlier in the week, Lee and Venturin talked about how they manage and motivate a four-generation workforce. “For us, we actually inserted a number of new engineers in the team,” Lee said. “I don’t want quality only; I want value.” That included even bringing back retirees to train the younger engineers, who were rotated through different aspects of the project to help keep them motivated.

“We do a lot of cross-training,” Venturin said, describing also how engineers would be cycled through activities on-site to keep them interested. Mortensen also brings retirees in as consultants in the office and out in the field. “We’re trying to get more information out of the retirees,” he added. ■



# PROCESS SAFETY AND SUSTAINABILITY ARE A TWO-WAY STREET

Effective Personal Safety, Process Safety and Asset Integrity Programs Can All Contribute to Sustainability Improvements

by Jim Montague, Executive Editor of *Control*, *Control Design* and *Industrial Networking*

Everyone is waking up to the fact that process safety and mechanical integrity are costs that can pay back big dividends in decreased downtime and improved efficiency in many applications. But what's less well-known is that investing in safety can also contribute to operational and process sustainability.

In short, safety is green. And, conversely, focusing on sustainability issues can even help improve process safety and mechanical integrity, according to Rob Smith, senior consultant and business development manager for process safety and integrity management services at ABB Consulting.

"Traditionally, personal safety focused on the actions of individuals, their awareness, culture, training, inspections and other factors that could affect them," said Smith. "However, process safety management (PSM) is based on OSHA's 1910.119 standard and focuses more on how an individual or application could affect anyone in the area or beyond. PSM covers normal and abnormal operations and their effects both on-site and off-site. Meanwhile, asset integrity management concentrates on design, overall operations, maintenance, inspections and other issues.

"Consequently, there's always been a lot of overlap between personal safety, PSM and asset integrity, but there also have been walls between them. So we want them to relate better and overlap in more helpful ways. People are the common element, of course, and we seek to align and optimize people, processes and plants for their best performance and increased sustainability."

Smith presented "The Impact of Safety, Process Safety and Mechanical Integrity on Sustainability" this week at the ABB Automation & Power World 2012 conference in Houston, Texas. ABB Consulting is an international technical and management consultancy focused on oil and gas, chemical, pharmaceutical and other process applications. Its North American division was formed just over a year ago in 2011, but its 500 employees have been part of ABB Group for about 12 years. ABB Consulting's core organization was part of ICI Engineering Services for many decades.

So what's located at the overlapping point between personal safety, PSM and asset integrity? Smith reports that it is

- Process safety leadership and culture,
- Safe work practices and procedures,
- Operating procedures and practices,



"The lesson is to not let misperceptions fool you." ABB Consulting's Rob Smith advises companies on how to sustain complementary personal safety, process safety and asset integrity efforts.



- Management of change (MOC),
- Audit and review of regulatory compliance,
- Emergency response and preparedness,
- Process hazard analysis (PHA) and review,
- Management of organizational change (MOOC),
- Safe systems of work,
- Alarm management,
- Safety integrity level/layers of protection analysis (SIL/LOPA),
- Human factors.

Smith explained that occupational safety can be thought of as analogous to dog bites, which don't seem very serious, but kill about 35 people in the United States per year. However, mechanical integrity is more like snake bites, which appear to be more serious, but only cause 15 deaths in the United States per year. Meanwhile, process safety is embodied by a black bear in a cage, which is fearsome, but typically only results in two or three deaths per year.

"The lesson is to not let misperceptions fool you," explained Smith. "When evaluating safety and implementing solutions, you don't want to just focus on easy-to-spot items that aren't very dangerous, but miss routine items that could

be far more hazardous. Many users and managers concentrate their safety efforts on mitigating frequent, low-severity events, but neglect to deal with hairy, complex problems that are more difficult and costly to solve. More recent calls to adopt sustainability practices could help users refocus on the need to address safety issues too."

As a result, Smith advises that a more sustainable safety environment can be created by:

- Defining a thorough risk profile;
- Developing well-defined plans for safety, process safety and asset integrity management;
- Involving everyone in your organization from the board room to the lunch room;
- Determining key leading and lagging measures for your business.

"Safety and sustainability are both tied to the vision of the organization," concluded Smith. "So you have to know where you're at, define where you want to be, secure an executive champion and think five to 25 years into the future to accomplish a truly sustainable solution that exists in a bigger context. Likewise, safety can improve efficiency and establish a safer environment, and this will improve throughput and profit too." ■



# UNPROTECTED CONTROL SYSTEMS ARE EASY PICKINGS

Lagging IT Practices, Lack of Rigorous Testing Make SCADA, Industrial Control Systems and PLCs “Low-Hanging Fruit” for Hackers. Smart Phones and Tablets Could Be Next

by Walt Boyes, Editor-in-Chief of *Control*

Wielding a relatively simple piece of code, Jonathan Pollet reached through cyber space into an industrial plant and disabled its emergency shutdown system and changed the states of individual tags at will. Fortunately, the plant in question was hypothetical, but the all-too-real demonstration drove home for attendees of Pollet’s cybersecurity presentation at this week’s ABB Automation & Power World just how vulnerable industrial control systems can be to cyber attack.

Industrial control systems and supervisory control and data acquisition (SCADA) systems are low-hanging fruit for hackers, said Pollet, who is founder and principal consultant for Red Tiger Security, in part because they do not go through the same rigorous security testing that commercial IT systems do.

“On average, Microsoft will put its software through 100,000 various fuzzing loops and debugging processes to test for crashes and bugs—yet we still find plenty of Microsoft vulnerabilities being discovered and reported,” said Pollet. And because industrial control practices typically lag IT practices by five to 10 years, control system suppliers have only recently begun testing their products for security flaws, Pollet said. “Thousands of legacy products out there were never tested for simple cybersecurity flaws like buffer overflows.”

Further, Pollet pointed out, there now exists a market in control systems exploits, where hackers can simply buy a way to attack a control system. In March 2011, Luigi

Auriemma, an Italian security analyst (read “hacker”) released 34 SCADA system vulnerabilities all at once, followed by another release in September 2011 of another bundle of exploits and vulnerabilities of six more industrial control systems.

Another example discussed by Pollet is “Project Basecamp,” an attempt by an irate and frustrated Dale Peterson of Digital Bond to embarrass SCADA and control system vendors into fixing vulnerabilities that have been known for years. Peterson’s team focused on six major programmable logic controller platforms and discovered “backdoors, weak credential storage, the ability to change ladder logic and firmware,” and much more.

And the next threat to control system security may come through a smart phone or tablet, Pollet predicts. As mobile devices proliferate in the plant environment, hackers will attempt to access control systems using these mobile devices. The potential pathway is clear: In several instances, he’s found a smart phone plugged directly into a plant’s distributed control system console.

“The sky is not falling...yet,” Pollet concluded, citing the need for both end users and suppliers to do much more to secure their facilities. An array of protective technologies and defense-in-depth practices can “hold back the tide,” he said, encouraging his audience to get training, become informed and to establish policies and procedures that will help mitigate the risk of attack. ■



“Thousands of legacy products out there were never tested for simple cybersecurity flaws,” Red Tiger Security’s Pollet on the need for continued vigilance on the cybersecurity front.