

The background of the cover is a photograph of the MGM Macau building. The building's facade is composed of large, curved panels in shades of orange and blue, creating a dynamic, undulating pattern. In the lower-left foreground, a bronze statue of a woman in a long dress, holding a large hoop, stands prominently. The sky is a clear, pale blue.

THE AdvisorTM

Bringing Buildings To Life Since 1966TM

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a  publication

WELCOME



Dear JBA Clients, Fellow Colleagues and Industry Associates,

As we begin the Year of the Horse and look back at nearly 50 years of service, we want to thank all our clients around the world for an excellent 2013 and hope you are enjoying a prosperous 2014.

We have seen a lot of change in the markets we serve, buildings we engineer and services we offer since we started in 1966. Reflecting on our past and the amazing projects and partnerships we have been involved with, we have repeatedly asked ourselves "How can we be better advisors?" This question reinforces our belief that our company needs to continually evolve to better serve our clients.

In 2003 JBA set a course to become Worldwide Trusted Advisors™ and to help our clients realize their goals by bringing their buildings to life. Building on our extensive MEP business, we added expertise in technology, acoustics, security and surveillance and expanded our fire protection group to better meet our client's needs. Yet in time we recognized that our commitment to each project far exceeded the date of completion so we focused more on services and innovations that would take us full circle.

In response, we coined the term "JBA360" to encompass ways we might help our clients maximize their investments throughout their buildings' lifecycles. We looked at ways to improve workflows, manage sustainability and provide in-depth technology consulting services. Fulfilling this vision would involve some crucial changes in our culture and the services that we offer. JBA360™ would continue to encompass world class engineering, but add CIO and technology consulting, energy services and resources to streamline facility management.

We began in 2012 by providing CIO and technology consulting services for the new Grand Resort and Casino in Vietnam. This investment would give JBA the ability to deliver technology services to our clients during the development and hiring stages effectively reducing the risk associated with committing to platforms prior to the CIO and CTO being hired.

In June of 2013 we made a strategic investment in Energenz™, a sustainability consulting firm. This partnership would enable JBA to offer a complete range of energy services. Now we can not only engineer world class sustainability projects, but also help our new and existing clients measure, maintain and manage their facilities to maximize their savings while minimizing their carbon footprint.

Throughout 2013 we also worked to develop software applications to improve team collaboration, document management and workflow. In March, JBA will launch JBA360™, a cloud-based application giving facility and IT professionals the tools to better organize their drawings and documents, communicate with their teams and maximize workflow. This service along with world class engineering, CIO and technology consulting and energy services sets JBA on a path to realize its vision of becoming Worldwide Trusted Advisors™ and gives our clients the tools and services they need to bring their buildings to life in comprehensive new ways.

In this issue you'll learn more about Energenz™ and JBA360™ as well as read about some of the exciting projects we are working on around the world. We truly value you as a client and will continue to invest in our Advisors, services and tools to fulfill our goal of being Worldwide Trusted Advisors™.

Respectfully,

Jim Gist
CSMO, JBA Consulting Engineers

Jim Gist, an innovative, inspired and forward-thinking executive, joined JBA in 2011 as Chief Sales and Marketing Officer. Jim is responsible for integrating JBA's innovations, sustainability message and exemplary client service philosophy throughout the company worldwide. Jim can be reached at jim.gist@jbace.com

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THE
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EDITOR **Jim Gist**
DESIGN **JBA Marketing**

CORPORATE HEADQUARTERS

JBA Consulting Engineers
5155 W. Patrick Lane
Las Vegas, NV 89118
702.362.9200

www.jbace.com

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Las Vegas



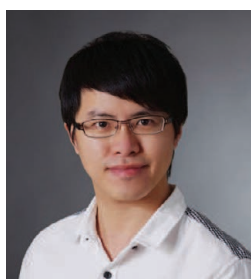
Cecilia Lo
Human Resource
Manager – Asia Pacific
Hong Kong



Jerry Ubisco
Drafter/CADD Operator
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Continuous Commissioning

ENERGY CONSULTING FIRM SAVES MGM
MACAU \$125,000 A MONTH IN POWER BILLS

A high efficiency design does not guarantee a high efficiency building.

That was certainly the case with the MGM Macau, a beautiful, 35-story casino resort that opened in southeastern China in December, 2007. As with many large projects, the owners assumed their engineering firm would give them the best and most efficient designs, but with the pressure of opening on time, energy consumption was not at the top of the list.

Still, according to Mel Hansen, Vice President of Property Operations, Planning and Projects at MGM Macau, it wasn't long before the resort began looking at ways to fine tune the building. Peter Chan, Director of Facilities Management, who joined the team two years after the property opened, explains that "by 2010, we knew there were opportunities for savings, so we brought in a team of specialists from Energenz Consulting to do an initial analysis and report."

Ben Heraud, CEO and Principal Energy Consultant at Energenz, says that some of the problems they uncovered were in the original design, others stemmed from the fact that the building was never properly commissioned, and some came from maintenance issues that cropped up since it had opened.

Perhaps the most obvious issues were with the building's air conditioning. "We have ten chillers on the roof, and during the summer all ten would run every day," Hansen explains. "Energenz initially looked at why that was the case – and with their help, on a very hot day, we are now running only four to five."

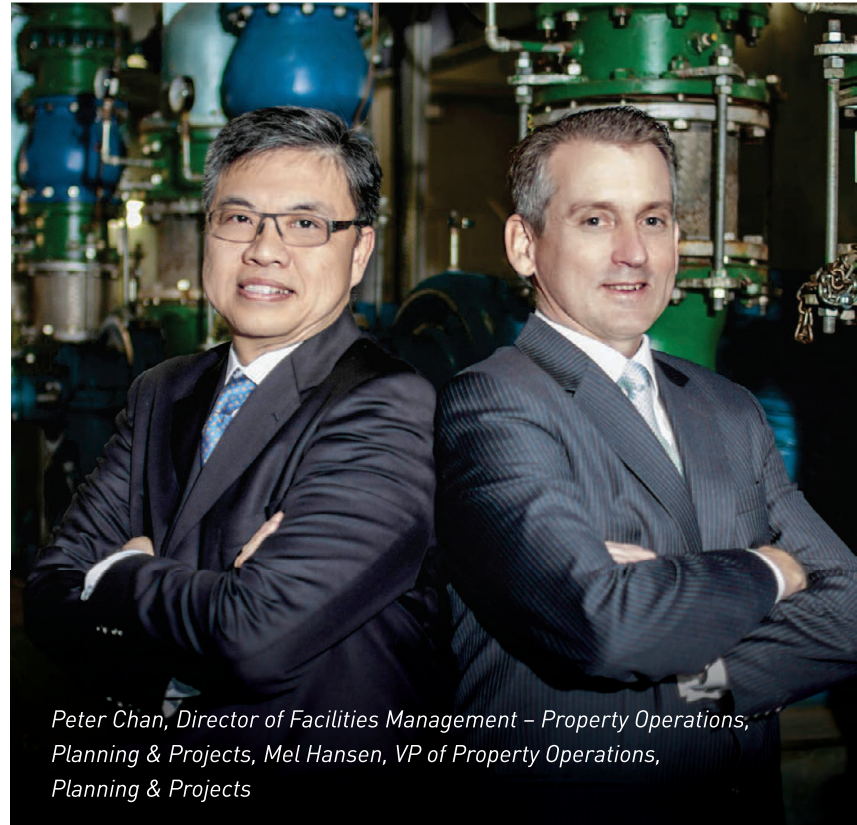
Cost Savings

According to Chan, one cause of the air conditioning problem was the use of single-speed motors in fans and pumps installed throughout the resort. For example, "even if there was no business in one of the restaurants, its exhaust fans had to run at full blast. The fans were accomplishing nothing but blowing out huge quantities of chilled air." Among Energenz' initial recommendations was the installation of variable speed drives for motors in heating, cooling and air handling systems throughout the property.

In addition, Chan explains, the Energenz/MGM team "studied the specific parameters of our cooling system. They then put those parameters into usable algorithms that would allow our chillers to run automatically at their highest efficiency." Is it better, for example, to have four chillers running at 90% of capacity or five at 72%? Ensuring that the overall system always runs at its optimum has been a significant source of savings.

A critical part of the initial report from Energenz was a detailed return on investment analysis of each recommendation. The firm is unusual in that one of the

partners, Gilbert Lennox-King, has a background not in engineering but in fiscal analysis. "Our financial people are very demanding," Hansen says, "but Gilbert speaks their language. They asked what would happen to the ROI if our energy costs went down instead of up, and he was able to show that these investments would be worthwhile in any likely scenario."



Peter Chan, Director of Facilities Management – Property Operations, Planning & Projects, Mel Hansen, VP of Property Operations, Planning & Projects

Chan says that every project with Energenz begins with a brainstorming session. "We suggest possible projects and they look first at whether they are technically feasible and second if the payback is attractive." One very positive part of the building's initial design was a power management system that takes input from more than 400 meters monitoring energy consumption. "We can look at each of our systems in detail, and get to the bottom of every area where consumption seems high," Chan reports. "Just as important, we can establish benchmarks for each system then use them to calculate the actual savings we achieve when we make a change."

With Lennox-King's help, MGM has continued to prioritize its investments to maximize ROI. It became obvious, for example, that replacing the onsite steam boilers with heat pumps would produce a positive return, despite the seemingly high initial capital costs.

Chan, with a background in MEP construction, came to the resort with a great deal of knowledge of installing building

automation systems. He challenged himself to optimize the system that had been put in his hands for the long term. "Ben not only brought us a lot of new ideas and new technologies, but he has trained us to take over the day to day monitoring and analysis of our building's systems." With that training, MGM technicians were recently able to pick up on the fact that two of their chillers had begun consuming about 20% more electricity than the others. "This is the true power of a building automation system," Heraud explains. "In a case like that, you could go months or even years without noticing a problem, since the units in most ways continued to function as they should."

The savings from all these changes has been immense: more than a million MOP (Macanese Patacas) each month, or more than \$1.5 million US dollars per year. That's roughly 10% of the energy costs for the entire property. "That figure is misleadingly low," Chan says. "When we opened the building, it was not fully occupied. In the last nine months

we have built out the unoccupied spaces, adding gaming areas and guest rooms. While those changes have counter balanced some of the savings, our net absolute consumption is about eight to ten percent less."

Sustainability

After three years of continually analyzing and monitoring energy use, Energenz is still finding ways to reduce consumption, yet certainly the biggest opportunities for savings have already been realized. Chan and Hansen have therefore asked them to shift their focus to sustainability, looking at water usage, waste and other important issues.

"We expect to save money in these areas," Chan says, "but there are moral considerations as well. For example, water in Macau is cheap, but in many areas of China clean water is simply not available. We have a responsibility to use this precious resource wisely."



Working together, Energenz and MGM staff recently completed a three-month audit of waste on the property. "The biggest surprise for me," Hansen says, "was the amount of food waste we uncovered. We are throwing away about eight tons of food every day, and that is certainly an area where we can do better."

The resort is also looking at the recycling of glass, paper and metal. In China, there are few recycling programs, so Energenz is looking for places that can use these materials. "One success so far," Hansen says, "is a local company that can take our glass and use it in the underlayment for asphalt roads."

In any environmental initiative, it's very important to win the support of upper management. Chan says MGM has been lucky to have the support of Hansen and CEO Grant Bowie, and their buy-in has followed naturally from the initial analysis and the savings gained from Energenz' work. He says, too, that employee support is crucial to the resort's ability to sustain these savings.

"On the one hand, many of the changes have had positive benefits for the staff," Chan says. "The chefs used to complain how cold the kitchens could be. With the changes we made in our air handling systems, they are now much more comfortable."

He also explains that the resort has entered a number of environmental competitions, and as they have won prizes, the staff have taken note and become much more interested in helping the efforts.

"We won the Macau Green Hotel award two years running," Hansen adds. "This kind of recognition gives the staff one more reason to be proud that they work for MGM."

Building the MGM Cotai

MGM management has also brought Energenz' expertise to bear in the engineering of a new MGM property to open on the Cotai Strip in Macau in 2016.

MGM Wins Macau Energy Saving Contest for the Second Year in a Row



Every year in Macau, the electricity provider CEM has a competition for the company that demonstrates the biggest gains in energy efficiency. MGM Macau has won this award two years in a row.

At the award ceremony, Director of Facilities Management at MGM Macau, Peter Chan, shared his company's experience in energy saving. He said that MGM Macau won the award again because they further deepened their energy savings program. "As initial gains in energy efficiency are realized, it becomes progressively more challenging to continue to demonstrate savings". Runners up in the competition were City of Dreams and Hotel Royal.



Peter Chan receiving the CEM Award for energy savings.

"Given all that we've learned, we didn't want the same mistakes made at the new resort," Hansen says. To help achieve better results, MGM brought in a new engineering firm with a great deal of experience in the hospitality industry, JBA Consulting Engineers. Then they put JBA together with Energenz.

"From their first meeting, we could see they were all talking the same language," Hansen says. "The information Ben had on hand was exactly what JBA needed."

Heraud adds that, "Normally in a project of this size, the engineering firm has to create models of heating and cooling loads, electrical consumption and water use. Here we were able to provide historical data showing the exact levels of consumption, greatly diminishing the need to overdesign to compensate for potential errors in the models."

Energenz' experience with various Asian markets has also been very helpful, Hansen adds. "For example, we can experience brownouts 20-30 times a day in Macau. Ben's knowledge of the problem has allowed JBA to put the solutions we need in place to protect our business and our electronics much more thoroughly than they had been in the original resort."

The relationship has prospered, with JBA buying a significant equity stake in Energenz last April. As partners, the two companies have much to gain. JBA, with Energenz' help, can design better, more efficient, more sustainable buildings, bringing their engineering services to a new level. Energenz, with JBA's help, can provide a smoother continuous commissioning process, maximizing the gains over the long term.

It's a win-win for MGM and any building owner interested in more cost-effective, profitable operations. ▣

One of the coolest features of the building automation systems JBA designs is the ability to 'continuously commission' electrical, HVAC, lighting and water systems. By doing so, our clients can significantly decrease costs and improve sustainability on an ongoing basis.

That's a great advantage, but getting the most out of these systems can go beyond the expertise of many facilities managers.

Meet Our Sustainability Partners

JBA INVESTS IN ENERGENZ TO ENERGIZE ITS' EXPANSION THROUGH CHINA

That's one reason why JBA has formed a strategic alliance with Energenz Consulting, a consulting firm founded specifically to help building owners optimize energy systems and set priorities for upgrades.

One of the company's founders, Ben Heraud, brings years of experience in energy management to his clients; the other, Gilbert Lennox-King, brings his years as a finance manager and consultant. Together the two are able to analyze data from the building systems simultaneously in engineering and financial terms, a winning combination for clients who want to improve their ROI.

"A lot of times a facilities manager will have a feeling that a particular improvement will be worth doing, but he's having a hard time justifying it to his company's senior management," Lennox-King explains. "We can give him the information he needs to understand the return on investment, get it approved, and then we can go back and measure the actual return."

The firm's practical experience with managing energy systems can also be very valuable in designing new systems. That's what brought Energenz together with JBA. "We had been working in the MGM Macau since 2011," Heraud recalls. "When JBA started on the system designs for MGM's new resort on the Cotai Strip, our client asked us to advise their engineers on the lessons we had learned from the existing site. JBA was also able to use our historical data in their designs, which is often more accurate than building computer models. *(continued on page 13)*





LESLIE FERNANDEZ

Senior Electrical Engineer
Las Vegas, NV

TURNING TRASH INTO TREASURE?





Q

Turning trash into treasure?

A

Trash. One of the most interesting sources of renewable energy and – at least at the Apex Regional Landfill north of Las Vegas – one of the cleanest.

A generating plant at the landfill is now producing enough electricity to power more than 6,000 homes. Unlike those using solar or wind, it's a base-load plant, available day and night, no matter what the weather conditions, so it can not only supplement coal or petroleum-based generating capacity but replace it.

Best of all, during the 200 years the generating plant is expected to operate, it will significantly reduce the amount of air pollution that the landfill would produce on its own and, given its biofuel basis, it has a carbon footprint of zero.

The engineering, procurement and construction contractor for the generating plant was DCO Energy of Mays Landing, New Jersey, which specializes in renewable energy projects. The electrical systems were designed by JBA Consulting Engineers and the mechanical systems by Concord Engineering of Voorhees Township, New Jersey. The plant is operated by CC Landfill Energy LLC, which is a wholly owned subsidiary of Energenic, a partnership between Marina Energy and DCO Energy. CCLE has a 20-year contract to supply electricity to the local utility, NV Energy.

Landfill Gas as a Fuel

The Apex Regional Landfill, one of the nation's largest, serves as the depository for all of the Las Vegas area's solid waste. "The operation has always been very smart," says Leslie Fernandez, Senior Electrical Engineer for JBA Consulting Engineers. "In very simple terms, they clear away rock for use in road and building construction, then fill those areas with trash, at the same time installing pipes and a vacuum system to vent the gas that's created as the trash decomposes. Now they're capturing that gas to burn in turbine generators."

Burning landfill gas is a little more complicated than burning other fuels. According to Matt Nyquist, a mechanical engineer at Concord Engineering, landfill gas is only about 50% methane, with the remainder consisting mostly of carbon dioxide and trace gasses including siloxanes (gaseous compounds of silicone and oxygen). "Landfill gas has a lot less energy than natural gas, and we need to do quite a bit of processing before we can utilize it in a combustion turbine," Nyquist explains.

The first step in the process is to pass the gas through a hydrogen sulfide removal process, then blowers are used to increase the gas pressure enough to pipe it about a mile from the landfill up to the generating plant. It next goes through a chiller skid to condense and remove moisture, then through a compression stage, a siloxane removal process, a carbon polisher to remove additional siloxanes (as needed), and then another compression stage to raise its pressure to about 270 psi. "We have 400 tons of air-cooled chillers on site to cool the combustion gas entering the turbine," Nyquest says. "That adds quite a bit of efficiency, especially in Nevada, since the denser the gas is, the more power you can get out of the turbine."

The Concord team specified the use of two 5.6 MW turbine generators, for a total generating capacity of 11.2 MW. Frank Skinner, Senior Project Manager for DCO Energy notes, however, that some of the electricity is used to power the plant and its associated processes. "In practice, our net output has ranged from about eight to nine megawatts at full load."

After the gas is combusted, it passes through a selective catalyst reduction system (or SCR), which combines nitrogen oxide in the exhaust gases with vaporized ammonia to produce nitrogen and water. Without this step, the NO_x would turn into nitric acid, the main ingredient of acid rain. Apex is one of just two landfill generating projects to include an SCR, making it one of the world's cleanest generating plants.

Tying Into the Electric Grid

Designing the electrical systems for a plant like this was no less complex. The JBA Trusted Advisors needed to handle the interface with the utility, provide electric power and operating controls for the turbines and gas handling processes, and design the electric lines and metering within the plant.

One challenge was simply the documentation required by the utility, NV Energy. JJ Wisdom, Senior Project Manager, Electrical Engineering for JBA says that "we had thousands of power and control wires that all had to be documented individually. I have spreadsheets that give each wire a name, note where it originates, where it's going to, and how it's routed." Given the number of utility customers who are dependent on the plant, operators need to be able to troubleshoot quickly and efficiently should there ever be a problem.

With the connection to NV Energy at 12,470 volts, safety is obviously a big concern. "We have a GSU (a generator substation unit transformer) in our switch yard to provide protection for the site so it can instantly and automatically disconnect from the grid," Fernandez explains. Without such protection, the possibility would exist that the plant could be damaged or destroyed without warning. "Let's say a car hits a utility pole and the lines come down. The current is running at 200 amps, but all of a sudden it can jump to

10,000. At 10 MW, that's probably 10,000 horsepower, not something you want surging back into your system."

Lightening protection was also a challenge. "The plant is sitting on what is essentially a big rock above the landfill," Wisdom notes. "We had to think very carefully about how we were going to handle grounding."

For the operating controls, the JBA team integrated an Allen Bradley SCADA system which provides process control and monitoring. They also provided a metering system to help monitor the generators and to measure the electrical output going to the utility. The design process was exacting, but it has paid off in flawless operation for the nearly two years since the generating plant was opened.

The only issue that DCO has seen, Skinner says, was some unevenness in the flow of the gas from the landfill itself, but that's normal in the startup of a plant of this type.



Selective catalytic reduction (SCR) are typically found on large gas turbines to reduce NO_x by 70-95%

He explains that DCO Energy has a history with JBA and felt they could count on the firm for this out-of-the ordinary project. "They were great," he says. "Les is brilliant, an unbelievable guy. We were very happy with the work that he and JJ did."

Skinner says that Apex is one of several landfill gas generating plants that DCO has developed. It's not a technology that can work everywhere. "There are several requirements for the landfill itself, the biggest being its size and the quantity of trash it contains to produce methane." For that reason, landfill generating plants tend to be on the east and west coasts near large population centers.

Still, the Apex plant and others like it are important pieces in a renewable energy puzzle that's helping to preserve petroleum while reducing greenhouse emissions.

"It really is a breathtaking operation" says Wisdom. "We were very pleased to be part of the process." ▢



We Organize. You Operate.™

FACILITY DRAWINGS AND DOCUMENTS ALWAYS AT YOUR FINGERTIPS

JBA360™ from JBA Consulting Engineers gives facilities managers and IT professionals instant access to building drawings and documentation using a mobile device.

Operating and maintaining a large building is not an easy task.

One of the biggest issues is that when a problem occurs, technicians and facility managers must often work blind, troubleshooting building systems without the use of drawings and documentation showing what has been installed. Yes, they usually have a full set of as-builts, conduit fills and other crucial drawings, but it can be very hard to find the right one when they need it – and of course the drawing is in the plan room rather than on the roof when the tech is up there ready to service a chiller.

Then, too, as-builts are rarely up to date. With a bit of a search, managers and technicians can generally find the right drawing, but after 10 years of modifications and repairs, it may have little relationship to what's actually on site.

JBA360™ is a cloud-based capture, storage and communications package that can dramatically increase the productivity of any facility management team. Its iPad interface connects team members to the information they need, when they need it anywhere in the facility. An Android version is currently in development.

Let's say you have a problem with the temperature in your auditorium. You send a technician out with an iPad in hand. The GPS in the iPad tracks his movements, so when he gets to the auditorium, JBA360™ automatically puts the documents related to the auditorium systems at his fingertips. He can instantly access drawings, cut sheets, pdf manuals and field notes for the HVAC system to help him solve the problem – and if he finds that a plumbing leak may be the cause, he can pull up the plumbing system quickly as well. He can also photograph the area and attach the images to an email or instant message, so he can get the advice of a plumbing tech or supplier while he is still on the spot.

The system dramatically improves efficiency by reducing the need to make multiple trips back and forth across the facility while putting all relevant drawings, notes and documentation into the technician's hands. As the technician completes the work, he or she can add notes, drawings and photos into the archive so that the records will be up to date the next time someone works with the auditorium systems. The team can easily access, edit, collaborate and share documents critical to the day-to-day operation of your facility.

Best of all, there's little or no capital outlay. JBA360™ is a low-cost cloud-based service always available to manage the never-ending flow of facility-related information.

Tools and Services

JBA360™ provides the cloud-based service and tablet interface that allows documents to follow each user throughout the workday. It's compatible today with the iPad; an Android version will be available soon.



360Share provides easy collaboration between team members.

360Sync and **360Pack-n-Go** provide automated synchronization between the cloud-based archive and the notes and edits each team member makes on his or her iPad. These applications are extremely helpful when working in an area where WiFi is not available. The technician can download needed documents in advance, attach notes, edits and photos and compose messages while on the work site, then the system will send and synchronize all when a WiFi connection is available.

360Capture provides a managed scanning and archiving service, to allow the team to input paper-based drawings and documents into the system. (JBA can also do the scanning instead.) 360Capture includes optical character recognition, capturing text to allow users to search the archive to find exactly what they are looking for.

360Communicate provides FAQs, directions and information on new features to users based on the questions users most frequently ask.

Everything is tied together using JBA's *intelligent pin technology*, which allows users to define the key areas of their facility on electronic floor plans and then pin drawings, documentation, equipment spec sheets, notes and photos to each of them.

The platform provides an ongoing reference to every system in the facility, constantly updated as changes are made. Since it preserves the original documents as well as changes and change history, it allows anyone to go back to a specific time and date and retrieve details on the work that was done. It also relates drawings, pins and systems to one another, simplifying planning when new infrastructure is needed. □

[Sustainable Partners continued from page 8]

A Tesla versus a Prius

This kind of expertise, and the benefits it offers clients, has allowed Heraud and Lennox-King to grow the company dramatically since its founding in 2009. Their clients tend to fall into two categories.

One group consists of companies with very large facilities, including MGM Resorts International and the Mandarin Oriental Hotel Group. These buildings may be painstakingly designed for maximum efficiency, but built on an accelerated schedule and not necessarily commissioned to their full capability. "Imagine owning a Tesla Roadster that runs like a Prius. It takes some expertise to tune it up and get it flying down the road the way it was designed to."

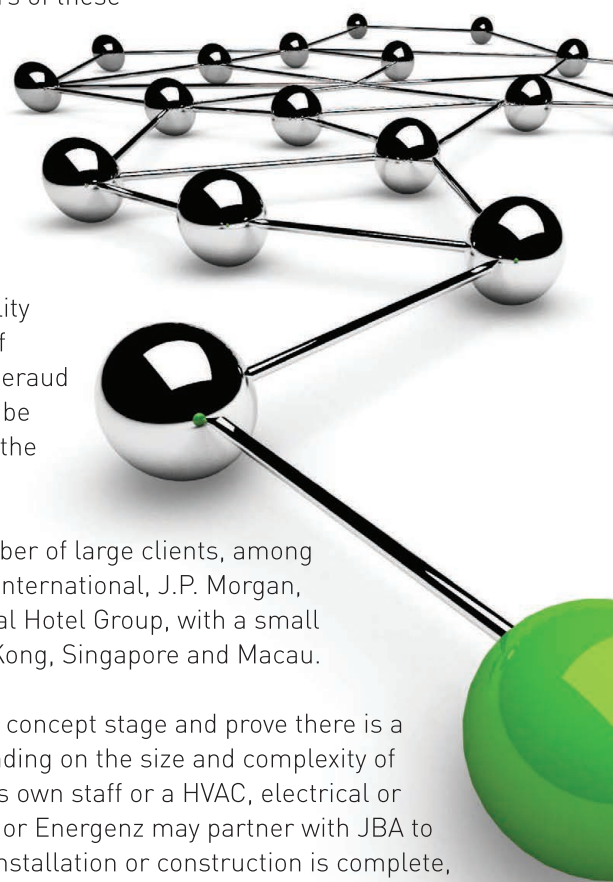
Another group consists of supply chain companies creating products for retailers like Walmart, Ikea and Marks & Spencer. One of these, the Li and Fung Group, has more than 15,000 small factories throughout China. "These clients often have extremely sophisticated manufacturing processes but may be housing them in very basic structures," Heraud explains. "Our challenge, on the one hand, is to understand and refine the efficiency of the manufacturing systems. Another challenge is to train the managers of these small sites to be more conscious of the way they operate their lighting and air conditioning systems, which normally have very simple controls."

As Energenz clients begin to get a better handle on their energy use, the firm encourages them to look at water use, waste management and other sustainability issues. "In a lot of cities, the availability of water is becoming an important issue," Heraud adds. "Our clients want their buildings to be sustainable from the resource as well as the financial point of view."

Today Energenz Consulting serves a number of large clients, among them Turner & Townsend, MGM Resorts International, J.P. Morgan, Siemens, Jabil Circuit and Intercontinental Hotel Group, with a small number of employees in offices in Hong Kong, Singapore and Macau.

The firm is able to develop a project to its concept stage and prove there is a worthwhile return on investment. Depending on the size and complexity of the needed change, the client may use his own staff or a HVAC, electrical or plumbing contractor for implementation, or Energenz may partner with JBA to provide detailed engineering. When the installation or construction is complete, Energenz will come back in, assist with commissioning and demonstrate the realized cost savings.

The partnership with JBA promises to keep the company growing rapidly. "Not only do we expect to integrate Energenz into many of our design projects, but we see the firm as enhancing our core MEP business by adding additional long term value for our clients," says Jim Gist, Chief Sales and Marketing Officer. "JBA will partner with the Energenz management team to further expand its roster of experts and provide their sustainability services to all of JBA's clients worldwide." □



GREEN GAMING

INNOVATIVE ELECTRICAL SYSTEMS HELP BALTIMORE HORSESHOE SAVE ENERGY AND MAINTAIN UNINTERRUPTED SERVICE DURING OUTAGES.



Something Big is Happening in Baltimore

The new Horseshoe Casino Baltimore, the centerpiece of a city revival project, is rising quickly. Crews have been working six days a week to meet an ambitious construction schedule.

The three story, \$400 million structure will include entertainment and restaurants as well as a poker room, 100 table games and 2,500 slot machines. It's expected to provide work for about 1700 direct employees and help revitalize Baltimore's sports and entertainment district south of the downtown area. "The city has aggressively supported this building, and they're expecting good things from its opening next summer," says JJ Wisdom, Senior Project Manager, Electrical Engineering at JBA Consulting Engineers.



*Brian Patalon,
Senior Mechanical Engineer*

With the City of Baltimore requiring a LEED Silver certification, the need for innovative electrical and mechanical systems was high. Wisdom says their design was the most challenging aspect of the project for JBA's Trusted Advisors.

Combined Heat and Power

When the 335,000 square foot building opens in July, 2014, it will include a two-story gaming floor, a multi-level bar, and a "Baltimore Marketplace" with locally-flavored restaurants and entertainment. There's also a third floor devoted to back of house support functions, a separate central services building and a seven-story garage.

Perhaps the most interesting of the behind-the-scenes systems is the innovative way the facility will handle emergency backup power.

Backup or emergency generators for any technology driven facility are configured to start upon loss of normal power and to serve the legally required emergency loads as well as any optional standby loads. If generators are configured to continuously provide some or all of the power for the facility, the time required to transfer the loads from the normal power service to the generators is no longer an issue. Configuring the generators to provide continuous power to the facility will also provide a usable source of heat in the form of engine exhaust and, in the case of reciprocating engines, jacket water. If this "waste heat" from the exhaust and water jacket can be captured and put to use elsewhere in the central plant, a significant savings in energy and dollars will be realized as well as a reduction in carbon footprint.

To accomplish this at the Baltimore Horseshoe, the JBA design team integrated a Combined Heat and Power (CHP) system designed by B & R Construction Services into the electrical and mechanical systems. Brian Patalon, Senior Mechanical Engineer, describes how this is done.

"Rather than wasting the heat from the generator, we use it in our building systems. In the summer, the heated water

passes through a heat exchanger to preheat hot water for the kitchens. In the winter months, it preheats water for the boilers." What that means in practice is that the Horseshoe will be able to keep its natural gas generators on standby 24/7 at close to zero energy cost, because they will recapture a majority of the otherwise wasted energy with their heating and domestic hot water systems.

Wisdom explains that the efficiency gain has changed the way Horseshoe management approaches backup power. "At the onset of the project ownership determined that the casino would provide generator backup power only to its most vital systems: emergency lighting, life safety and the data center. But with the addition of the 1.2MW CHP generator, they are backing up the slot machines as well, so that play can continue in the event of an outage." The casino not only saves money on energy, they increase revenue by staying open during power outages.

There are some additional innovations JBA incorporated to save on energy costs and to help qualify for the LEED Silver certification. Among them, a building automation system with central HVAC and lighting control, LED and florescent lighting throughout the facility, high-efficiency electric chillers for the air conditioning, and total energy heat recovery air handling systems. "Our plumbing department designed a storm water recovery system as well, with the water used to service toilets and irrigation," Patalon adds.

JBA provided all of the engineering services for the main and services buildings except code consulting—that is, mechanical, electrical, plumbing, security, telecommunications, audio visual, fire protection and fire alarm. JBA Trusted Advisors worked closely with architects KA Architecture of Cleveland, the Friedmutter Group, and the general contractor, Whiting-Turner.

With the opening planned for Summer 2014, anticipation is high. Baltimore television news and newspapers have been closely following the progress of this innovative facility. □

INNOVATIONS & MILESTONES

The **RIO** lights up the night sky in Las Vegas for the first time and JBA's team provided a long list of services including: MEP, Fire Protection, and Telecommunications to name a few.



The first SMS text message was sent. JBA's Trusted Advisors™ now utilize texting to stay connected with clients 24/7 world-wide.



Eighteen months after construction began, **THE LUXOR** opens to a crowd of 10,000 guests. JBA is proud to have been on the team that contributed to the design and development of this amazing property.

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The Game Boy is released world-wide.



The World Wide Web and Internet protocol (HTTP) and WWW language (HTML) created by Tim Berners-Lee.

The Channel Tunnel, which took 15,000 workers over 7 years to complete, opens between England and France





GPS launches to help people find their way and today JBA360 utilizes it to track your documents.

Construction begins on the **BELLAGIO** and JBA's Trusted Advisors take the lead on Mechanical and Plumbing.



Google, begun as a research project in 1996, was released in 1998.



The Erector Set was inducted into the National Toy Hall of Fame

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The technology for WebTV was developed by Diba Inc and Zenith Electronics.



With Mechanical & Electrical systems provided by JBA, the **MANDALAY BAY's** 11 acre pool debuts to rave reviews.



The first public HDTV broadcast airs and JBA quickly recognizes the benefits of this technology and begins incorporating it into projects like video walls and advanced security & surveillance systems.

NEW YORK, NEW YORK HOTEL & CASINO opens on the Las Vegas Strip. JBA's contributions include: MEP, Fire Protection, QAA and Acoustical Engineering.

JUST CHILL

Bringing air conditioning costs under control at InterContinental Hong Kong



How Efficient Is Your Building's Chiller Plant?

Very often, a careful study will reveal that there are great opportunities for energy savings.

The system at the InterContinental Hotel in Hong Kong illustrates what's possible. The hotel completed a major upgrade of its chiller plant configuration, yet even still, air conditioning accounted for about 25% of the total energy consumption for the property. That's a high number even in Hong Kong's subtropical climate, given the size and configuration of the chiller plant. Furthermore, the system's ASHRAE coefficient of performance (COP, or power output/power input) was only 2.76, very low for a chiller plant of this caliber.

Harvey Wong, Director of Engineering for the property, says he wanted to do more in terms of energy savings, so he began looking for a consultant to study the chiller plant operation. "We have good engineers on staff, but they did not have the kind of expertise we needed or the time to undertake a detailed study," Wong explains. Convinced that the chiller plant could work much more efficiently, he decided to bring in an independent company, Energenz Consulting, at the end of last year.

It was a good decision. Energenz was able to identify opportunities to save about 30% of the chiller plant operating costs.

Of that, almost 60% was realized through operating changes which could be implemented immediately; the remaining savings will be realized over the next few months through projects requiring capital expenditures.

Immediate Savings Opportunities

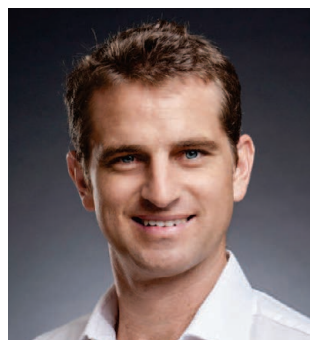
According to Ben Heraud, CEO and Principal Energy Consultant for Energenz, the first part of any efficiency study consists of gathering data. "We look at the chillers, pumps and submetering, including name plate ratings and historical trends," he explains. "Once we know what information is available from the client, we will go on site and install our own monitoring equipment, which can include anything from ultrasonic flow meters to temperature gauges." This phase normally takes about three to six months, and most often it includes fine tuning of the system.

"Very often advanced building systems can be commissioned more thoroughly," Heraud explains. "Oftentimes, the contractors installing them and even the control system personnel who service them lack the training and experience needed to get the most out of them."

At InterContinental Hong Kong, there are four York high-voltage centrifugal chillers, of which two are 500 ton and two 1,000 ton, plus a seawater pumping system that takes the place of a more conventional cooling tower for heat rejection. The chilling system



"Energenz was able to identify opportunities to save about 30% of the chiller plant operating costs."



Gilbert Lennox-King



Ben Heraud

was originally set up in a primary / secondary configuration. This is a traditional configuration that includes two chilled water loops, separated by a decoupling pipe. Primary pumps satisfy the flow and pressure requirements of the chillers at constant flow, while the secondary pumps cater for the fluctuating building demand. Since newer chillers are capable of handling a variable flow of water, it is possible to remove one set of pumps and vary the flow through both the chillers and the building.

"One of the first things we noticed in reviewing the building data," Heraud says, "was that the compressors were consuming 87% of the electrical load, and the seawater pumps only 3% [with the chilled water pumps consuming the other 10%]. That 3% was a really low number and a red flag for us – there was not enough seawater flow, significantly reducing the efficiency of the compressors." By simply ramping up the seawater pumps, the team was able to save about 3.7% of the energy used by the chiller plant, and that savings was realized very early in the project. Further study revealed an additional issue: the logic used to control the system after the upgrade was never revised.

"In a primary/secondary system you want to base your control on the return temperature of the building's cooling load; in a primary only you're better off controlling the supply temperature," Heraud explains. "To work around this problem, we gave the team a tool into which they enter readings they observe from the BMS. They now manually adjust what chillers they should be running and the pump speeds on an hourly basis." This change, intended only as a temporary fix, also produced a significant immediate savings: about 2.6% of the cost of the energy used by the chiller plant.

Low Delta-T Syndrome

One of the more insidious issues the team uncovered had led to a common condition known as low Delta-T syndrome.

The issue began with the type of pumps installed during the upgrade. Set up as they were, these pumps were able to run at only about 80% of their rated speed. The building engineers saw the pumps cutting out above 80% and also saw that the building was not being cooled sufficiently. To get more cooling, they simply turned on another pump.

In this case, 80% of pumping power would have been sufficient to cool the building had the rest of the system been working optimally. Running the chiller plant in this N+1 configuration was not a good solution, because the only extra pumps to be had were associated with chillers. To turn one on meant pumping return water through a chiller that was not running, thus bypassing the ones that were.

It's important to understand that the system was designed to use water chilled to 6°C, which, as it cooled the building, would be warmed gradually to 11°C. The temperature difference or Delta-T of this system should have been 5-6°C. To get enough cooling, the engineers ramped up the operating chillers to produce chilled water at 4°C but the colder water immediately mixed with the water coming out of the extra chiller, which had not been cooled, bringing the average temperature of water entering the cooling system to 8°C. Now the Delta-T was only 3°C, with some variation depending on how many chillers and pumps were running.

Once the Energen team realized what was happening, and once they took a few additional steps to ensure that the system was working optimally, they simply shut off the extra pump and reset the chillers to 6°C. That change saved the hotel about 3.2% of the energy used by the chiller plant and was realized immediately.

Recommissioning the Cooling System

There were three additional steps that had to be taken before the team could shut down the extra pump and still get enough cooling power to keep the hotel at the targeted



temperature. They first identified a savings opportunity in the balancing of the cooling system.

At InterContinental Hong Kong, there are actually three chilled-water loops circulating cold water throughout the property. To ensure that all areas are cooled evenly, it's necessary to restrict the water supply somewhat to two of the three areas using balancing valves, but the team found that all three balancing valves were partially closed, requiring higher pressure from the pumping systems than would otherwise be necessary.

The team also found that the main chilled water supply was also unnecessarily throttled, requiring even higher pressure.

Finally, they found that the control system supplier and the building engineers had calculated a higher than necessary differential pressure, 20 psi, to compensate for normal pressure losses within the chilled water loops. The Energenz team calculated the necessary pressure at only 8-10 psi.

"You can see that these issues were compounding," Heraud explains. "Restrict the valves too much and you don't have enough pumping power. Add another pump and you drive up the chilled water temperature and require even more pumping." Rebalancing the valves and lowering the pressure levels resulted in another 5.4% energy savings. So far, the team was able to save the property a total of 18.1% of the energy costs of the chiller plant simply by making operational changes. The report analyzed changes that required capital expenditures.

Capex Recommendations

There were two significant opportunities that Heraud and his team uncovered that could save the property additional energy costs.

The first was with the chiller control system. The BMS installed in the upgrade was, in fact, less than ideal for a primary-only cooling system.

The Energenz team suggested that the system either be upgraded or replaced in order to fully automate the chiller plant controls. The hotel has opted for a new BMS, eyeing the possibility of improving efficiencies even more over the long term. The cost of equipment and installation will be significant but should result in a 10% additional cost savings – a 2.03 year simple payback.

The second involves redoing some of the pipe work to further reduce the differential pressure needed in the system. "There are some very old pumps that were part of the primary/secondary system, unused but still connected," Heraud explains. Removing these pumps and simplifying the layout of the chilled-water loops will result in energy savings of 0.7% with a 1.86 year payback.


By the time these changes have been implemented next year, the savings will total 30.20% of the chiller plant energy cost or about 7.6% of the energy bill for the entire property. On average, there will be a 1.54 years simple payback for the optimization project.

Wong has been very happy with the results the team was able to provide. "It was very helpful for us to engage a company with the expertise to commission our system properly. We appreciate how they first looked at the operation side and only then suggested changes requiring capital expenditures. Their presentation was excellent, giving us a clear look at our return on investment. Energenz was able to give us a fresh perspective on our systems and very clear savings." ☐





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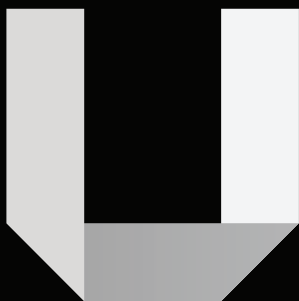
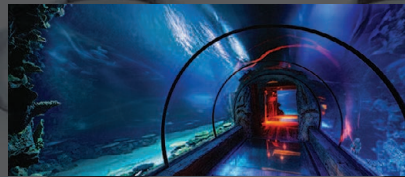
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