Plant Operations Support ShopTalk

Plant Operations Support Consortium Volume 13, No. 2 Summer 2008

Inside

State Patrol realizes 'deal of a lifetime'

Consortium celebrates another member-to-member success

By Phil Partington, POS staff

It takes positive assertion and a will to do good things to make member-to-member successes work within the Consortium. Through Plant Ops, Washington State Patrol's Property Management Division and Liquor Control Board were able to make such a win-win possible. Great communication and careful attention to detail helped, too.

The Liquor Control Board (LCB) had a high-density filing system that became available through a construction project. The system--declared excess to the LCB--was authorized for agency disposition by State Surplus because of disassembly requirements. Liquor Control turned to their Consortium and the item was posted to the Listserv and members were surveyed. The State Patrol stepped up to the challenge of disassembling the item and hauling it away, which resulted in a great savings for the agency.

"We got a deal of a lifetime," said Bill Glaeser, division administrator of WSP Property Management Division. "This filing system costs about $20,000 if bought new, and it's in great condition."

Jerry Bradshaw, supply manager for Liquor Control Board, was instrumental in the fruition of the transaction.

"This deal helps us out, too," said Bradshaw. "We needed that item gone and the State Patrol helped save us the hassle and cost of demolishing it. They were wonderful to work with. We anticipated complaints from our tenants, but everyone said there was minimal to no disturbance at all. They left the site clean and there were no dust problems afterwards. We're very pleased."

Brenda Biscay, WSP office assistant 3, illustrates the newly acquired high density filing system in operation.

Plant Ops staff is proud to have so many members on board with the Consortium mantra of, "Our hearts will be clean when we seek to avoid the landfill; there will be no private benefit; and members win." This approach to public stewardship has helped save $45 million in tax dollars in the last 12 years, and we applaud folks like Bill and Jerry for playing their parts.

(Please see "File System", continued on page 5)

Washington State University

GA General Administration STATE OF WASHINGTON

POS *notes*

Bob MacKenzie

The expressed goal of the marriage between WSU Energy Program and Plant Operations Support was enhanced services to mutual customers. Members have realized a number of successes to date and the latest offering is so exciting I wanted to elaborate in this summer's POS Notes.

The Northwest Building Efficiency Center (NBEC) is a new WSU program offering that delivers technical support for energy projects in state or local government buildings. This first year, NBEC staff has invited POS to receive advanced-level services at no or low cost. This will be too cool for words!

When you have questions about energy use or energy management practices in your buildings, your POS staff and NBEC will work together to support you. This could be a quick phone question for information research, or an onsite visit for engineering consultations or assessments, and custom training services. Building and energy specialists, trainers, professional engineers and university librarians are all available to POS members. Most of these services are FREE and are provided by the WSU Extension Energy Program with funds from the US Department of Energy's Building Technologies Program.

It gets better…!

NBEC and POS will coordinate with a range of federal agencies, national and regional organizations, your friends in state agencies, and local and professional groups to coordinate services. So, just ask, and you shall receive a wide network of support focused on energy efficient buildings.

"We chose POS because they are most likely to have the interest and resources to implement building energy efficiency projects," said Linda Witham, NBEC manager. "Our goal is to catalyze successful projects. If you want to implement a project but you need a building assessment, baseline monitoring, skills training, or a lighting mock-up, we'll help you get one."

For all building managers, NBEC is developing a website with a collection of current and objective information resources. The site already features a regional Energy Events calendar with trainings, conferences and webinars. Later this year, there will be a selection of technical resources and links, and a regional programs directory.

Regional Energy Events Calendar: *www.nwBuildings.org*

Ask an Expert: 866-929-6232 or *Info@nwBuildings.org*

The WSU Energy Program is a self-supported department within the university's Extension Service. It receives project funding from federal government agencies, federal power marketing agencies, the nonprofit Northwest Energy Efficiency Alliance, and several other sources.

The WSU Energy Program has a budget of about $6 million and a staff of 60 working at its downtown Olympia office, in Spokane and at other satellite locations. Customers range from industrial plants, to private consulting firms, businesses, government agencies, and utilities.

POS is delighted to partner with such a prestigious, well respected and responsive program.

Give us a call to discuss the NBEC, POS or other WSU Energy program offerings. Have a super summer and thanks for all you do for our respective stakeholders.

Bob

Shop Talk is a quarterly publication of the Plant Operations Support program. The newsletter is intended to be an informative and operationally-oriented medium for public facilities managers. Contents are also available in hard copy. We welcome feedback and input on the newsletter's contents from readers. We reserve the right to edit correspondence to conform to space limitations.

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Maintenance and Troubleshooting HVACR Equipment for Mechanical Problems

By Greg Jourdan, HVAC professor and BOC instructor, Wenatchee Valley College

This article was originally published in the BOC Bulletin and is reprinted here with permission. For more information about Building Operator Certification, go to www.theBOC.info/wa. Images and illustrations provided by the Fluke Corporation. Look for parts 2 and 3 of this article in upcoming issues.

Greg Jourdan

Commercial buildings utilize four (Four common types of mechanical systems to accomplish air conditioning and heating within the building. They are:

1. Central Systems with Built Up Air Handling Unit (AHU) with Chilled Water and Hot Water or Steam Heat. (See Figure 1)

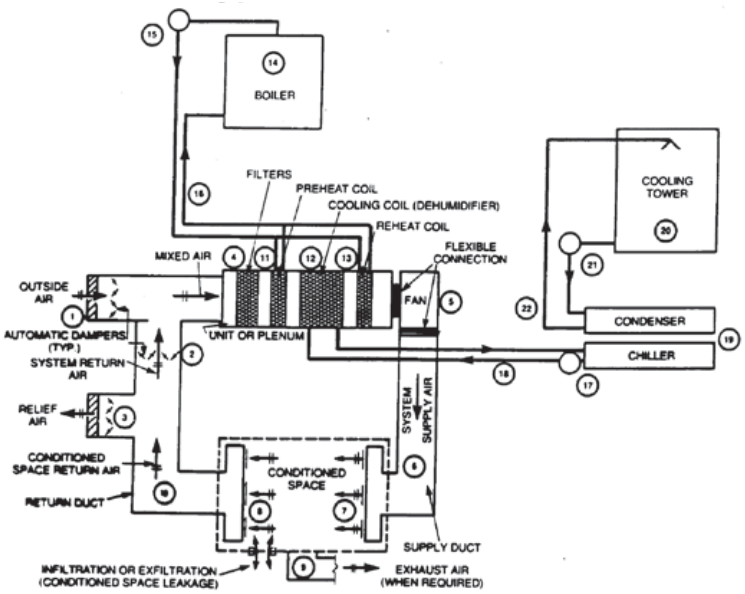


Figure 1

2. Rooftop Units (RTU's) are packaged HVAC units typically located on the roof of the building. (See Figure 2) 3. Split AC and Heating Systems which are systems that are similar to a home air conditioning application. The indoor unit is comprised of an evaporator and central air handler which is inside the building, the outdoor condensing unit is outside of the building. 4. Split Heat Pump Systems which are similar to a split AC and heating system, except they utilize a reversing valve for providing mechanical heat from the compressor during the winter months with an auxiliary heat source for cold climate conditions. In the summer, these units work just like a standard air conditioner.

This article will focus on troubleshooting the refrigeration system, and the central AHU air supply system which is utilized in most commercial building. Most of these systems work on the basic vapor compressor principles which are composed of 4 components; the evaporator, condenser, compressor, and the metering device. Some air conditioning systems work on the absorption refrigeration principle. These systems will not be discussed in this article. We will describe how to perform maintenance and troubleshoot the associated equipment and the AHU's, along with the related problems that can cause a system to fail prematurely. We will discuss the proper methods of diagnosing and repairing system problems, rather than just their symptoms.

The Compressor

The main component of the vapor compression system is the compressor, which is designed to pump cool refrigerant gas from the evaporator into the condenser. The compressor design can either be a piston, a centrifugal, or a rotary screw type. Size of the building and the

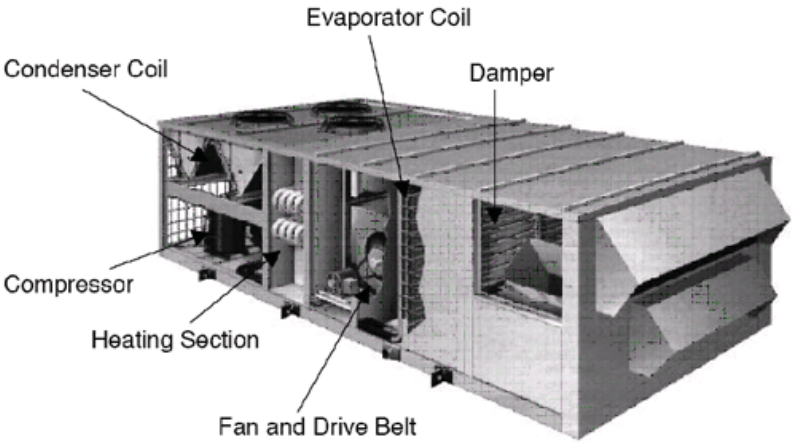


Figure 2

HVAC system will dictate the type of compressor. Regardless of the compressor type, the compressor raises the temperature and pressure of the low superheated cool gas, forcing it into the condenser. The compressor should never pump liquid. This will not only damage the compressor, but can create a potential safety hazard. Similar to the human heart, the refrigeration compressor needs to be properly maintained and requires periodic inspection and testing. Unfortunately, the compressor is often ignored until it malfunctions or stops running altogether, at which time it gets replaced and the system is back up and running—temporarily.

(Please see "HVAC", continued on page 7)

Retro-commissioning -- benefits and common sense guidelines

How to determine whether retro-commissioning is right for you

By Kent Barber, principal in charge with Keithly-Barber & Associates

Kent Barber

If you have a building with high utility bills, numerous occupant complaints, or poor equipment performance, retrocommissioning may be the key to solving your problems. Successful retrocommissioning can result in superior indoor air quality, better thermal comfort, increased occupant productivity, more efficient operation and maintenance, enhanced occupant safety, and greater energy efficiency. Unfortunately, a lack of standardized terms and processes leaves a lot of building owners and operators unclear about what retrocommissioning really is and what benefits it can provide.

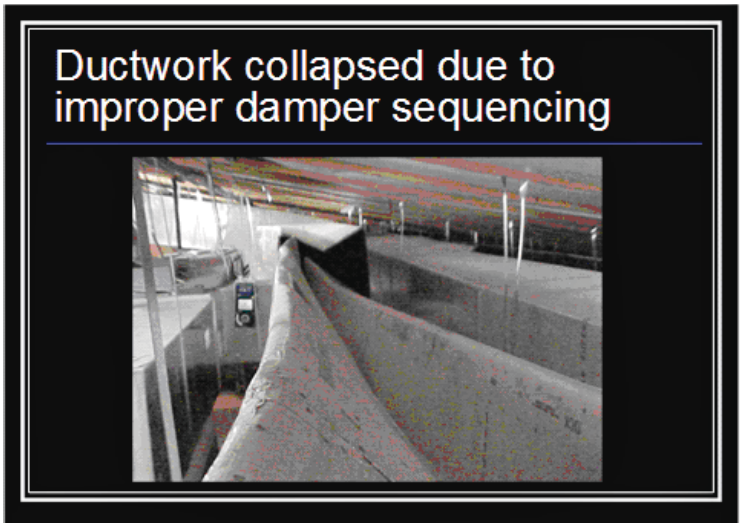
The road to clarity begins by agreeing on a common definition of terms. Terms like *existing systems commissioning*, *retrocommissioning* and *recommissioning* do not have definitions that are uniformly used throughout the world of building construction and operation. In fact, these are sometimes used interchangeably or differently by different agencies. This article will use the following common definitions, which are consistent with ASHRAE and Building Commissioning Association (BCA) guidelines.

Fundamental purpose of all building commissioning: The fundamental purpose of commissioning is to confirm that the owner's functional requirements for a building or its systems are satisfied. This applies to the commissioning of new and existing buildings and systems, including recommissioning, and retrocommissioning. The widely accepted Essential Attributes of Building Commissioning, as defined by Building Commissioning Association (BCA), apply to all types of commissioning, though implementation processes may differ from type to type.

Existing systems commissioning: This refers to commissioning any system or building that is not under new construction or renovation. Retrocommissioning and recommissioning are types of existing systems commissioning.

Recommissioning: Recommissioning, which is sometimes referred to as a commissioning tune-up, involves evaluating the performance of existing systems that have been commissioned before. That's all we'll discuss about recommissioning in this article, because our focus is on retrocommissioning

Retrocommissioning: The fundamental purpose for retrocommissioning is to verify that an existing building that has not been previously commissioned functions in accordance with the owner's functional requirements. Typical



reasons to retrocommission include addressing high utility bills, numerous occupant complaints, or poor equipment performance. The retrocommissioning process often includes:

1. Documenting the owner's current functional requirements (OFR), which for older building may have changed over time from the original design intent;
2. Investigation, diagnostic testing, and analysis of the buildings performance relative to the OFR;
3. Adjustment or repair of system deficiencies;
4. Final functional testing to confirm that the systems are performing in compliance with the OFR; and

(Please see "RCx", continued on page 8)

Lynch honored as public leader

Division director has given over 28 years to public

John Lynch

John Lynch, director of the Engineer and Architectural Services of the Department of General Administration, has been awarded the 2008 Governor's Award for Leadership in Management. This honor is well deserved as John has devoted over 28 years to public service, GA, and public works management.

John is active in state and national organizations such as the: Capital Project Advisory Review Board, serving as chair for nearly three years; Northwest Consumer Construction Council (board member); Association of General Contractors of America; American Institute of Architects; Architects, Engineers and Agencies Committee; African-American Partners For Prosperity Group; and the National Association of State Facilities Administrators.

John has also assumed a leadership role in the agency's efforts to provide additional contractual opportunities to small-business owners, particularly minority- and women-owned businesses, as well as to help ensure fairness in all contracting opportunities within Washington.

POS applauds John for this great achievement and thanks him for his leadership.

(Continued from "File System", page 1)

The filing system is 96 inches wide, 95 inches tall, 20 feet long, has seven movable file cabinets and one stationary cabinet. Movable cabinets lock to the stationary cabinet. The system has 28 total adjustable shelves per cabinet as well.

Bill Glaeser

Aside from the filing system, WSP also recently nabbed a high-end generator from The Evergreen State College.

"We've been very happy with our involvement in the Consortium," said Glaeser. "The Plant Ops team does a great job of pulling together tough-to-find resources in order to realize maximum value for all parties."

Jerry Bradshaw

To find out more about how Plant Ops saves its members time, dollars and resources, visit the POS website, www.ga.wa.gov/plant, or contact us, 360-956-2057, or e-mail plantops@energy.wsu.edu.

Consortium Member Roster

K-12 Schools

Abbotsford, BC
Bremerton
Brewster
Bridgeport
Camas
Centralia
Chehalis
Clover Park
Coquitlam, BC
Delta, BC
East Valley, Spokane
Easton
Eatonville
Edmonds
Enumclaw
ESD 101
ESD 171
Federal Way
Goldendale
Highline
Hoquiam
Ketchikan, AK
LaCrosse
Liberty
Marysville
McCleary
Mission, BC
Moses Lake
Mount Vernon
Mukilteo
North Thurston
Oak Harbor
Ocosta
Olympia
Peninsula
Port Angeles
Port Townsend
Puget Sound ESD
Quilcene
Quillayute Valley
Rochester
Saanich, BC
Selah
Shoreline
South Kitsap
Snohomish
Sumner
Sunrise Beach
Surrey, BC
Wenatchee
White River
Willapa Valley
Wishkah Valley
Yelm

Universities/Colleges

Big Bend CC
Cascadia CC
Clark College
Columbia Basin CC
CC of Spokane
Everett CC
Grays Harbor College
Highline CC
Olympic College
Renton TC
South Puget Sound CC
The Evergreen State College
Univ. of Washington
WSU Extension Energy

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Port of Everett
Port of Kennewick
Port of Sunnyside

Municipalities

City of Bellevue
City of Hoquiam
City of Kent
City of Oak Harbor
City of Olympia
City of Seattle, Dept. of Transportation
City of Seattle, Fleet and Facilities Dept.
City of Tacoma
City of Tumwater
City of Walla Walla
City of Vancouver
Clark County
Cowlitz County
Cowlitz County PUD #1
Grays Harbor Public Dev. Auth.
Jefferson County
King County Dept. of Exec. Services
Lakehaven Utility District
Lewis County
Pierce County
Pierce County Library System
Skamania County
Tacoma-Pierce Cty Health
Whatcom County

States/Tribal

Alaska DOT
Hopelink
Oregon Youth Auth.
Squaxin Island Tribe
Vancouver Convention & Exhibition Center

Wash. St. Agencies

Corrections
Criminal Justice Training Comm.
Ecology
General Administration
Health
Information Services
Licensing
Liquor Control Board
Military
Natural Resources
Parks & Recreation
School for the Blind
School for the Deaf
Social & Health Services
Transportation
Veteran's Affairs
Washington State Patrol

Our warm welcome to the new members in green type and to those members who have re-subscribed. We look forward to serving your facility and operations needs.

EFC 2008 raises bar of professional development training

Next year's conference is already set for May 13-15, 2009 at the Enzian Inn in Leavenworth, WA

By POS staff

The 2008 Energy/Facilities Connections was a huge success according to attendee feedback consensus. On a scale of 1-5, with 1 being very poor and 5 being excellent, 93% of those who filled out feedback forms ranked the conference at least a 4 based on comparisons to similar types of conferences. We're very proud of that number, but will be aiming for 100% for the 2009 Conference.

Attendees were most impressed with the overall quality of speakers, the coziness and professional atmosphere of the Enzian Inn, and the integration of tours and hands-on demonstrations. A couple improvements that were suggested regarded the stuffiness of the Danube room and the lack of PowerPoint printouts for attendees.

The EFC Planning Committee takes feedback seriously, so if you attended EFC 2008 and missed your opportunity to provide feedback, please feel free to make your suggestions by e-mailing *plantops@energy.wsu.edu*

Special thanks to our sponsors in 2008: Barn Beach Reserve; BetterBricks; Cashmere School District; McKinstry Col.; Northwest Energy Efficiency Council; The Sleeping Lady Resort; Wenatchee School District

In addition, many thanks to our co-hosts: General Adminstration's Energy Team and the Washington State University Extension Energy Program.

2008 Energy/Facilities Connections Conference Photos:

(Continued from "HVAC," page 3)

Oftentimes, the culprit is not the compressor, but a system failure or design problem with accessory equipment which killed the compressor prematurely. This application note describes how to perform maintenance and troubleshoot the mechanical and associated problems that can cause a system to fail prematurely. We will discuss the proper methods of diagnosing system problems, rather than just their symptoms.

Caution, federal EPA regulations requires that anyone who accesses a stationary refrigeration system have a Section 608 license. Be sure to obtain this license or hire a qualified contractor to perform this service if need to access the refrigeration side of the system.

However, if you do not access the refrigeration system, you can still diagnose many of the potential problems with the proper equipment as explained in this article.

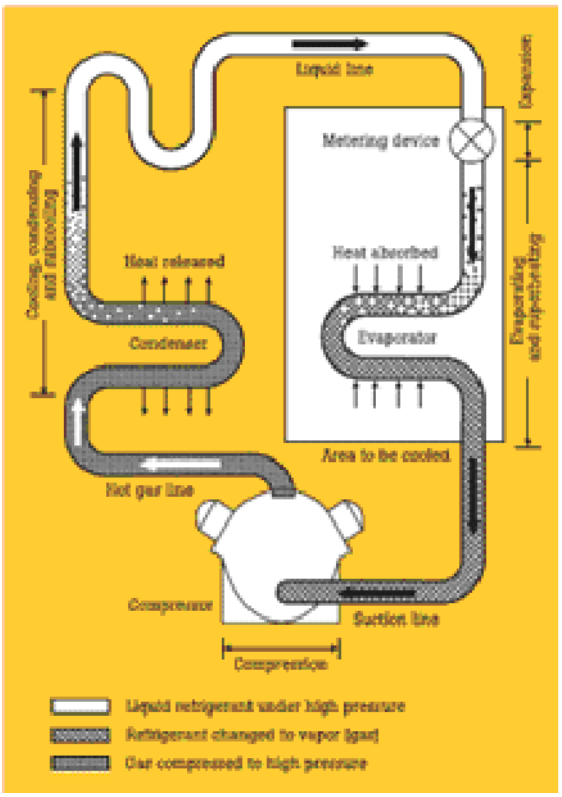
Temperature Surveys

A temperature survey is a critical part of the service technician's job. A quick check of a system's components not only helps to diagnose troubles but also allows you to anticipate failures by regular monitoring of critical temperatures. Use an infrared thermometer to do a quick survey of:

- Compressor head temperatures
- Compressor oil sump temperatures
- Evaporator coil and suction line temperatures
- Discharge line temperatures
- Condenser coil and liquid line temperatures
- Fan motor and pump motor temperatures.

With an infrared or surface thermometer you can quickly survey a refrigeration system by scanning the temperatures of various components (see Figure 3).

While touching each of the components with your hand is often done, to minimize and prevent burns, a non-contact infrared tool or surface thermometer is faster and safer. By keeping careful records it is possible to detect trends that indicate impending failure. This allows you to keep the system in top condition and avoid costly failures. Note: IR instruments read best when measuring an object with a dull (not shiny) surface. If the surface is shiny, dull it with black markers, non-gloss paint, masking tape, electrical tape, etc. For more information on taking temperature measurements with an IR thermometer, refer to the Fluke application note titled "Non-contact temperature measurements using IR thermometers."



Recording a temperature overnight

To check refrigeration system performance, it is often useful to record temperatures in the refrigerated space. This allows you to detect problems that may go unnoticed with a single system check. For instance, in a conditioned space, it is important to ensure that temperature variations are minimized. Temperature variations may result from changes in load or ambient conditions that occur over periods of time, so constant monitoring is required. By recording minimum and maximum temperatures in key locations over a period of time you can be sure that air circulation and refrigeration capacity meets the application requirements. Digital recording thermometers allow you to record minimum and maximum temperatures over extended periods of time. Temperature values can be viewed at any time by pressing the view button (recording still continues). If the HOLD button is pushed, the recorded MIN/MAX values are saved and recording stops. The data is saved until the user selects a different input or turns off the instrument. When selecting a digital recording thermometer look for a model that can record hundreds of temperature samples so you get precise measurement. Additional features that are helpful include a time stamp feature, operator interval settings and dual channels to record two temperatures and the same time. With this type of device you can record temperature difference across a coil for extended periods of time. This feature is especially handy for troubleshooting erratic problem areas of the HVAC equipment where time limitations do not allow the technician to wait until the problem occurs.

Check out Part 2 of Greg's article on HVAC in the Fall 2008 Issue of *Shop Talk*, when Greg will discuss more troubleshooting issues, tips on diagnosing refrigeration problems, and more.

Greg Jourdan has been the Director/Instructor of the Refrigeration Technology Program at Wenatchee Valley College since 1985. He is a certified instructor for the Air Conditioning Contractors of America and has taught for the U.S. Navy and Grand Coulee Dam. Contact Greg for more information, gjourdan@msn.com

(Continued from "RCx", page 4)

5. Final turnover of the systems to the operators.

Fully understanding the five steps of retrocommissioning requires extensive discussion beyond the scope of this article. Fortunately, there are a number of retrocommissioning guidelines and best practices available. Two such sources that are readily available online are: 1) The Retrocommissioning Handbook for Facility Managers. Prepared for the Oregon Office of Energy by Portland Energy conservation Inc., March 2001: *http://www.oregon.gov/ENERGY/CONS/BUS/comm/docs/retrocx.pdf*; and, 2) State of Idaho Retrocommissioning Guidelines, 12/20/99: *http://adm.idaho.gov/pubworks/archengr/app7rcg.pdf*. It should also be noted that the Building Commissioning Association (BCA) has just released a Best Practices for Retrocommissioning document, the U.S. Green Building Council has recently introduced the LEED for Existing Buildings program, and ASHRAE is working on a guideline for commissioning existing building

Energy-focused retrocommissioning: Funding is sometimes available from local utilities for retrocommissioning focused solely on conserving energy. The sponsoring utilities sometimes refer to these programs as retrocommissioning, even though they may not include measures to improve comfort or indoor air quality (IAQ). In fact, it should be noted that sometimes improving some comfort and IAQ involves taking measures that actually increase energy consumption. An example of this is restoring adequate ventilation to an under ventilated space. Some commissioning professionals use the term "energy focused retrocommissioning" to distinguish this type of partial, energy focused process from the more holistic approach to retrocommissioning. Sometimes it is possible for an owner to implement full holistic retrocommissioning and obtain utility funding for the energy saving portion of the process. This approach can yield excellent payback for some facilities.

Some important guidelines: As previously described, retrocommissioning is typically approached as a five-step process. The process is simple to summarize, and for buildings that are in reasonable condition it can be simple to implement. For more deteriorated or complex buildings however, it can be difficult to define the scope and cost of each step of the process without first completing the preceding steps. This can make it hard for an owner to know what they're getting into and what to budget for the project. As you enter into a retrocommissioning process the following guidelines can help manage scope and cost:

First things first: When considering a retrocommissioning project, it's critical to quickly assess whether or not the building will truly benefit from retrocommissioning. Is the building already working very well? Is it in such serious condition that it needs a major retrofit? Retrocommissioning may not be appropriate if the answer to either of these questions is yes. The building may be a good candidate for retrocommissioning if it appears that its functionality or performance can be improved with repairs, minor revisions or optimized operating strategies. If the building appears to be a good retrocommissioning candidate, it's important to quickly begin to determine the magnitude of the adjustment or repair phase of the project. Does it look like the work can be handled in-house, or will bid documents be required. Consider approaching the five-step retrocommissioning process with two or three successive contracts; beginning with an initial assessment of the building's retrocommissioning potential by an experienced retrocommissioning expert. This approach allows for planned periodic assessment of the project goals, scope and budget; thereby reducing risk for the building owner and the retrocommissioning provide. The Retrocommissioning Handbook for Facility Managers mentioned earlier offers advice for selecting an experienced retrocommissioning provider.

Start complex projects by keeping things simple: It's good practice to approach retrocommissioning projects by establishing reasonable and achievable performance goals. This is especially true for buildings that appear to have extensive or complex systems or performance issues. Begin by concentrating on restoring stable basic operation before you can begin to determine cost effective measures to optimize performance and energy efficiency.

Keithly Barber Associates perform building diagnostic services on existing building systems to help determine the cause of any number of system issues.

Conclusion: If you have a building with high utility bills, numerous occupant complaints, or poor equipment performance, retrocommissioning may be for you. The success of your project depends on: 1) becoming familiar with the fundamentals of the retrocommissioning processes; 2) obtaining a good retrocommissioning service provider; 3) realistically assessing the building's condition and appropriateness for retrocommissioning early in the process; and 3) actively participating in a logical, well documented, step by step process. The payoff for success will be superior indoor air quality, better thermal comfort, increased occupant productivity, more efficient operation and maintenance, enhanced occupant safety, and greater energy efficiency.

Kent Barber, P.E. is a founding member of the Building Commissioning Association. His background includes construction, mechanical systems design and existing systems consulting. He is currently the Managing Principal of Keithly Barber associates (KBA). Contact Kent for more information, 206-947-8879.