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HVAC OPTIMIZATION STRATEGIES

By properly sizing the HVAC equipment, the annual operating efficiency is improved even though the equipment is actually operating for longer periods of time. This is similar to the way a car gets better gas mileage when running at a steady 55 miles per hour rather than in stop-and-go traffic.

When buying a new home, homeowners assume that the HVAC system will keep them cool in the summer and warm in the winter. In an attempt to avoid customer complaints about comfort, HVAC contractors often specify too many HVAC units, or individual units that are simply too large for the home. The idea seems to be to provide far more than what is necessary, as “insurance” against having to send a service technician out to the house to deal with comfort complaints after move in. But, oversized systems compromise the home’s efficiency and can sacrifice other aspects of the home’s performance. In fact, oversized systems can cause comfort issues – exactly what the contractor is trying to avoid. For example, oversized cooling systems run less, providing less dehumidification, which can cause cold, clammy conditions in the summertime. So what’s the solution to oversized systems? Optimize the system through deliberate engineering and ensure that the rest of your home performs appropriately.

Start with the Rest of the House—Improve the Building Envelope

One reason HVAC contractors oversize systems is to make up for other thermal deficiencies. These deficiencies include uncontrolled air leakage, improperly installed or missing insulation, and minimum efficiency windows, all of which contribute to comfort problems in houses. In many cases even oversizing the HVAC system may not solve the problem.

Building envelope airtightness and proper installation of insulation is important not only to reduce energy consumption, but also to alleviate customer comfort complaints resulting from drafts or uneven temperatures. The most complicated areas are typically overhang areas such as fireplaces, bay windows, and rooms beside or over unconditioned spaces like attics or garages. Making sure the house has a properly installed continuous insulation system

and all air leakage pathways are sealed using solid sheathing materials, spray foam, or caulk helps to ensure that the HVAC system is not the sole means for creating a comfortable environment for your customers.

Properly installed double glazed, low-emissivity windows will also improve the performance of the thermal envelope by reducing heating and cooling loads, and can minimize drafts and comfort complaints. Use windows with a low U value (0.35 or less) and a Solar Heat Gain Coefficient appropriate for the climate zone.

The Distribution System—Engineered Ductwork and Duct Sealing

Would you buy a sports car that had skinny little tires? Would you expect a motor boat with a souped up engine and a little tiny propeller to get you anywhere? The same issue is at play with a heating and cooling system. A state-of-the-art furnace or air conditioner is only effective if the air it heats and cools gets to the spaces where the people are. Performing engineering calculations allows the HVAC contractor to determine proper duct sizes according to the appropriate airflows for each room, taking into consideration the duct lengths and number of transitions in the various branches. Properly sizing registers helps to ensure good mixing of the air in the room, and installing balancing dampers where necessary will help ensure proper flow of conditioned air to and from all rooms in the home. Additionally, duct tightness and location are also important factors in designing a high quality air distribution system.

When ductwork is located outside the insulation layer of a house or in exterior walls, it is exposed to outdoor temperatures. Moreover, leaks in ducts located outside the house cause conditioned air to be dumped directly outside or into the attic or crawlspace rather than delivered to the house. Even leaky

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HVAC equipment located within the building envelope.



HVAC Optimization Strategy

continued from page 1



A common complaint among homeowners is paying to heat or cool that extra room that only serves as a resting place for exercise equipment and boxes of junk. Typically, restricting airflow requires manual closing of ducts or separate heating systems with different temperature settings for zones within the house.

A new method for selectively controlling airflow to rooms in the home from a central HVAC system has been developed by EnerZone Systems, funded by the U.S. Department of Energy's Office of Industrial Technologies Inventions and Innovation Program (OIT). The method involves inflatable inserts called Flexdampers (much like the floaties kids wear on their arms in the pool) that inflate to restrict airflow to unoccupied areas and deflate to allow full airflow when needed. This product is suitable for any size home with a central HVAC system.

Flexdampers are remotely powered by air, so no bulky motor is present on the outside of the damper to hinder installation. Round or rectangular Flexdampers can be easily installed into new ductwork or retrofitted into existing ducts. Because they can be folded or bent, they can be inserted through a register or other small openings, making them a viable option for retrofitting ducts that have been partially covered.

According to the OIT Program, this product has saved about 20 to 30% in a typical heating and cooling bill (about 17 million Btu per year for a typical home.) For cost information contact Jerry Tartaglino, President of RetroZone, Inc., at jjt@retrozone.com.

For more information, see:
<http://www.oit.doe.gov/inventions/factsheets/retrozone.pdf>

This information is a summary from the Department of Energy's Inventions and Innovation Program. IBACOS presents this information as news about an innovative product in the market, and does not endorse the use of any product in particular.

ducts inside the house can cause distribution and balancing problems, resulting in lower comfort and a higher probability of homeowner complaints. These problems can be minimized by locating the ductwork inside of the thermally insulated, air-sealed envelope of the home and sealing the entire duct system with a UL-181 approved closure system.

Properly Sizing HVAC Equipment

Programs like Energy Star Homes® and Building America show that builders are interested in improving the performance of their homes. Because changes to one system in a home may affect others, it's important to determine the size of an HVAC system in relation to other improvements, like airtightness and better windows. Unfortunately, many contractors still follow 20-year-old rules of thumb. The only way to properly size heating and cooling equipment is to perform an engineered analysis according to industry standards, like the Air Conditioning Contractors of America's Manual J. By properly sizing the equipment, the annual operating efficiency is improved even though the equipment is actually operating for longer periods of time.

This is similar to the way a car gets better gas mileage when running at a steady 55 miles per hour rather than in stop-and-go traffic.

In addition, it's important to locate the HVAC equipment within the conditioned building envelope.

A furnace or air conditioner in the attic, for example, will be fighting the winter cold and

summer heat at the same time it is trying to heat or cool the house. Putting HVAC equipment in unconditioned spaces typically means having to buy a larger system, to make up for these losses.

The size of heating and cooling equipment for a home can be reduced through a better building envelope and an HVAC optimization strategy. Installing high performance windows, increasing building airtightness, and improving insulation contributes to a better envelope, and helps to reduce the heating and cooling loads. An HVAC optimization strategy includes doing a detailed HVAC design that takes into account the actual (lower) loads, HVAC equipment specifications and placement, optimized ductwork pathways, and improved duct system airtightness. The combination of an improved envelope and an HVAC optimization strategy can result in one air handling unit with a zone control system being used instead of two separate systems, thereby saving construction costs while not sacrificing comfort.

Many HVAC contractors initially resist decreasing the number of units typically used in a home because they're worried about comfort complaints. By showing them you are taking control of many comfort related issues by improving the thermal envelope, changes to the HVAC system strategies are more readily accepted, including best practice advances like designing an engineered duct system, sealing the ducts, and proper sizing of the HVAC equipment.

A typical home with two HVAC systems can have a web of ducts running from the system in the attic, as shown in the photo below.



Sealing ductwork with UL-181 approved mastic, as shown in the photo below, is one component of an hvac optimization strategy.



Things Aren't Always What They **S e e m**

GUS, A SERVICE MANAGER, WAS ON A ROUTINE VISIT TO A BUILDING SITE WHEN HE NOTICED TWO SMALL CHILDREN PLAYING NEAR A SAND PILE. DIRECTLY BEHIND THE HUGE MOUND, A BACKHOE WAS BUSILY SCOOPING AND MOVING SAND, THE OPERATOR COMPLETELY UNAWARE OF THE CHILDREN'S PRESENCE. FEARING THAT THE YOUNGSTERS WERE IN DANGER, GUS RAN TO THE CHILDREN AND ASKED WHERE THEIR PARENTS WERE. ONE OF THE CHILDREN POINTED TO A HOME IN THE FRAMING PROCESS.

As Gus guided the children to that home, his mind raced with a litany of questions and judgments about this derelict parent. What kind of parent would let their children play unsupervised on such a potentially dangerous building site? Gus found their father and said, "I found them playing by themselves near a sand pile with heavy machinery operating near by. Do you realize these kids could have been seriously injured?" The father was silent. "Look I know you've got to work but couldn't you leave them at home with your wife or with a sitter? The father explained, "Last night my wife was killed in an auto accident. We have no family. There was no one to help with the children. I didn't know what to do so I brought them with me."

Don't jump to conclusions.

It may seem like an extreme example, but Gus told me that this incident has taught him not to make assumptions or jump to conclusions so quickly with trades people, employees, or homeowners. Sometimes people act in what seems to be in irrational ways. But things aren't always as they first appear. Sometimes the real cause is hidden, and can only be uncovered if we take the time to try to understand. By suspending our preconceived notions, asking a few questions, and not jumping to immediate conclusions, we can learn the real root of a problem, and everyone benefits.

If our intent is to help create a quality homeownership experience by understanding our customers, finding the true cause of a problem is critical.



Ultimately it will save time and money because we'll improve our chances of getting it right the first time by learning the real issues. Here's another example.

Dennis, a service warranty technician,

was handling a customer's punch list. The homeowner seemed overly irritable about the minor items on the list. The service tech assumed that it was the checklist items that were making him nervous—but this guy



was over the edge with anxiety. Then Dennis noticed a small chip broken out of the homeowner's beautiful new hardwood floors near the front door entrance. He mentioned something to the homeowner, who became increasingly distressed. Dennis continued to ask questions and the homeowner explained that the movers had chipped his otherwise perfect hardwood floors. The homeowner was anxious about having to live with the defaced floor and Dennis offered to take care of the chip immediately. The homeowner sighed with relief, and Dennis knew that the punch list items weren't the real reason for the homeowner's dissatisfaction.

Recalling that incident, Dennis said, "If I had assumed the several items on the homeowner's punch list were what was making him irritable, and I hadn't asked a few questions about the obvious chip in the floor, I know from experience that he would have never been fully happy with his home. In fact, he probably would have slammed us on survey scores and possibly word of mouth even though someone else caused the damage."

Understanding the real problem pays off.

If a homeowner is unhappy, the customer survey scores will not likely be good, no matter how much we try to resolve concerns with the home. Sometimes, a homeowner's dissatisfaction may not be directly related to the home itself. Every time we understand the real issue, we move one step closer to a delighted customer.

Bottom line, if a home is built right, but the relationship with the homeowner isn't, the builder will not be perceived of kindly. In fact, customers simply expect the builder to build a good home. Going above and beyond means understanding the homeowner's needs and wants.

So when it comes to dealing with contractors, employees, or homeowners, remember that things aren't always as they seem. Avoid making assumptions—ask more questions instead.

--Daron Powers

Daron Powers is the Senior Associate and Director of Quality Programs at TrueNorth Development, Inc. which is a consulting and training company specializing in residential homebuilding located in Northville, Michigan. E-mail: Daronpowers@aol.com

THE TRUE COSTS OF TURNOVER

An employee leaving a company is like throwing a stone in a still pond: ripples of disruption spread through the company, creating unbalance. In a business, this unbalance can be costly.

According to a recent study by the Hay Group, a management consultancy in the U.K., the replacement costs of professionals is 18 months salary. Bill Carpitella, CEO of Sharrow Group, a consulting and executive search professional for U.S. home builders, believes that turnover can cost a builder two times the employee's base annual salary, or more. "But intangible costs, like loss of good will and damage to a builder's name, are even more costly. And a builder can never recoup those costs," he says.

To minimize such costs, many builders are doing everything they can to keep their employees. These days, a good base salary and bonus structure isn't enough. Builders are recognizing the value of employee satisfaction, and are implementing innovative training initiatives aimed at recognition, growth, and quality relationships.

Out with the old, in with the new.

New employees come with both tangible and intangible costs. Among the tangible are recruiting costs, which comprises both advertising expenses as well as time spent writing job descriptions, reviewing resumes, and interviewing; relocation costs, including temporary housing and orientation to a new city; and payroll, tax, and benefit set-up.

Intangible costs include slower productivity while new employees learn the ropes. If a construction superintendent who had been managing between 15 and 30 houses leaves, it may take the new employee several weeks, if not months, to get a handle on things. Beyond simply overseeing construction, it takes time for the new employee to know what to say (and not say) to a customer. Ed Snider, Vice President of Training and Safety for Beazer Homes, attests to the cost of miscommunication. "Any new employee not knowing the

right thing to say can lead to increased construction costs, increased service costs, and perhaps even increased litigation costs."



Employee loss can mean business loss.

The costs associated with a new employee are often considered. However, these can be inconsequential when compared with those attributed to the employee who's leaving. Tangible costs include the administrative work necessary to remove the employee from payroll, benefits, and taxes. Other costs may involve severance pay, or pay owed for vacation or comp time.

It's the intangible costs, however, that can make the most waves. The day that unhappy employees give their notice may be the same day they really check out of the job. Sure, they may report to work for a few more weeks, but their minds are already immersed in their new freedom. A wandering mind is sure to lead to a few dropped balls. The quality of construction may degrade as a result of missed inspections, poor supervision, unclean jobsites, or apathy. Mis-scheduling, the job site not being ready, or materials not being there may adversely affect trades. Relations with customers and vendors may also be compromised due to

lack of attention and last-minute delays.

Poor quality, unclean jobsites, missed meetings or closing dates...all these can quickly make a customer very unhappy. Joe Sabella, Regional Vice President of Construction at Ryland Homes, knows well the costs of an unhappy customer. He recognizes that issues that result from a dissatisfied employee can translate to loss of customer referrals, as well as reduced chance of a customer's repurchasing. "Through customer satisfaction surveys, Ryland knows what a satisfied customer brings to the company by way of referrals and it is substantial," he says. Now, think of the customer whose house is not completed on time, resulting in a missed closing date and, consequently, needing to move twice in order to sell their existing home. A referral from this customer? Not likely.

Another damaging aspect of turnover is what Carpitella describes as "last rites" given by the employee's peer group. Here's how it works: John tells Todd why Randy's leaving ("Can you believe the company did that to him?"), and Todd tells Sue and Jose and Kate, all of whom tell their three best buds. The result is that negativity spreads through the company, causing distraction and unwanted dialogue.

Carpitella recently worked with a builder who was experiencing a 30% turnover of their superintendent/project manager group. This builder did a local satisfaction study over 24 months of all people who bought new homes, not just that builder's product. The builder was surprised to learn that his company's perception dramatically suffered because of the poor perceptions generated by word-of-mouth from unhappy employees. This builder also found that another effect of turnover is dissatisfied employees who keep in touch with friends from their old company, generating discontent by comparing the bad traits of the old company with the good of the new.

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ROOF FLASHING GUIDELINES

GUIDELINES

THE MAIN OBJECTIVE OF A ROOF IS TO PROTECT THE HOUSE FROM THE ELEMENTS, ESPECIALLY RAINFALL. WATER RESULTING FROM RAINFALL MUST BE SHED AWAY FROM WALLS, CHIMNEYS, OR OTHER STRUCTURES THAT CAN BE DAMAGED BY EXCESSIVE WATER COLLECTION.

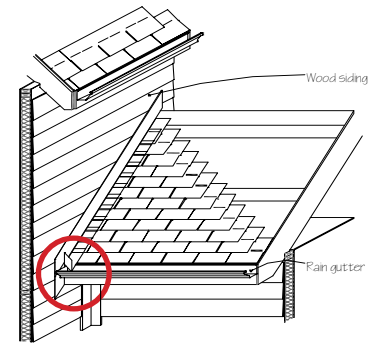
A sloped roof that meets a vertical wall (like the wall of a dormer window, or where a garage attaches to the two-story section of the house) requires special attention for water management. In ideal conditions, rain water that hits the siding will continue to flow down to the roof and then to the rain gutter. But no siding system is perfect, and inevitably some water gets behind the primary finish siding system. While the secondary drainage plane will keep water out of the wall, when it gets to the roof it must be given a way to get out of the wall and back onto the roof. If no water management strategies have been applied at the roof-to-wall transition, water can enter the building at this area, which can cause serious damage. Wet building materials can lead to mold growth, known to cause respiratory problems, and can lead to wood rot, which creates structural concerns.

There are two components for a good water management strategy at the critical roof-to-wall transition area. The first is to apply step flashing at the area where the roof connects to the wall, and to make sure that the secondary drainage plane behind the siding is integrated into the step flashing, so that any water that gets past the siding is diverted back out from behind the siding onto the roof. The second is where the roof ends at the gutter. To prevent water that is traveling down the step flashing from entering the wall system, a "kick-out" piece of flashing is needed to divert water away from the wall and into the gutter. This piece of flashing, which hangs over the edge of the roof, helps to divert water away from the adjacent wall or around any obstacles that the roof may butt into.

The five illustrated steps on page 6 show the preferred method to ensure that these flashing techniques have been done properly on a home with any sort of lap siding (wood, engineered wood products, cement board, etc). Following these steps will minimize the potential for water intrusion and contribute to a quality home. Planning for frequent inspections during construction to verify the proper sequence is being followed is also important to ensure proper implementation.

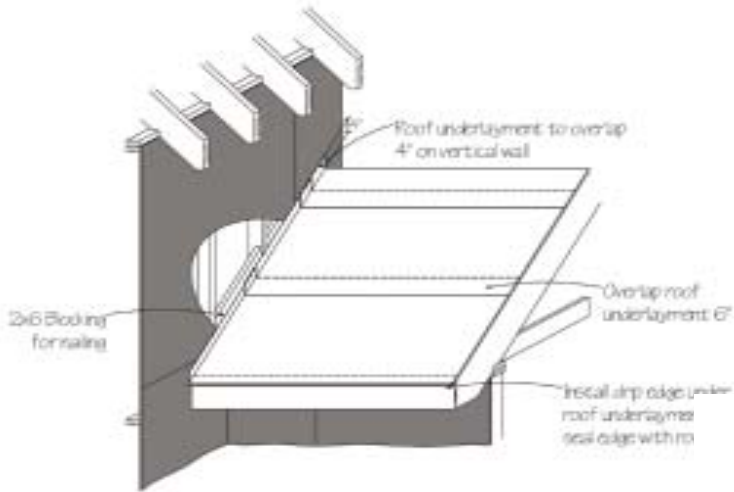


The intersection between the roof and the wall of this dormer should have a good water management strategy.



Kick-out flashing (seen in the red circle) diverts water away from the wall and into the gutter.

roof flashing guidelines

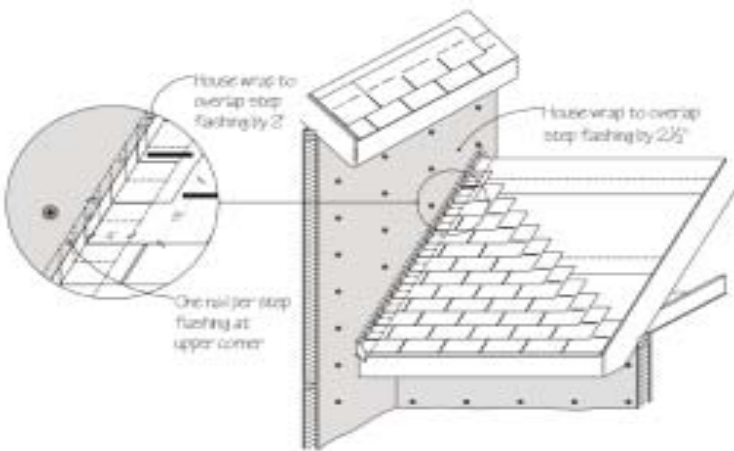
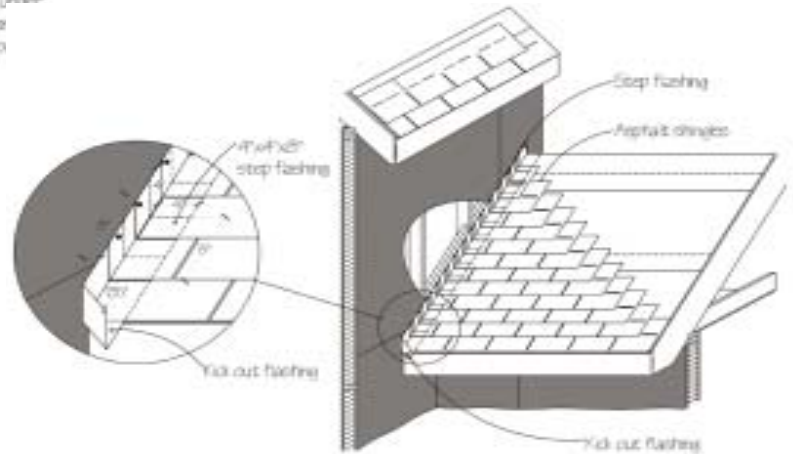


Step 1

Install 2x6 blocking between each stud for nailing and support of flashing, and then install roofing underlayment in shingle fashion with a 6-in. vertical overlap and a 4-in. lap up the vertical wall.

Step 2

The step flashing is installed as the roofing shingles are laid. Nail step flashing on vertical leg in the high corner. Kick-out flashing is installed so water is diverted away from the adjacent wall, over the roof edge, and into the gutter.

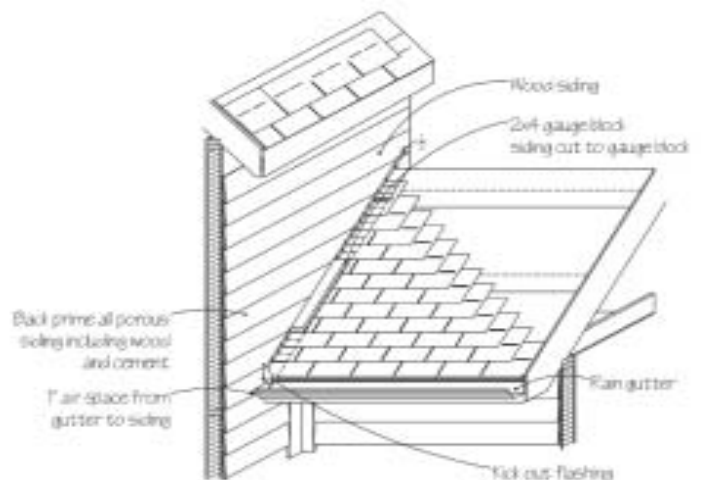


Step 3

The drainage plane material is installed on the vertical wall with a 2 1/2-in. overlap on the flashing to ensure water drains down and away from the wall and onto the roof. If a thin structural sheathing is used, the sheathing should overlap the step flashing.

Step 4

Use a 2x4 as a gauge block between the roof shingle and the siding material to prevent water on the roof from being wicked up into the siding material. Finally, a rain gutter is installed at the edge of the roof.



The True Costs of Turnover

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Depending on the job and the builder, some companies may choose to cut an employee loose and pay the two weeks salary to avoid the associated risks of keeping an unsatisfied employee around.

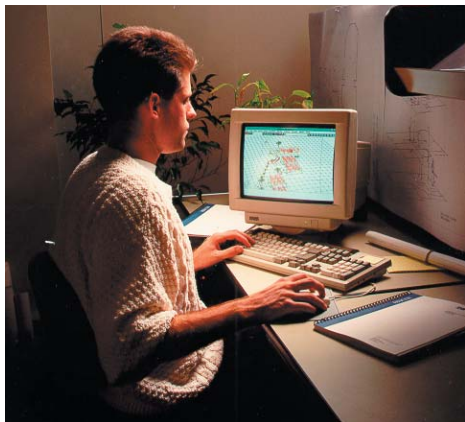
Can you really afford turnover?

The costs of turnover add up quickly, and can exceed two times the costs of the employee's base salary. Damage to a builder's name and customer dissatisfaction resulting from poor quality and delays can be even more costly, and can never be recouped.

Keeping good employees is critical for minimizing such loss.

Keep 'em happy.

Recognizing the costs of turnover, John Wieland Homes, one of the nation's largest home builders, has implemented an innovative employee training program targeted at employee satisfaction. Selected two years in a row as one of the top 100 global training organizations by Training Magazine, John Wieland Homes teaches managers to invest in their employees daily. Based on research on job satisfaction as well as their own employee satisfaction results (which they incorporate into their classes), they believe that turnover is most directly related to interpersonal relationships, particularly with supervisors. So they teach managers how to provide achievement, responsibility, and growth opportunities for their



team members.

In 1998, John Wieland had 35% turnover and implemented their first training programs. Now Wieland University offers 27 targeted training programs, and turnover is down to 18%.

"The results are phenomenal," says Laura McMurray, Vice President of Organizational Development for John Wieland Homes, "considering that typical turnover in the construction industry is 35%."

"An employer's investment in training their employees is recognized as an investment in the development of their individual careers. Making this training opportunity both easy and effective for the employees benefits the company by having a more knowledgeable, more productive workforce."

MICHAEL DICKENS
CEO, BuildIQ

Despite the current slow economy, the U.S. will face a shortage of more than 10 million workers in about seven years, according to projections of the U.S. Bureau of Labor Statistics, so retaining good employees is vital. "Home building companies compete for talent not only with each other, but with companies in other industries, and people want to work for a company that fulfills their need for growth and achievement," McMurray says.

Carpitella agrees that trust, open communications, and good relations with supervisors are critical to employee satisfaction. "If employees are able to establish relationships with supervisors, they are more



likely to stay with a company. Supervisors who show genuine interest in their employees, instead of giving the idea that they are irreproachable, will build trust better with them," he says.

He also cites recognition, fairness, involvement in the business, decision making, career opportunities, being part of a winning team and company, and continuous learning as important factors in retaining employees.

"People are more committed to their discipline than their company, so if employees feel like they're consistently growing and learning, they're more likely to stay with the company," Carpitella says.

Michael Dickens, CEO of BuildIQ, Inc. agrees that opportunities for learning are a key part of a happy employee infrastructure. BuildIQ offers online training to production home builders. "An employer's investment in training their employees is recognized as an investment in the development of their individual careers. Making this training opportunity both easy and effective for the employees benefits the company by having a more knowledgeable, more productive workforce," says Dickens.

Don't make waves.

Ripples of change will inevitably affect a business. But minimizing turnover by keeping employees happy will save a builder a lot of grief, as well as a lot of money.



ABOUT US:

IBACOS

2214 LIBERTY AVE PITTSBURGH, PA 15222 • 412.765.3664 • WWW.IBACOS.COM



Since 1991, IBACOS has worked in the field to enable builders to consistently design and build homes to higher standards of quality and performance, and in the lab to define and develop the technology and process necessary to achieve this goal. We provide the tools and resources necessary to build better homes. For more information contact Stacy Hunt, at 412.325.1523 or shunt@ibacos.com.

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ABOVE, CLOCKWISE: WASHINGTON'S LANDING, PITTSBURGH, PA; QUALITY IS IN THE DETAILS; IBACOS' INNOVATION CENTER, PITTSBURGH, PA; BELOW, LEFT TO RIGHT: BUILDER TRAINING AT STAPLETON, DENVER, CO; BARREL CEILING; FURNISHED LAB HOME, PITTSBURGH, PA.



TAX INCENTIVES FOR BUILDERS

Want another reason for building energy efficient houses (if increasing customer satisfaction and establishing market advantage isn't enough)? Builders will be able to receive tax credits of up to \$2,000, if legislation introduced earlier this year is passed. The Efficient Energy through Certified Technologies (EFFECT) Act of 2003 (S.507) offers tax incentives for building new energy efficient homes. To receive the credit, new homes must exceed the 1998 International Energy Conservation Code by 30% or more. The goal of S.507 is to reduce homeowner's energy costs by 30 to 50% compared to national model codes.

To find out more about these proposed tax credits, visit the Residential Energy Services Network's (RESNET) web site: <http://www.natresnet.org/taxcredit/s507.htm>