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The Relationship between Space Temperature and Energy Usage

By **Bill Holmes, P.E.** January 25, 2013 12:11:36 pm[Email](#)[Print](#)[Like](#)

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Energy Myth #1 is, "The way you save energy is to make people uncomfortable by lowering temperatures during occupancy." It makes perfect sense according to theory, but in this case, I would agree with some of the people I have encountered in the field over the years; "That theory don't work out here in the real world." Why not? Everyone knows the best way to save energy is to lower thermostats, be uncomfortable. The kicker is that it's not true; maybe in your home or in a small building but certainly not in most larger buildings. Talk about a single piece of common knowledge that by itself has probably done more to hurt the cause of energy conservation in this country than anything else. What a way to get people interested in saving energy; by making them uncomfortable, lowering their productivity, and just really pissing them off.

When the federal government issued directives back in the 1970s to reduce temperatures in offices during the winter, the thermostats were lowered, the air conditioning came on and the bills went up. Oops! Seemed like a nice theory. Interior spaces never need heating no matter what the outdoor conditions are. In many larger buildings, exterior rooms, once they are warmed up in time for the occupants to arrive, with solar gains, the lights, computers and other equipment on, may stay warm the rest of the day, most days, except in extremely cold weather, without adding more heat. On some days the heat gain from the bodies, lights, equipment, etc. is too much heat. Haven't you ever wondered why, when you drive by a building with operable windows on a 25 or 30 degree day, some of the windows are open? The heat is already off – at least it should be if the temperature controls are working properly – and yet the rooms are still overheating.

Saving Energy by Shutting Off Classroom Heat in Schools?

I was at a conference several years later and talking to a sales engineer for a major temperature controls company. When he found out that one my clients was a school corporation, he said, "I've got just the classroom controller you need. When the students leave the room, the heat shuts off." Of course my smart-alecky question in reply was, "Why should I buy a control to do that?" He said, "Because it will save a lot of money."

I said, "You know, I monitor all of the utility meters in 20 school buildings, real-time. I watch them continuously and can absolutely guarantee that when your control shuts the heat off in that classroom, it won't change the meter reading. It will be impossible to detect any change. The gas consumption won't decrease. As a matter of fact, in the largest high school, our monitored data shows that the amount of gas the main boilers use doesn't seem to be related to whether one classroom or all of the classrooms are being heated. And since the only money the school pays is for what goes through the meters, your control won't save them a cent. It's worthless."

Beware the 8th Law

I was involved with the redesign of the energy systems in a regional hospital in southern Indiana, and for a few years in the mid-1980s had regular meetings with the administrator in his office. He had two assistants who sat in a reception area right outside of his door. With all of the articles being written

about reducing space temperatures during heating and increasing them during cooling to save energy, I was always amused to observe these two women sitting about six feet apart, one always wearing a sweater with an electric heater at her feet and the other with a sleeveless blouse and a fan on her desk summer and winter. I did owe them a debt of gratitude however, because thanks to them I was able to come up with the also little-known 8th Law of Thermodynamics: When more than one person occupies the same space, they can only be comfortable at temperatures a minimum

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Author Bio



Bill Holmes, P.E.

Bill Holmes, P.E. founded Holmes Energy LLC www.holmesenergy.com and developed the AutoPilot Monitoring-Based Commissioning (MBCx) System in 1979. He has a B.S. and M.S. in mechanical engineering and has done additional coursework and research for his PhD. He is a former Purdue professor and taught for several years in the Continuing Education in Energy Management Program at the University of Wisconsin.

Bill has produced savings from 20% to, in a few projects, more than 50% from low-cost, no-cost changes in management, operation, maintenance and control alone in all types of facilities including Industrial Plants owned by Fortune 500 Companies.

He is the recipient of a DOE Award for Energy Innovation and was the Indiana Energy

Wow. That was a rough way to treat a young sales engineer who had been taught that his new classroom control would save a bunch of money. But how did he know? He was just repeating what he had been taught. Besides, there is really no valid way to detect whether it saves anything or not. But at least when one of the school board members asks the superintendent what she has done to save energy, she can puff out her chest and proudly say, "We have installed 300 of those little control thingies to shut the heat off in the classrooms where the heat hasn't run since 9:00 am." Good show! Carry on.

In a classroom, the time to save energy by turning down the temperature is at night, over weekends and during vacations; not when the students are in the room. The amount of heat a space requires is directly related to the difference between the temperature outside and the temperature inside. For example, in the winter in the Midwest, if it is 20 or 30 outside and 70 inside, the difference is 40 or 50 degrees. If the classroom is kept at 70 or 71 or 72, the additional heat required is negligible and depending on the type of heating system, raising the room temperature may not use one additional Btu or kWh. No kidding. In theory, only looking at the heat required for that one room, maybe a little bit more energy should be used, but when looking at the total building and all of the systems, that is often not the case.

Now think of nights and weekends. If it was 30 degrees outside and the classroom temperature could be dropped from 70 to 60, from a 40 degree difference to 30 degrees, the heating requirement drops by 25%. Plus you can often shut off supporting pumps, blowers and other equipment during those hours; a huge savings in some buildings. And elementary school students in the schools we ran were in class from 8 am to 3 pm, five days a week – 35 hours out of a total of 168 hours in a week. That is where the savings came from. Unfortunately, that Energy Myth #1 is closely followed by Energy Myth #2: "It takes more energy to heat a room or building back up in the morning than you save." Baloney, that's not true either.

of 5 degrees apart.

Obviously, they hadn't seen the charts in the Heating and Air Conditioning books defining the comfort zone. Those clever engineers could have told them as long as the room temperature was between 68 and 72 and the humidity near 40%, they were comfortable. I'm sure their office was right in the middle of the comfort chart. Throw away that heater and fan. Don't you realize that according to ASHRAE (The American Society of Heating Refrigeration and Air Conditioning Engineers), of which I was a member, you should be perfectly comfortable without them?

Manager of the Year in 1990. He has published numerous papers and been making presentations on his projects and methods for more than 25 years. Bill is a sculptor, a writer and a regular contributor to Sustainable Plant.

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