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Comfort vs. Energy Use

By Dan Int-Hout, Fellow ASHRAE

As a member of the ASHRAE Technical Activities Committee (TAC), my assignment is to manage the new Multidisciplinary Task Group (MTG) committees. One of them is focused on energy targets, and they are working on tweaking their scope.

It appears that the term "energy target" has a specific meaning in the energy industry that has nothing to do with energy conscious design in buildings. The term seems to have been assigned to the practice of forcing electric utilities to use more renewable energy in their generation of electricity. This is an example of how the whole issue of energy use and the prediction of energy consumption has corrupted the goal of providing efficient and comfortable buildings.

Recently, the LEED Environmental Quality (EQ) committee asked to see the weightings for occupant comfort vs. energy use. At first, the USGBC was reluctant to disclose them, but ended up with equal weighting between energy and occupant issues.

Those who force renewable energy, or energy conservation on building designers and architects, in place of the end goal—providing a safe and acceptable environment for the occupants of the buildings—are doing us no favors. It leads to complex energy calculations based on no facts and only on wild assumptions that in the long run, are proving to be unattainable.

The result is that a number of LEED projects are not even coming close to the predicted energy savings. The same can be said of a number of ENERGY STAR projects. Meanwhile, BOMA reports that the number one reason for not renewing the lease in high-rise buildings is occupant dissatisfaction with the thermal environment (for at least the last 20 years in a row).

I would suggest that in addition to "targets" the goals should include some means of validation of the calculated energy use. Maybe the word "realistic" needs to appear somewhere. And, it would be great if we could somehow get some data on the existing mainstream computer models' ability to accurately predict the energy use of "innovative" systems, many of which cannot be modeled without the user making modifications to existing software with no basis for the assumptions necessary to make the "innovative" systems work in the models.

A case in point is the General Services Administration's claim that it has 10 million ft^2 (929 030 m^2) of non-performing underfloor systems, resulting in the pulling, and rewriting, of ASHRAE's underfloor air distribution (UFAD) design guide (which, sadly, is still lacking any real energy savings information). At the same time, many continue to push UFAD as an "energy saving" strategy.

In the meantime, practicing engineers are forced to "make stuff up" to calculate energy consumption for systems not included in the available computer models. And, in the end, buildings use more energy than predicted, and tenants fail to renew the lease, looking for the fabled "comfortable space" in which to work.

We use something on the order of \$2/ft^2·year (\$22/m^2·year) to heat and cool a building, while salaries are more on the order of \$200/ft^2·year (\$2153/m^2·year) (*Figure 1*). We can argue the numbers above, but not the orders of magnitude. Reducing energy 30% is pennies compared to the cost of employing the folks who work in the environments we create. A net zero energy building, if actually possible, is still saving only 1% of salary costs!

Measuring actual HVAC energy use is complicated, of course, as is measuring occupant productivity. But as noted in articles recently published here, we do have productivity data, and it is greatly affected by the environment we are tasked to provide. In truth, we are, first of all, in the business of applied biophysics. Doing so using the least amount of energy is not the goal, but a part of the process. Sometimes we lose sight of that fact.

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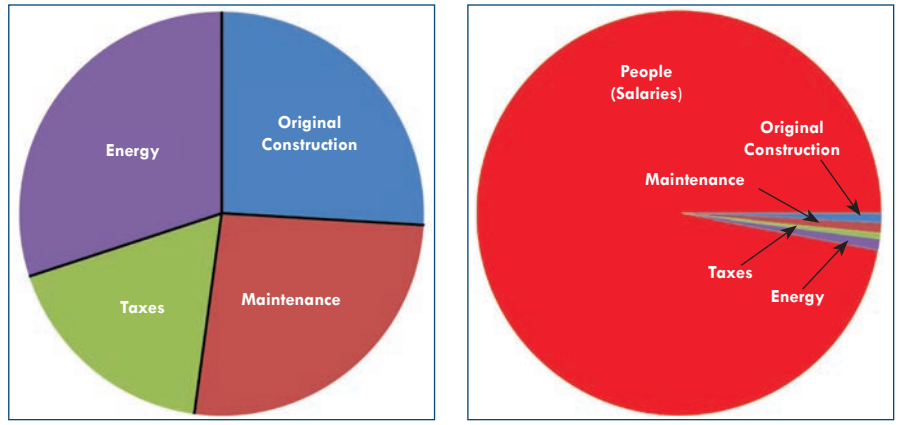

Figure 1: (left) Life-cycle building costs breakdown; (right) life-cycle building costs breakdown with people (salaries).