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WORLDCHANGING

Non-Energy Benefits, Energy Efficiency in Buildings

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We often recognize that energy efficiency in buildings can reduce energy bills, and can reduce the harmful emissions associated with energy production. But we rarely see the additional, ancillary benefits that often result from energy efficiency, and until recently, we hardly understood them at all.

There are all sorts of public benefits programs, promoting efficiency as the most cost-effective short-term energy resource. Education programs, rebate programs, free audits, free compact fluorescent lightbulbs (CFLs), and the like. Free stickers and canvas tote bags, encouraging you to turn off the lights when you leave the room, turn off the hot water in the shower, replace your refrigerator with an EnergyStar model.

These programs often encourage a sense of surreptitious guilt when we take long hot showers, moral indignance when we see others leaving the lights on, embarrassment when others chide us for running the air conditioning all the time. There is a sense of resentment and powerlessness that causes us to cringe at the mention of the phrase, "energy efficiency". This is a disservice to efficiency. If it really is the most cost effective short-term solution, which can reduce greenhouse gas emissions right now, while also relieving congestion on our overloaded and archaic grid, then are these guilt-driven education programs really the best we can do to make efficiency happen?

Until recently, it has taken an energy geek to appreciate the sex appeal of high-efficiency building design. Those with only minor geeky tendencies may be convinced by the lifecycle-cost-savings, simple-payback period, and bottom-line argument.

Some energy savings calculator tools have been developed which bring joy to these minor geeks' hearts, enabling us to evaluate the annual savings of energy efficiency measures in the home. For example, with the "[Home Energy Saver](#)" developed by Lawrence Berkeley Labs, you can use the input pages to describe your house, and the program will calculate potential savings due to efficient lighting, appliance upgrades, upgraded heating and cooling equipment, insulation, etc. So you can see how many dollars per year you could be saving, and how quickly the investment can pay itself back. Similar and more sophisticated free tools exist to simulate energy performance of commercial buildings, and estimate energy savings (DOE's [EQuest](#) , PG&E's [Energy Evaluator](#)).

Pretty cool, but upgrading that air-conditioning system, or improving the design of the building to introduce more natural light, also have ancillary benefits that appeal even to the not-so-geeky. There is an emerging field of research that seeks to quantify the value of these "non-energy benefits", so that consumers and building designers, who may not care about annual kWh savings, can make truly informed choices about some of the greater impacts of energy efficient design.

Some example non-energy benefits, in commercial office buildings and health care buildings are outlined below:

- A retrospective study of patients in a cardiac intensive-care unit treated in either sunny rooms or dull rooms found that mortality in both sexes was consistently higher in dull rooms. (cited in Joseph 2006)
- Patients [in a recent study] were admitted to the bright or the dim side of the same hospital unit postoperatively. This study found that patients exposed to an increased intensity of sunlight experienced less perceived stress, marginally less pain, took 22% less analgesic medication per hours, and had 21% less pain medication costs. (Walch et al., 2005)
- Replacing outdated office lighting with quality lighting components (high performance lamps, ballasts, fixtures, and advanced controls) can result in median productivity gains of 3.2%, with a value of about \$1,600 per employee per year. (assuming average annual salary of \$45,000 per employee. Productivity measured by working speed, error rate, reading comprehension, short-term memory and logical reasoning, or self-reported increases in productivity, in a review of nine studies). Compare to estimated annual energy savings from this measure - \$82/employee (assuming 200 gross sq ft per employee, and peak load of 6W/sq ft). (Carnegie-Mellon CBPD, 2004)
- Sick leave or short term absence will decrease by 10% for every doubling of outdoor air supply rate. (Seppanen et al, 2005)
- Reduced recirculation of indoor air pollutants [from natural ventilation and other efficiency measures] can reduce respiratory illness rates by 9-20%, and can reduce allergy- and asthma-related symptoms by 8-25%. (Fisk, 2000)
- Energy efficiency investments have been shown to increase property values by 2 to 40 times the initial investment cost (factor of 2 for efficient windows, and factor of 40 for efficient lighting). (Mills, 2004)

Non-energy benefits are often difficult to measure, and even more difficult to assign economic value. But as the body of research grows, the non-energy benefits may far outweigh the historical argument “be responsible and save a few dollars and a few kWh every year” favored by the energy geeks among us. Carnegie Mellon is developing one of the first software tools to estimate the value of non-energy benefits. This tool is called [Building Investment Decision Support \(BIDS\)](#). We can expect more tools like this to sprout up as the field matures, and hopefully a sea-change in attitudes towards efficiency and high-performance building design will accompany the emergence of these non-energy benefit calculator tools.

[image credit](#)

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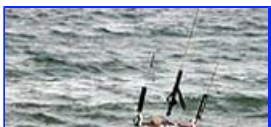
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